# *Comhairle Contae Chiarraí*

*Kerry County Council*

Waste Licence Ref No. W0001-04

## ***Annual Environmental Report for North Kerry Landfill 2015***

Reporting Period:

January 2015 – December 2015

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# APPENDICES

## 1.0 ***Introduction and Reporting Period***

Kerry County Council (KCC) operated a municipal solid waste landfill facility at Muingnaminnane, Kielduff, Tralee, Co. Kerry.

It is located approximately 8km northeast of Tralee, in the Stacks Mountains.

The landfill site accepted solid waste for disposal and is operated under licence W0001-04.

This Annual Environment Report is prepared in accordance with Condition 12.6 and Schedule F of Waste Licence W0001-04.

The reporting period for this Annual Environmental Report is from January 1st 2015 to December 31st 2015.

The acceptance of waste for landfilling and for recycling ceased on site on the 11th July 2014. Both the landfill site and the civic amenity site are now closed to all customers.

Kerry County Council is now looking at alternative options for North Kerry Landfill and the Agency will be advised and consulted on the same as this progresses.

## 2.0 ***Waste Activities carried out at the Facility***

Waste disposal activities carried out at North Kerry Landfill were in accordance with Part 1 of Waste Licence W0001-04.

Licenced activities include;

| | |
|---|---|
| Class 2 | Land treatment, including biodegradation of liquid or sludge discards in soils. |
| Class 4 | Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons. |
| Class 5 | Specially engineered landfill, including placement into lined discrete cells which are capped and isolated from one another and the environment. |
| Class 6 | Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule. |
| Class 7 | Physico-chemical treatments not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in paragraphs 1 to 10 of this Schedule. |
| Class 11 | Blending or mixture prior to submission to any activity referred to in a preceding paragraph of this Schedule. |
| Class 12 | Repackaging 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. |

Waste recovery activities carried out at North Kerry Landfill are in accordance with Part 1 of Waste Licence W0001-04.

Licenced activities include:

Class 2 Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).

Class 3 Recycling or reclamation of metals and metal compounds.

Class 4 Recycling or reclamation of other inorganic materials.

Class 10 The treatment of any waste on land with a consequential benefit for an agricultural activity or ecological system.

Class 11 Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.

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.

## ***3.0 Quantity and composition of waste received, disposed and recovered***

The acceptance of waste for landfilling and for recycling ceased on site on the 11th July 2014. Both the landfill site and the civic amenity site are now closed to all customers.

Kerry County Council is now looking at alternative options for the site.

*Quantity of Waste disposed at facility*

Since opening in May 1994 the total quantity of waste disposed of at the facility was 888,400 tonnes.

*BMW Percentage Composition of Waste disposed at facility*

| Year | Period | Total Qty MSW of which the BMW Condition Applies | Total Qty BMW | % BMW |
|---|---|---|---|---|
| 2010 | Q3 – Q4 | 9,461.84 | 5,834.46 | 61.66 |
| 2011 | Q1 – Q4 | 16,315.41 | 10,301.91 | 63.14 |
| 2012 | Q1 – Q4 | 71,006.59 | 44,689.45 | 62.94 |
| 2013 | Q1 – Q4 | 55,117.72 | 30,668.49 | 55.64 |
| 2014 | Q1 – Q4 | 4,741.01 | 2,628.35 | 55.44 |
| 2015 | Q1 – Q4 | 0 | 0 | 0 |

Please note that submitted figures for 2013 and 2014 were incorrect below shows the discrepancies in both.

| Year | BMW Returns | Total Waste Landfilled | Total BMW (biological municipal waste) | % BMW |
|---|---|---|---|---|
| 2013 | Reported | 55,117.72 | 30668.49 | 55.64% |
| | Actual | 55,276.68 | 29,749.68 | 53.52% |
| | | | | |
| 2014 | Reported | 4,741.01 | 2,628.35 | 55.44% |
| | Actual | 4,521.4 | 2,476.83 | 54.78% |
| 2015 | Reported | 0 | 0 | 0 |
| | Actual | 0 | 0 | 0 |

## *4.0 Remaining Capacity and Closure Date*

The North Kerry Landfill and civic amenity site ceased operation on the 11th July 2014.

The Total Permitted Landfill Capacity is 1,527,567 m³ as per Table A.2 of the Waste Licence and the total quantity of waste disposed of at the facility is 888,400 m³ which leaves an undeveloped licensed volume of 639,167 m³ which could be utilised in the future.

## *5.0 Method of Deposition of Waste at North Kerry Landfill - 2015*

The civic amenity ceased operation on the 11th July 2014.

## *6.0 Summary Report on Emissions for the Reporting Period.*

***Emissions to Water.***

A full report prepared by the Environmental Laboratory of KCC is included in this document in Appendix B. However, the Invertebrate Results and Biological Assessment are not included in this Report but will be carried out for 2016 and included into the next AER. Kerry County Council's lab is currently working towards ISO accreditation and as a result the Senior Executive Chemist time has been taken up with this process and has not closed out 2015 to date. The verified lab results are also provided in Appendix B.

***Emissions to Air.***

Gas management practices at North Kerry Landfill are an interlinked system of actions no one of which can fully control or manage the generation of LFG from the deposited waste mass. In combination however, they comply fully with the requirements of the licence.

The Systems and operations include:

- Active management of the gas control infrastructure
- Odour patrol
- Monitoring and testing of infrastructure

The infrastructure in place at North Kerry Landfill includes the construction of a basal liner and capping system.

Outside the footprint of the landfill is a network of LFG monitoring boreholes. There are constructed in a grid around the footprint of the area that waste has been deposited within. These wells are monitored on a monthly basis for the presence of a suite of indicator gases that would signal the possible migration of LFG.

Perimeter Gas Wells No. 6 through to 6d continues to show methane and CO2 concentrations above the allowable limits. These are historically problematic wells. In 2004 wells 6a to 6d were constructed to monitor the gas migration in the vicinity of the gas well. These perimeter gas wells also showed gas concentration levels in excess of the allowable at times during the year.

It is noted however that there is no odour nuisance at the location of gas wells 6 through to 6d or any evidence of vegetation die back. The likely cause was due to Historical contamination issues. The perimeter Gas Wells 6, 6a to 6d were constructed on a man-made embankment.

In November 2011 the gas to energy project was successfully commissioned. A Genset of nominal rating - 320 kW is in operation at the facility.

The demand of the generation plant has been balanced against the generation output of the field. Field balancing and network management are vital components of a successful operation of the gas to energy project. These are actively managed by B9 to ensure maximum production.

Gas Balancing records, Flare and Engine Stack, Dust and Noise Monitoring are included in are Appendices: C, D, E, F, and G.

## *7.0 Resource and Energy Consumption.*

The following is the energy consumption for North Kerry Landfill for the reporting period.

***Diesel***
The diesel usage for the reporting period (1st January to 31st December 2015) was 1,265 litres. This is a significant decrease in diesel usage of 17,583 litres.

***Electricity***
The total usage for 2015 was 95,650 kWh. This is a significant decrease in energy consumption of 36,675 kWh.

## *8.0 Energy Efficiency and Audit Report Summary*

*Electricity*

The kW hour usage on site for 2015 is set out in the attached table.

*Table 8.1, kWh usage 2015*

| From | To | Day kWh | Night kWh |
|---|---|---|---|
| 31/12/2014 | 28/02/2015 | 12,300 | 5,650 |
| 28/02/2015 | 30/04/2015 | 13,050 | 6,000 |
| 30/04/2015 | 30/06/2015 | 8,350 | 5,000 |
| 30/06/2015 | 31/08/2015 | 8,900 | 5,200 |
| 31/08/2015 | 31/10/2015 | 10,450 | 6,100 |
| 01/11/2015 | 31/12/2015 | 8,850 | 5,800 |
| | | **61,900** | **33,750** |

## *9.0 Proposed Development of the Facility and timescale of the Development*

The following projects are proposed at North Kerry Landfill over 2016.

***SCADA Project***

*Installation of a telemetry system for the recording of leachate levels in lined cells 1 to 16 and the connection of this system to the SCADA. There is an existing functioning SCADA system for Cells 17 to 19*

***Minor Remediation of capping***

*There are a number of minor repair and improvement works that have been listed for completion at North Kerry Landfill (NKL).*
*They have been identified through:*

- *Gas collection infrastructure audits undertaken by B9 Energy Ltd (the company who manage the gas collection infrastructure and generate electricity from the retrieved gas under agreement with KCC)*
- *Routine KCC site inspections*
- *VOC Survey remediation works*

***Decommissioning of the ICW***

*The project was undertaken with a view to determine if the ICW principle could form part of a site specific solution to leachate management at NKL taking account of the particular constraints on the site and if it could be scaled as required for the expected volumes and concentrations in time.*

*The Pilot Project is now complete and it is now intended to decommission/mothball the wetland.*

*It is intended that the works will be completed in a number of phases, progression between phases will be dependent upon more specific information/data being confirmed indicating that it is appropriate to proceed.*

- *Phase 1 – initial discontinuation of the flow and removal of pumping/electrical connections*
- *Phase 2 – assessment of constraints – particularly any required treatment of the growing media*
- *Phase 3 – retiring the bunds and ensuring continuity of the geocomposite layer to ensure satisfactory surface water drainage.*

***Decommissioning of the Compost Lagoon***

*It is proposed that the compost lagoon be decommissioned in 2016 having sampled and assessed the water quality and submitted to the EPA for approval. The proposal will be to divert all surface water at the CAS area to the surface water drains that lead to the Northern Surface Water Lagoon.*

## ***10.0 Volume of leachate produced and volume transported off site.***

Over the reporting period, 44,029.68 $m^3$ of leachate was produced on site.

The total quantity of leachate produced on site since the landfill site opened in May 1994 to the end of the reporting period is 895,655.12$m^3$

*Table 10.1, Leachate volumes tankered off –site, 2015*

| Month | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| January | 4,230.94 | 5,255.90 | 11,271.74 | 9,991.34 | 14,069.56 | 6,375.97 |
| February | 5,666.38 | 5,395.38 | 6,780.04 | 10,926.18 | 11,161.2 | 2,905.77 |
| March | 3,324.86 | 3,768.72 | 2,502.62 | 2,412.84 | 6,039.42 | 4,176.74 |
| April | 4,080.68 | 3,845.78 | 3,623.48 | 5,506.44 | 3,269.7 | 2,231.66 |
| May | 1,711.48 | 2,805.70 | 3,724.42 | 5,322.99 | 3,479.30 | 3,859.72 |
| June | 1,236.44 | 3,735.13 | 4,351.31 | 3,488.05 | 2,358.17 | 2,563.78 |
| July | 4,304.64 | 3,698.12 | 7,551.38 | 2,313.66 | 1,317.42 | 1,457.82 |
| August | 2,208.06 | 2,751.70 | 6,072.90 | 4,572.32 | 3,043.37 | 2,236.16 |
| September | 4,902.34 | 3,655.51 | 4,576.09 | 2,028.98 | 1,229.30 | 2,606.70 |
| October | 2,393.60 | 3,956.40 | 5775.56 | 5,791.80 | 3,748.06 | 2,434.60 |
| November | 6,719.70 | 4,905.12 | 6997.38 | 9,154.71 | 6,346.25 | 5,147.28 |
| December | 1,663.61 | 6,335.12 | 5836.08 | 6,320.70 | 5,102.68 | 8,033.48 |
| **Total** | **42,442.73** | **50,108.58** | **69,063.00** | **67,830.01** | **61,164.43** | **44,029.68** |

## ***11.0 Report on Development Works Undertaken during the Reporting Period***

The permanent capping of Cells 17 to 19 and their connection to the landfill gas network was completed in March 2015.

## ***12.0 Report on Restoration of Completed Cells and Phases***

All constructed cells 1 – 19 are fully capped with a gas extraction system.

## ***13.0 Site Survey showing existing Levels of the Facility at the end of the reporting period***

See Appendix K for Topographical Survey 2015 showing the extent of the Facility with contours.

## 14.0 *Estimated Annual and Cumulative quantities of landfill gas emitted from the Facility*

The GasSim Model gas curve estimates in 2015

**1. Actual**

| | | hrs | rate m3/hr | total m3 | methane % | methane m3 | |
|---|---|---|---|---|---|---|---|
| Flare | Jan | 487 | 120 | 58,440.00 | 48 | 28,051.20 | |
| | Feb | 402 | 100 | 40,200.00 | 50 | 20,100.00 | |
| | Mar | 594 | 120 | 71,280.00 | 47 | 33,501.60 | |
| | Apr | 712 | 140 | 99,680.00 | 48 | 47,846.40 | |
| | May | 732 | 140 | 102,480.00 | 52 | 53,289.60 | |
| | Jun | 665 | 110 | 73,150.00 | 44 | 32,186.00 | |
| | Jul | 725 | 140 | 101,500.00 | 48 | 48,720.00 | |
| | Aug | 724 | 150 | 108,600.00 | 50 | 54,300.00 | |
| | Sep | 707 | 140 | 98,980.00 | 52 | 51,469.60 | |
| | Oct | 737 | 150 | 110,550.00 | 51 | 56,380.50 | |
| | Nov | 686 | 135 | 92,610.00 | 49 | 45,378.90 | |
| | Dec | 700 | 120 | 84,000.00 | 53 | 44,520.00 | |
| Engine | Jan | 711 | 160 | 113,760.00 | 48 | 54,604.80 | |
| | Feb | 643 | 155 | 99,665.00 | 50 | 49,832.50 | |
| | Mar | 732 | 165 | 120,780.00 | 47 | 56,766.60 | |
| | Apr | 720 | 160 | 115,200.00 | 48.6 | 55,987.20 | |
| | May | 725 | 150 | 108,750.00 | 52 | 56,550.00 | |
| | Jun | 718 | 180 | 129,240.00 | 44 | 56,865.60 | |
| | Jul | 718 | 165 | 118,470.00 | 48 | 56,865.60 | |
| | Aug | 634 | 160 | 101,440.00 | 50 | 50,720.00 | |
| | Sep | 711 | 155 | 110,205.00 | 52 | 57,306.60 | |
| | Oct | 744 | 150 | 111,600.00 | 51 | 56,916.00 | |
| | Nov | 718 | 155 | 111,290.00 | 49 | 54,532.10 | |
| | Dec | 714 | 145 | 103,530.00 | 53 | 54,870.90 | |
| | | 16,359.00 | | 2,385,400.00 | 49.3583333 | 1,177,561.70 | @98% efficiency 1,154,010.47m3 |

**2. Theoretical**

| | | hrs | rate m3/hr | total m3 | % Methane | Total | |
|---|---|---|---|---|---|---|---|
| Theoretical | | 8,760.00 | 375 | 3,285,000.00 | 49.3583333 | 1,621,421.25 | methane m3 |

**3. Difference**

| | Methane | Density | Total | |
|---|---|---|---|---|
| Theoretical | 1,621,421.25 | 0.67 | 1,080,023.00 | kg |
| Actual | 1,154,010.47 | 0.67 | 777,294.94 | kg |
| | | | 302.73 | tonnes unexplained |

These figures were used in the estimation of landfill gas generation over the reporting period and submitted as part of the Landfill Gas Survey 2015 (Appendix H) and the PRTR 2015 (Appendix H).

## B9 Power Gas Sim Model

### *13.0 Estimated Annual and Cumulative quantities of Indirect Emissions to Groundwater*

None to report.

### *14.0 Annual Water Balance Calculation and Interpretation*

The predicted Water Mass Balance calculation shows predicted leachate production for 2015.

**Lo =** [ER(A) + LW + IRCA + ER(l)] - [aW]

| | | | 1 | | 2 | | 3 | 4 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **Active Phase** | **Active Area** | **Active Area infiltration** | **Restored Phase No.** | **Liquid Waste** | **Restored Area** | **Restored Area Infiltration** | **ER(I)** | **Total Water** | **Absorptive Capacity** | **Leachate Produced** | **Actual Leachate** | **Difference** |
| | | ***A (m2)*** | ***ER(A) (m3)*** | | ***LW (m3)*** | ***RCA (m2)*** | ***IRCA (m3)*** | | ***1+2+3+4 (m3)*** | ***aW (m3)*** | ***Lo (m3)*** | ***(m3)*** | ***(m3)*** |
| 2002 | 5 | 11,800.00 | 19,918.40 | 1,2,3 | 0 | 22,050 | 2,840.04 | 3127.264 | 25,885.70 | 1,770.81 | 49,771.34 | 34,218.23 | -15,553.11 |
| 2003 | 6 | 16,100.00 | 20,946.10 | 1,2,3,4 | 0 | 25,450 | 2,547.55 | 2430.428 | 25,924.07 | 879.12 | 51,436.60 | 30,721.59 | -20,715.01 |
| 2004 | 6 | 19,500.00 | 32,416.80 | 1,2,3,4 | 0 | 27,550 | 3,306.00 | | 35,722.80 | 840.95 | 37,947.25 | 45,130.40 | 7,183.15 |
| 2005 | 6,7 | 16,200.00 | 27,596.70 | 1,2,3,4,5 | 0 | 29,600 | 4,004.88 | | 31,601.58 | 602.54 | 34,155.79 | 5,784.59 | 20,628.80 |
| 2006 | 7 | 28,800.00 | 27,596.70 | 1,2,3,4,5 | 0 | 29,600 | 4,025.60 | | 31,622.30 | 1,050.44 | 33,361.86 | 60,922.61 | 27,560.75 |
| 2007 | 7 | 14,400.00 | 24,036.48 | 1,2,3,4,5,6 | 0 | 53,340 | 6,769.91 | | 30,806.39 | 1,391.46 | 33,307.30 | 55,436.15 | 22,128.85 |
| 2008 | 8 | 24,300.00 | 50,517.27 | 1,2,3,4,5,6 | 0 | 53,340 | 6,931.00 | | 57,448.27 | 1,528.82 | 59,811.81 | 78,558.23 | 18,746.42 |
| 2009 | 8 | 32,400.00 | 62,763.98 | 1,2,3,4,5,6 | 0 | 53,340 | 8,295.22 | | 71,059.21 | 695.72 | 73,862.60 | 73,727.85 | -134.75 |
| 2010 | 8 | 32,400.00 | 43,957.08 | 1,2,3,4,5,7 | 0 | 63,340 | 4,736.82 | | 48,693.90 | 367.27 | 50,009.27 | 42,442.00 | -7,567.27 |
| 2011 | 8 | 32,400.00 | 45,398.88 | 1,2,3,4,5,7 | 0 | 63,340 | 1,280.86 | | 46,679.74 | 289.55 | 46,845.19 | 50,108.58 | 3,263.39 |
| 2012 | 8,9 | 33,616.67 | 61,630.45 | 1,2,3,4,5,7,8 | 0 | 95,740 | 11,620.16 | | 73,250.60 | 1,242.62 | 72,462.98 | 69,063.01 | -3,399.97 |
| 2013 | 9 | 38,323.34 | 53,334.59 | 1,2,3,4,5,7,8 | 0 | 95,740 | 9,650.59 | | 62,985.18 | 967.33 | 62,472.84 | 67,830.10 | 5,357.26 |
| 2014 | 9 | 21,515.00 | 38,468.82 | 1,2,3,4,5,7,8 | 0 | 134,063 | 13,961.32 | | 52,430.14 | 79.12 | 52,806.01 | 61,164.43 | 8,358.42 |
| 2015 | 9 | 21,515.00 | 9,524.69 | 1,2,3,4,5,7,8 | 0 | 134,063 | 12,371.33 | | 21,896.02 | 23.81 | 23,948.51 | 44,029.68 | 20,081.17 |

Rainfall figures for the first three months of the year only. Cells 17, 18 & 19 were fully capped by the end of March 2015.

Actual leachate does include leachate from civic amenity site area.

## 15.0 Report on the Progress towards Achievement of Environmental Objectives contained in previous AER 2014

| Target Area | Objective | Works Carried Out | Results |
|---|---|---|---|
| *Reduction in Fugitive Gas Emissions* | Reduction in number of on-site minor surface emissions following two VOC surveys | Regular patrol of gas collection infrastructure to ensure that there is no blockages on the lines.<br>Permanent capping of cells 17 to 19<br>Gas extraction from cells 17 to 19.<br>Minor remediation works on gas wells and side risers | No Odour Complaints in 2015. |
| *Surface Water Emissions* | Keep Surface Water Emissions within agreed limits | Proper management of leachate on site.<br>Regular inspection of surface water drains<br>Regular inspection of bunded area for integrity on site<br>Hydrological Review/Technical Assessment Report carried out and is part of the 2015 AER | No ammonia levels exceeded in surface water lagoons. |
| *Ground Water Emissions* | Keep Ground Water Emissions to within agreed limits | Proper management of leachate levels on site.<br>Hydrological Review/Technical Assessment Report carried out and is part of the 2015 AER | No licence limit exceeded in Boreholes |
| *Leachate Management* | Reduction in the quantity of leachate produced on site | Final capping of cells 17 and 18 commenced in November 2014 and was completed in March 2015. | Decrease in leachate produced on site during reporting period. |
| *Dust* | Keep dust deposit limits within allowable level. | Dust Monitoring Report carried out | No licenced limits exceeded |

| | | | |
|---|---|---|---|
| *Vermin* | Keep vermin population on site to a minimum | Regular baiting of bait boxes throughout the site | No visible activity of vermin on site |
| *Energy Resources* | Reduce the quantity of diesel and electricity used on site | | Significant decrease in electricity consumption on site |

## *19.0 Schedule of environmental objectives and targets for the forthcoming year.*

The following tables sets out the environmental objectives for the facility under a range of headings.

| Target Area | Objective | Actions to be progressed and methods | By | 2016 | 2017 | 2018 | 2019 |
|---|---|---|---|---|---|---|---|
| Reduction in Fugitive Gas Emissions | Reduction in number of surface emissions from VOC Survey | o Minor remediation works around gas wells and side risers | FM | On-going | | | |
| Surface Water Emissions | Keep surface water emissions within limits | o Proper management of leachate on site<br>o Installation of SCADA to Cells 1 to 16<br>o Regular inspection of surface water drains<br>o Regular inspection of bunded area for integrity on site | FM<br>FM<br>FM<br>FM | On-going<br>On-going<br>On-going<br>On-going | On-going<br>On-going<br>On-going | On-going<br>On-going<br>On-going | On-going<br>On-going<br>On-going |
| Ground Water Emissions | No emissions | o Proper management of leachate on site<br>o Regular inspection of bunded area for integrity on site | FM<br>FM | On-going<br>On-going | On-going<br>On-going | On-going<br>On-going | On-going<br>On-going |
| Leachate Management | Reduction in the quantity of leachate produced on site | o ICW decommissioning<br>o Compost Lagoon decommissioning<br>o Minor remediation works to capping | FM<br>FM<br>FM | Q3<br>Q3<br>Q2/Q3 | | | |

FM – Facility Manager

## *20.0 Summary of Procedures Developed by the Licensee during the reporting period*

No additional procedures were developed by the Licensee during the reporting period. However, the CRAMP was approved in March 2015 and is on file for inspection.

## *21.0 Tank, Pipeline and Bund Testing and Inspection Report*

Integrity testing was completed on leachate lagoons 1 and 2 in 2013.

## *22.0 Environmental Incidents and Complaints*

*Environmental Incidents*

The incidents reported to the agency refer to exceedances experienced in perimeter gas wells 6 to 6d and the temporary exceedence above one meter in the leachate level of Waste Cells 5 and 13.

It is noted that there was no odour nuisances in the perimeter gas well exceedences or no vegetative die back and so it is thought that the readings in gas well 6 to 6d refer to a sump effect in a rock fill embankment that is at a finished construction height above the original ground level.

*Complaints*

There were no complaints received for the reporting period (2015).
There were 10 in 2013 and 1 in 2014.

*Table 18.1: Breakdown of complaints received over last five years*

| Issue | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|
| Odour | 1 | 16 | 5 | 1 | 0 |
| Illegal Dumping | 6 | 3 | 1 | 0 | 0 |
| Rubbish on Main Road | 2 | 1 | 1 | 0 | 0 |
| Uncovered/unsecure loads being admitted into landfill site | 0 | 9 | 0 | 0 | 0 |
| Flies | 5 | 5 | 0 | 0 | 0 |
| Site Infrastructure | 6 | 3 | 3 | 0 | 0 |
| Speeding Leachate Trucks | 0 | 0 | 0 | 0 | 0 |
| Noise from Leachate Lorries at Treatment Plant | 1 | 0 | 0 | 0 | 0 |
| Windblown litter | 0 | 0 | 0 | 0 | 0 |
| Total Number of Complaints | 21 | 37 | 10 | 1 | 0 |

## ***24.0 Report on Financial Provision***

Kerry County Council has a Landfill Aftercare and Development Fund.

The CRAMP report as submitted to the agency and approved in March 2015 requires the Kerry County Council to maintain the landfill site both during its active phase and closed phase.

Kerry County Council is well positioned to meet its financial liabilities.

The EPA will be asking for Local Authorities to make financial provisions to cover any liabilities associated with the operation (including closure and aftercare) of the facility, as per Condition 13.3.3. These statements will be included in the 2016 AER.

## *25.0 Management and Staffing Structure at the Facility 2015*

**Kerry County Council**

Chief Executive: **Ms. Moira Murrell**

Director of Services: **Mr John Breen**

Senior Executive Officer: **Mr. Liam Quinlan**

Engineers: **Mr. David Donegan & Mr Conor Culloo**

SEC
***Mr. David Lenihan***

Environmental Consultants
***Various***

Landfill Manager:

*Mr Alan Kennelly*

Site Supervisor

*Mr. Tony Bradley*

## 26.0 Programme of Public Information

The following files are available for inspection and it is proposed that all files will be available at Maine Street, Tralee, Co. Kerry. KCC intend to propose this change as a Licensee Return which will then require approval from the EPA.
The site has been closed since 11th July 2014.

- AER of previous reporting year.
- All correspondence with the Agency
- Surface Water Monitoring Results
- Ground Water Monitoring Results
- Perimeter Gas Detection Well Monitoring Results
- Nuisance Control Documentation
- Leachate Chemical Analysis results
- Leachate quantities produced
- Operational Procedure Manual

## .27.0 Training of Staff 2015

The Site Supervisor is up to date with regards to training in SAFEPASS and CSCS.

## 28.0 Cost of Landfill / Community Fund.

Please see Condition 13.5 of Waste Licence referenced W000 1-04
***The licensee shall provide the sum of €57,419 per annum*** *(index linked)* ***for local environmental and community initiatives for each year that the landfill accepts waste for disposal. A report on the use of this annual fund shall be included in the Annual Environmental Report to the Agency.***

The Community Fund is operated under the Local Government Act 2001 – Section 109 – (1)
*In this section "community initiative" means any project or programme which in the opinion of the local authority will benefit the local community and includes the provision or improvement of amenity, recreational, cultural or heritage facilities, the protection or enhancement of the environment and programmes to promote social inclusion and community development.*

As no waste was accepted at North Kerry Landfill in 2015, Kerry County Council did not allocate any money to the Community Fund. There is a balance of approximately €50,000 remaining in the Community Fund. Kerry County Council, Environment Section has been in contact with community leaders & asked them to submit a viable community initiative project *(or projects)*, for consideration. To date no community initiative project has been received.

The following table gives a breakdown of the financial outlay under the recycling and landfilling headings.

Table 22.2, Financial outlay 2015

*Recycling Costs 2015:*

| **RECYCLING COSTS 2015** | **Total Charge (€)** |
|---|---:|
| Wages | 661.29 |
| Salaries | 2,751.17 |
| ER PRSI | 342.52 |
| Eating on site allowance | 9.50 |
| Minor Contracts- Trade Services & other works | 580.10 |
| Staff Travelling & Subsistence Expenses | 0.00 |
| Communication Expenses | 41.24 |
| Security - Property | 655.88 |
| **North Kerry Landfill Recycling Costs 2015 TOTAL** | €5,041.70 |

*Waste Operations Costs 2015:*

| **WASTE OPERATIONS COSTS 2015** | **Total Charge (€)** |
|---|---|
| Wages | 29,119.65 |
| Salaries | 26,527.90 |
| ER PRSI | 6,385.48 |
| Overtime | 239.06 |
| Sick Pay | 249.90 |
| Annual Leave | 5,426.71 |
| Bank Holiday Leave | 1,186.85 |
| Travel/Subsistence | 13.71 |
| Eating on site allowance | 403.94 |
| Minor Contracts- Trade Services & other works | 193,020.38 |
| Non-Capital Equip Purchase - Fire Services | 22.00 |
| Non-Capital Equip Purchase - Computers | 1,078.85 |
| Non-Capital Equip Purchase - Other | 9,508.14 |
| Hire (Ext) - Plant/Transport/Machinery & Equipment | 6,911.60 |
| Repairs & Maint - Plant | 5,655.59 |
| Repairs & Maint - Other Equip | 1,127.35 |
| Transfers from Machinery Yard | 3,592.00 |
| Other Vehicle Expenses | 772.40 |
| Materials | 334.08 |
| Issues from Stores | 1,337.92 |
| Insurance | 5,487.20 |
| Staff Travelling & Subsistence Expenses | 5,968.23 |
| Entertainment Expenses and Associated Expenses | 46.90 |
| Computer Software and Maintenance Fees | 1,136.00 |
| Communication Expenses | 506.53 |
| Courier | 0.00 |
| Security - Property | 735.86 |
| Training | 470.00 |
| Consultancy/Professional Fees and Expenses | 44,410.72 |
| Printing & Office Consumables | 153.65 |
| Statutory Contributions to Other Bodies | 24,285.42 |
| Rates & Other LA Charges | 176.80 |
| Cleaning | 4,080.00 |
| Energy / Utilities | 21,886.01 |
| Overdraft interest & financial charges | 1.00 |
| **North Kerry Landfill Waste Costs 2015 TOTAL** | €402,257.83 |

## *29.0 Meteorological, Noise and Dust Monitoring Results*

### *Table 23.1, Rainfall data 2014 / 2015*

| | 2014 | | | 2015 | | |
|---|---|---|---|---|---|---|
| | Rainfall (mm) | TRUE Evaporation (mm) | Effective Rainfall (mm) | Rainfall (mm) | TRUE Evaporation (mm) | Effective Rainfall (mm) |
| Jan | 307.7 | 56.7 | 251 | 199.4 | 33.2 | 166.2 |
| Feb | 309.6 | 60.8 | 248.8 | 108.1 | 29.9 | 78.2 |
| Mar | 145.5 | 51.8 | 93.7 | 135.2 | 58.4 | 76.8 |
| Apr | 93.8 | 68.5 | 25.3 | 54.0 | 99.4 | -45.4 |
| May | 120.5 | 71.8 | 48.7 | 127.6 | 104.1 | 23.5 |
| Jun | 59.3 | 104.8 | -45.5 | 81.4 | 109.6 | -28.2 |
| Jul | 84.7 | 79 | 5.7 | 120.5 | 106.7 | 13.8 |
| Aug | 72.7 | 80.1 | -7.4 | 126.0 | 90.4 | 35.6 |
| Sep | 28 | 65.2 | -37.2 | 148.9 | 73.6 | 75.3 |
| Oct | 205.6 | 47.8 | 157.8 | 96.1 | 45.3 | 50.8 |
| Nov | 212.1 | 30.7 | 181.4 | 199.9 | 31.9 | 168 |
| Dec | 149.2 | 30.1 | 119.1 | 339.0 | 30.8 | 308.2 |
| *Total* | *1788.7* | *747.3* | *1041.4* | *1736.1* | *813.3* | 922.8 |

### *Noise Monitoring 2015*

Southern Scientific were commissioned by Kerry County Council to undertake a noise survey at North Kerry Landfill for 2016 because it was not carried out in 2015.

No limits were exceeded as shown in Appendix G in the first round of results.
The full report will be included in the 2016 AER. It is intended to seek approval from the EPA to reduce the frequency of noise monitoring now that the Landfill is closed.

### *Dust Monitoring 2015*

The EPA have approved (LR017694) to discontinue certain monitoring criteria as set out in Condition 8.12.

However, this is subject to:

1. The licensee shall contact the Agency should any change occur in the activities on site which may require a reinstatement of this monitoring.

2. Monitoring shall resume in the event of any complaints being received by the facility in relation to litter, vermin, birds or mud.

3. The Agency may revoke/amend this agreement at any time. The Agency does not agree to the discontinuation of odour monitoring at this time as concerns remain in relation to the management of landfill gas at the facility. .

However, Southern Scientific was commissioned by Kerry County Council to carry out dust deposition monitoring at four locations at North Kerry Landfill in 2016.

No limits were exceeded and the results are set out in Appendix F.

## ***30.0 Statement on the Achievement of the Waste Acceptance and Treatment Obligations***

*None to Report*

# Appendix A: Historic Data

| *North Kerry Landfill Leachate Tankered Off Site* | | |
|---|---|---|
| | | |
| | **Waste Tonnes** | **Leachate m3** |
| **1994** | 16,902 | 1,494.00 |
| **1995** | 23,505 | 6,475.00 |
| **1996** | 23,722 | 8,496.37 |
| **1997** | 25,581.88 | 12,175.49 |
| **1998** | 33,529.67 | 20,318.09 |
| **1999** | 57,872.71 | 22,822.95 |
| **2000** | 60,473.65 | 36,780.71 |
| **2001** | 63,945.91 | 18,953.85 |
| **2002** | 62,821.52 | 34,218.23 |
| **2003** | 50,235.29 | 30,721.59 |
| **2004** | 48,054.47 | 45,130.40 |
| **2005** | 34,430.82 | 54,784.59 |
| **2006** | 60,025.22 | 60,922.61 |
| **2007** | 56,794.24 | 55,436.15 |
| **2008** | 62,412.96 | 78,558.53 |
| **2009** | 39,755.40 | 73,727.85 |
| **2010** | 20,986.80 | 42,442.73 |
| **2011** | 16,545.71 | 50,108.58 |
| **2012** | 71,006.59 | 69,063.01 |
| **2013** | 55,276.68 | 67,830.01 |
| **2014** | 4,521.40 | 61,164.43 |
| **2015** | 0 | 44,029.68 |
| | | |
| **Total** | **888,400.08** | **895,655.12** |

# *Appendix B: Summary of results and Interpretation of Environmental Monitoring*

# ANNUAL ENVIRONMENT REPORT
## Physio-chemical and Biological Monitoring of North Kerry Landfill
## 2014/15

**Prepared by:**
***David Lenihan***
**Senior Executive Chemist** **30/03/2016**

**INTRODUCTION**

As Part of requirements under EPA Licence for North Kerry landfill this laboratory produces a report on a six monthly basis as well as an annual detailed report. This report can thus be interpreted as *Laboratory contribution to* ***Annual Environment report.***

Enclosed are:

- Annual results in spreadsheet format for Leachate, Surface Water and Groundwater as required per monitoring provisions as of licence requirements for 2015.
- Interpretation of results pertaining to three matrices of concern i.e. Groundwater, Surface water and Leachate
- results from ELS contract laboratory pertaining to individual List 1 and List 2 organics which were analysed for in Nov 2015 at three groundwater locations ***App3***
- ***Appendix 1*** detailing sample locations and associated grid references used in report
- ***Table 1*** outlines trigger values for strategic parameters analysed in groundwater
- ***Appendix 2*** details list of List 1,2 Organics monitored and their associated Limits of detection (LODs)

All except for analysis of ***Total cyanide, list 1*** and ***List 2 organic substances*** was conducted at KCC laboratory.

Analysis on these Parameters (italics *and asterix*) was farmed out to ***ELS laboratories*** Mahon Industrial Estate, Cork.

A summary of Environmental requirements has been prepared by Tobin Consulting engineers. This is the document we are using. Results are also included for monthly analysis of groundwater as required by provisions of old licence.

In 2014 and 2015 a total of ***344*** samples were sampled by KCC Laboratory personnel
Altogether ***5426 tests*** were analysed to satisfy requirements of licence monitoring.

Of these ***5344*** tests were analysed in KCC laboratory
The outsourced tests were analysed by *ELS laboratories*. The latter included Cyanide and List1 / 2 organics as required on an annual basis for three groundwater locations It must

however be stressed that each test for SVOCs or VOCs comprises analysis for 153 specific compounds

The monitoring locations monitored are as per requirements of new licence.
***APP1*** outlines locations and associated northings and eastings

## Trigger limits

Trigger limits are required to be set for certain parameters in groundwater and submitted to EPA. Perhaps the best such limits to use are groundwater threshold values as set out in groundwater regulations 2009. Other standards used, correspond to drinking water regulatory standards. However where drinking water limits cannot be adhered to because of natural conditions (non anthropogenic effects) i.e. PH the trigger value would have to be more flexible. The trigger values for Boreholes 1 to 4 are as highlighted in Table 1. Borehole 5 appears to be monitoring an aquifer which contains a lot of decaying organic matter more than likely from natural sources. Therefore trigger value for ammonia may be too strict.

### Table I Parametric Trigger values for Groundwater

| Parameter | units | Trigger value ( max) | Trigger value(min) |
|---|---|---|---|
| **Ammonium** | mg/L | 0.225 | |
| **Nitrite** | mg/L | 0.38 | |
| **Total Oxidised Nitrogen** | mg/L ($NO_3$) | 37.5 | |
| **Conductivity** | Us/cm | 800 | |
| **Ph** | Ph units | 10 | 4.5 |
| **Dissolved Oxygen** | mg/L O2 | | 1.0 |
| **Chloride** | mg/L | 200 | |
| **Flouride** | ug/L | 1000 | |
| **Sodium** | mg/L | 150 | |
| **Potassium** | mg/L | 10 | |
| **Boron** | mg/L | 0.75 | |
| **Copper** | mg/L | 1.5 | |
| **Cadmium** | ug/L | 3.75 | |
| **Chromium** | ug/L | 37.5 | |
| **Arsenic** | ug/L | 7.5 | |
| **Lead** | ug/L | 10 | |
| **Nickel** | ug/L | 15 | |
| **Mercury** | ug/L | 0.75 | |
| **Total Cyanide** | ug/L | 37.5 | |
| ***VOCs*** | | | |
| **Benzene** | ug/L | 0.75 | |
| **1,2 dichloroethane** | ug/L | 2.25 | |
| **Tetra chloroethene and Trichloroethene** | ug/L | 7.5 | |
| **Toluene** | ug/L | 5 | |
| **Phenols** | mg/L | 0.05 | |
| ***SVOCs*** | | | |
| **Atrazine** | ug/L | 0.075 | |
| **Simazine** | ug/L | 0.075 | |
| **Poly aromatic Hydrocarbons**[1] | ug/L | 0.075 | |

| Parameter | units | Trigger value ( max) | Trigger value(min) |
|---|---|---|---|
| **Pesticides**[2,3] | ug/L | 0.375 | |

***[1] PAHs neasured should include at least benzo(b)Fluoranthene, benzo(k Fluoranthene, benzo(ghi)perylene,indeno(123-cd)pyrene Fluoranthene***
***[2] the trigger value applies to each individual pesticide measured.***
***[3]Pesticides include organic insecticides, Organic herbicides, Organic nematocides, organic acaricides, organic algicides, organic rodenticides, organic slimicides, related products (inter alia, growth regulators***

## List 1 and List 2 Organics

Under the provisions of monitoring requirements we are required to monitor List 1 and List 2 organic compounds in three groundwater locations on an annual basis. These locations have to be agreed with EPA. In this report we report on four groundwater locations which were monitored for these compounds i.e. ***Borehole 2**, **3, 4 and GWML-E1***

The compounds analysed comprised of two types Volatile Organic compounds ***( VOCs)*** and Semi Volatile organic compounds ***( SVOCs)*** . VOCs comprise of organic compounds with boiling points close to or less than that of Water i.e. ***Petroleum products*** and common solvents –up to 83 compounds were screened for using Purge and Trap GC MS.
Semi Volatile compounds comprise of higher boiling point organics and comprise of classes of compounds such as ***pesticides, herbicides, PCBs*** ***(****polychlorinated Biphenyls****)*** and ***PAHs(****Poly aromatic Hydrocarbons)* .Up to 63 different compounds in this category were screened for. A list of these compounds, together with limits of detection is given in ***Appendix 2***
***No VOCs or SVOCs greater than their respective detection limits were detected***

## Heavy Metals

As we possess and use *ICP-MS instrument we monitored many more locations for heavy metals than were strictly required i.e. 12 surface water,6 Leachate, and 8 groundwater locations
**Inductively coupled Plasma Mass spectrometer*

# INTERPRETATION OF RESULTS

Groundwater*:*

All boreholes are showing evidence of surface water contamination to a greater or lesser extent – borehole 2 been least affected. . This is evident from turbidity colour and Total Organic carbon levels. The source of this surface water contamination is undoubtedly exacerbated by abnormally high rainfall.
There have been however no abnormal changes in water quality. The last abnormal changes observed were in 2013 with GWML –E1 when high Ammonia levels in May 2013 were experienced due to issues with leakage of leachate. ***See Fig 1.***

Since then however there has been no recurrence.
Borehole 5 continues pattern of other years i.e. high Ammonias coupled with highest levels of colour and molybdate reactive Phosphorous. The primary source of this would appear to be natural decomposition material in peaty soil s***ee Fig 2***

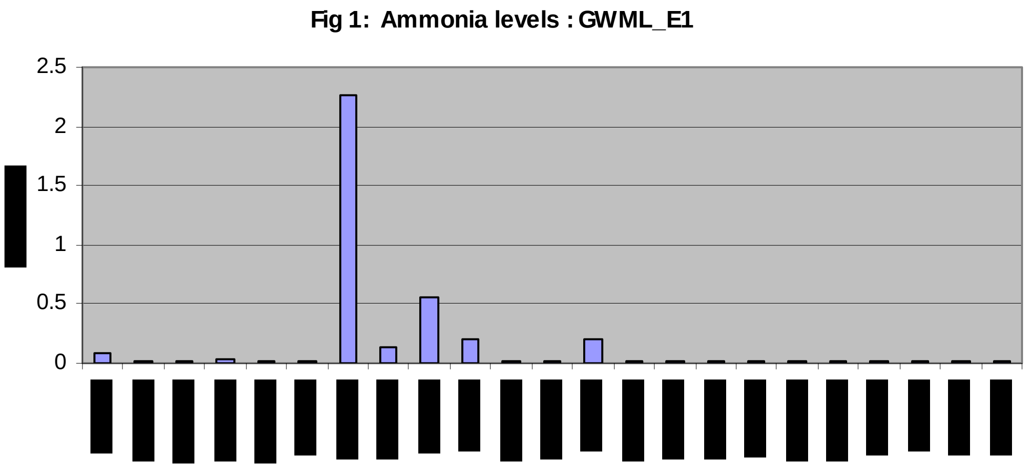
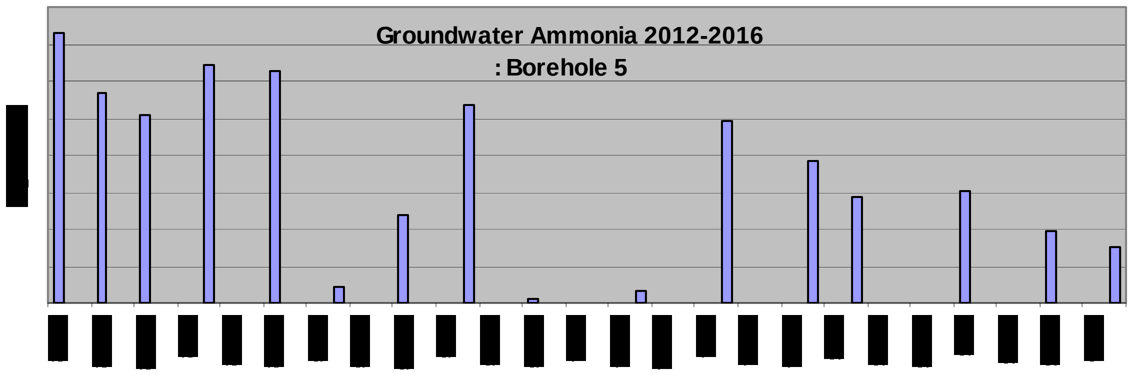



Fig 2




Boreholes GWML_***E1, 2*** and ***3*** were tested for list 1, 2 organics. No organic compounds in excess of their respective detection limits were found here.

# Surface water:

**Impact of Suspended solids:**

Results from monitoring over last 10 years indicates that most significant threat or impact from Landfill activities in surrounding waters is suspended solids
Samples were obtained "in site monitoring" from Stations ***SWML 1, 2.3,4,5,10,11 and new lagoon SWMLE1***.

Suspended solids have declined significantly since 2014 at on site surface water lagoons (***SWMLE1***) and ***SWML 10*** in Nov. Figs 4 and 7. There was one spike in Western Lagoon ***(SWML2)*** in Jan 16 which corresponded to preceding heavy rainfall as a result of storm activity *See Fig 3*

There has been a noticeable decrease in suspended solids in receiving waters at W1 during period of study – The last significant spike in results was in July 2013. *See Fig 5 Suspended solids @ W1 2013/2016.*

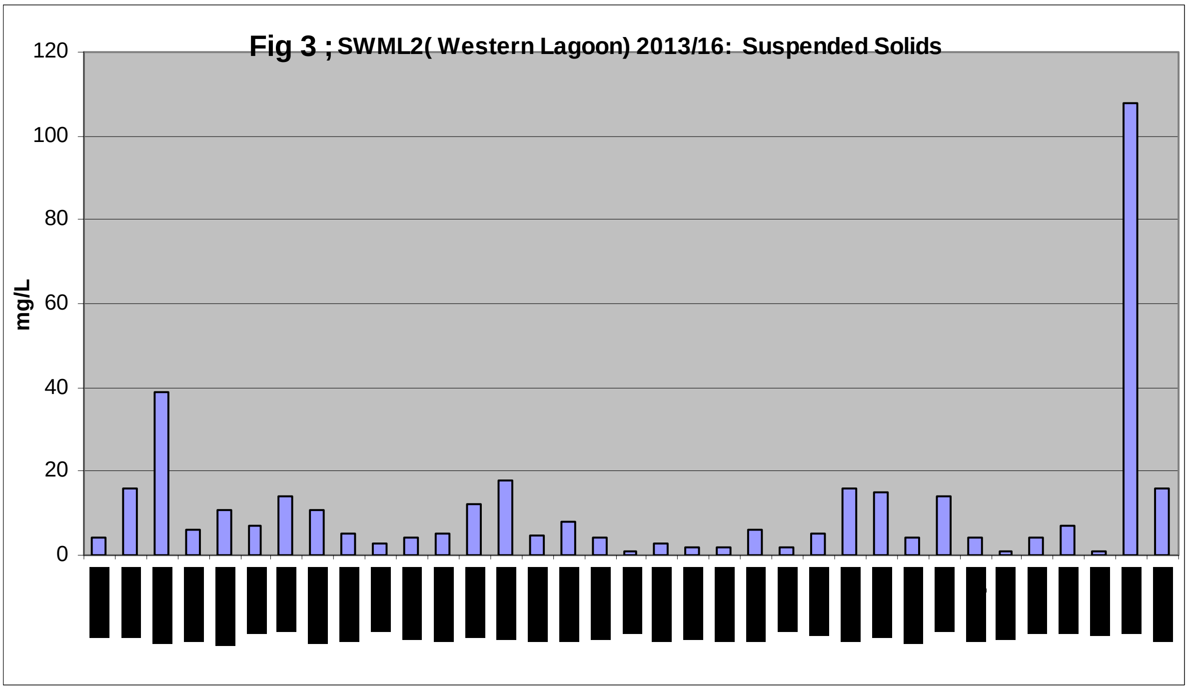
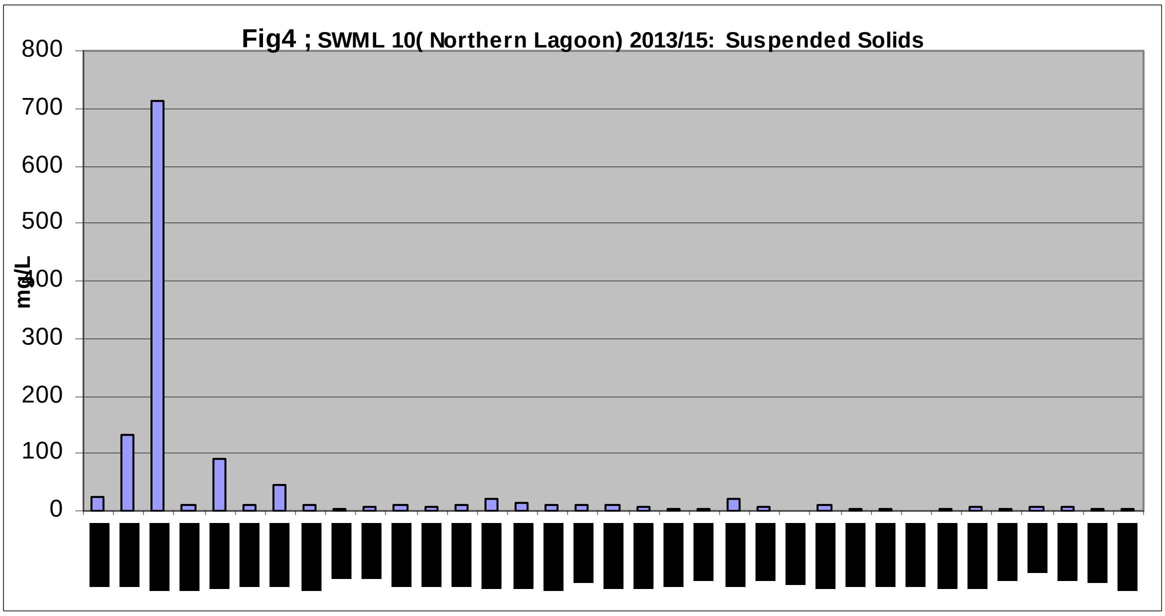
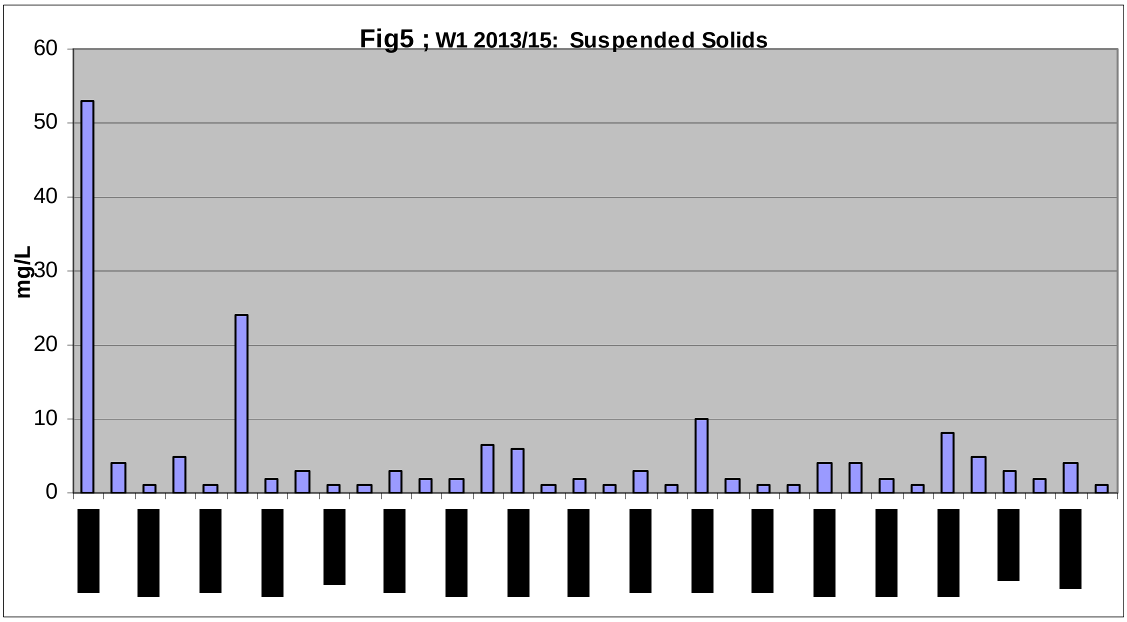
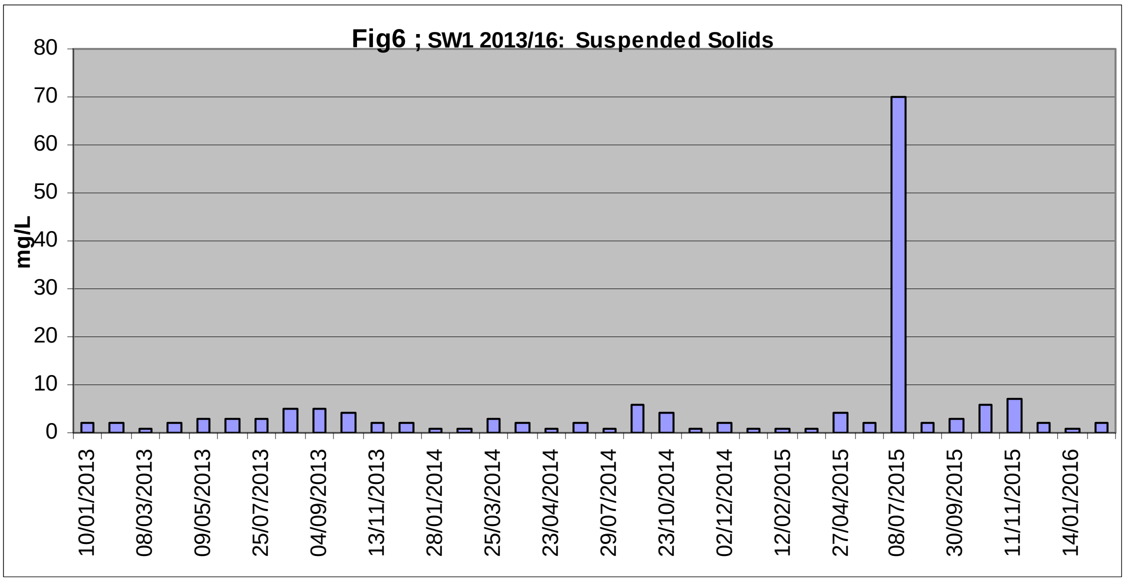


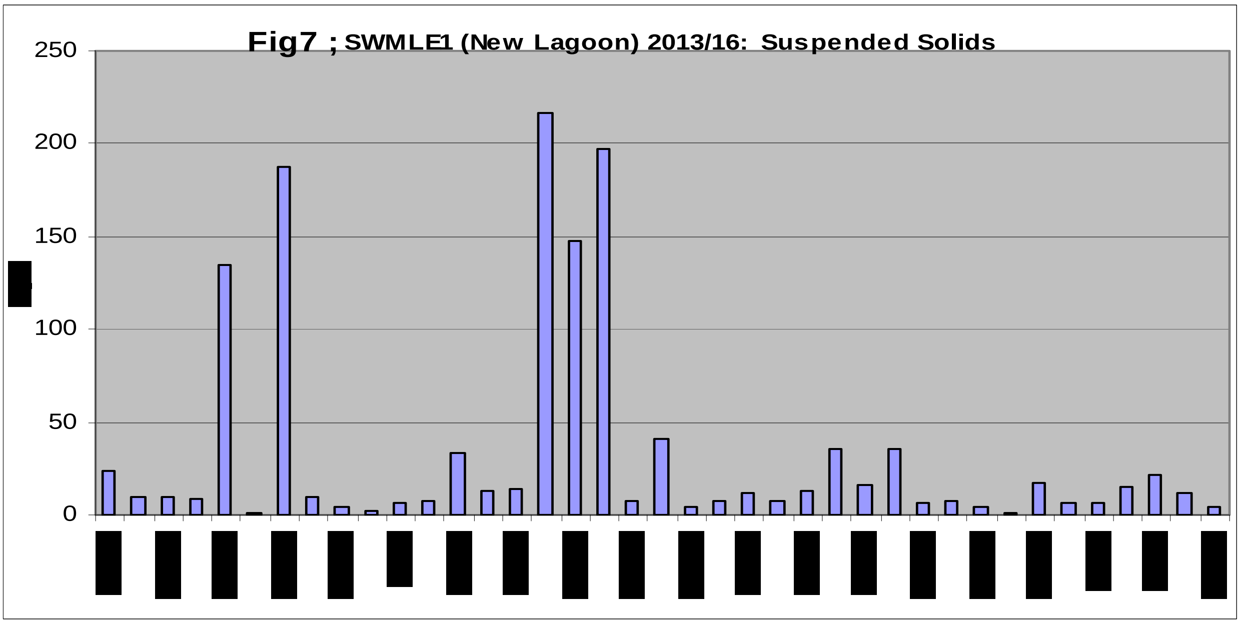

**Fig 3 ; SWML2( Western Lagoon) 2013/16: Suspended Solids**




There was also in general less significant impact from Suspended Solids on off site SW1. However one spike was recorded in July 2015 See *Fig 5Suspended solids @ sW1 2008/2011*






High suspended solids in river waters may impair fish spawning grounds particularly in winter and spring. Occasional pulses of suspended matter entering these sites are more than likely the main contributory factor for unsatisfactory biological quality at this site in the past (see 2011 AER)

Ecological assessment of ***W1*** In 2013 denotes a ***Q3*** value (moderate pollution), which still reflects some impact. This is a deterioration from 2012 where same site scored a ***Q 3 -4***. Biological assessment at station on Lee about 3 km downstream (O'Brennans bridge) indicates a stream of good quality i.e. ***Q =4-5.*** The causes of this pollution may not necessarily stem from Landfill activities as there are other excavation works upstream of this site. Because of logistical factors we were unable to conduct invertebrate monitoring in 2014 and 2015. In 2014 we were unable to do so because of difficulty of access. However we hope to do so in 2016

Because of importance and significance of Suspended solids monitoring of both W1 and SW1 are at a much higher frequency for this parameter than license obligations

**Impact of Ammonia levels on receiving waters**
No significant levels of ammonia were recorded in period 2014 to 2016 unlike in 2013, where up to Nov 2013 significant levels were recorded in new lagoon ***SWML E1***

## Conclusion

- ***Evidence of surface water contamination noted in all boreholes –***
- ***Biological assessment in 2014 denoted disimprovement in main surface water impact site i.e. W1 from Q 3-5 to Q 3***
- ***No significant levels of Ammonia detected in receiving water sites unlike in earlier years i.e. 2013***

**References:**

***1. Summary of Environmental Monitoring requirements For- Kerry Co Council Landfill, Muingnaminnane, Tralee, Co Kerry -Waste Licence Ref No: 1-3: Tobin Consulting Engineers***
***2. Biological Invertebrate Monitoring of Surface Waters 2012; Laboratory KCC***

## APPENDIX 2 ; LIST 1, 2 Organics

**Appendix1: Details Sampling points referred to in report**

| Location | comments | old or alternative name | Location Easting | Location Northing |
|---|---|---|---|---|
| | | | | |
| **Groundwater** | | | | |
| **specified groundwater monitoring pts** | | | | |
| Groundwater – GWML-E1 | | | 94697 | 117360 |
| Groundwater - BH-2 | | | 94814 | 117306 |
| Groundwater - BH-3 | | | 94808 | 117005 |
| Groundwater - BH-4 | | | 95430 | 117040 |
| Groundwater - BH-5 | | | 94917.5 | 117152.7 |
| Groundwater – GWML-E3 | | | 94843 | 117658 |
| **Private boreholes adjacent to landfill** | | | | |
| borehole: Dennis O Mahony | not specified in new licence | | 97390.7 | 118348.7 |
| borehole: Gerry Sugrue | not specified in new licence | | 93037.8 | 116489.5 |
| **Leachate** | | | | |
| **Detection manholes** | | | | |
| LD-1 | | leachate detection manhole 1 | 94909 | 117268 |
| LD-2 | | leachate detection manhole 2 | 94894 | 117298 |
| LD-3 | | leachate detection manhole from lagoon | 94905 | 117264 |
| **Lagoon sampling pts** | | | | |
| LL-1 | | Leachate in lagoon 1 | 94904 | 117237 |
| LL-2 | | leachate in Lagoon 2 | 94927 | 117166 |
| LL-3 | | lagoon containing run off from compost | 94979 | 117414 |
| **Ancillary pts** | | | | |
| Puraflo Treatment Inlet | not specified in new licence | | | |
| Puraflo Treatment Outlet | not specified in new licence | | 94867.2 | 117332 |
| Wheelwash | Not specified in new licence | | | |
| **Surface water** | | | | |
| **Off site sampling pts** | | | | |
| Surface Water sampling point: W1 | not specified in new licence | biological station | 94493.3 | 117107.5 |
| Surface water sampling point: E2 | Not specified in new licence | O'Learys farm | 95870.6 | 116575.6 |
| Surface water sampling point: W2 | Not specified in new licence | | 94493.3 | 117159.9 |
| SW-1 | | previously E1 | 95471 | 117077 |
| SW-2 | | | 95143.6 | 117969.4 |
| SW-3 | | | 94853 | 118263 |
| **On site sampling pts** | | | | |
| SWML-1 | | previously 1 | 94948.3 | 117376.4 |
| SWML-2 | Western Lagoon | previously 2 | 94837.9 | 117263.7 |
| SWML-3 | | | 94866 | 117221 |
| SWML-4 | | previously 4 | 94883.9 | 117092.6 |
| SWML-5 | | | 94911 | 117027 |
| SWML-10 | Eastern lagoon | | 95092 | 117470 |
| SWML-11 | | previously 11 | 95067 | 117520 |
| SWML-E1 | New surface water lagoon | | 94592 | 117510 |

SVOCs: (Semi Volatile base Neutrals)
Std Method 6410 B Liquid-Liquid Extraction GC/MS.

| Parameter | limit of detection | units |
|---|---|---|
| 1.3 - Dichlorobenzene | 1 | ug/l |
| 1.4 - Dichlorobenzene | 1 | ug/l |
| Hexachloroethane | 1 | ug/l |
| bis(2-Chloroethyl) ether | 1 | ug/l |
| 1,2-Dichlorobenzene | 1 | ug/l |
| bis(2-Chloroisopropyl) ether | 1 | ug/l |
| N-Nitrosodi-n-propylamine | 1 | ug/l |
| Nitrobenzene | 1 | ug/l |
| Hexachlorobutadiene | 1 | ug/l |
| 1,2,4-Trichlorobenzene | 1 | ug/l |
| Isophorone | 1 | ug/l |
| Naphthalene | 1 | ug/l |
| bis(2-Chlororthoxy) methane | 1 | ug/l |
| Hexachlorocyclopentadiene | 1 | ug/l |
| 2-Chloronaphthalene | 1 | ug/l |
| Acenaphthylene | 1 | ug/l |
| Acenaphthene | 1 | ug/l |
| Dimethyl phthalate | 1 | ug/l |
| 2,6-Dinitrotoluene | 1 | ug/l |
| Fluorene | 1 | ug/l |
| 4-Chlorophenyl phenyl ether | 1 | ug/l |
| 2,4-Dinitrotoluene | 1 | ug/l |
| Diethyl phthalate | 1 | ug/l |
| N-Nitrosodiphenylamine | 1 | ug/l |
| Hexachlorobenzene | 1 | ug/l |
| a-BHC | 1 | ug/l |
| 4-Bromophenyl phenyl ether | 1 | ug/l |
| y-BHC | 1 | ug/l |
| Phenanthrene | 1 | ug/l |
| Anthracene | 1 | ug/l |
| B-BHC | 1 | ug/l |
| Heptachlor | 1 | ug/l |
| d-BHC | 1 | ug/l |
| Aldrin | 1 | ug/l |
| Dibutyl phthalate | 1 | ug/l |
| Heptachlor epoxide | 1 | ug/l |
| Endosulfan I | 1 | ug/l |
| Fluoranthene | 1 | ug/l |
| Dieldrin | 1 | ug/l |
| 4,4'-DDE | 1 | ug/l |
| Pyrene | 1 | ug/l |
| Endrin | 1 | ug/l |

**VOCs : Std Method 6210 D-Purge and Trap Capillary Column GCMS.Screening per USEPA 524.2 list.**

| Parameter | limit of detection | units |
|---|---|---|
| Dichlorodifluoromethane | 10 | ug/l |
| Chloromethane | 0.5 | ug/l |
| Ethyl Chloride/Chloroethane | 0.5 | ug/l |
| Vinyl Chloride/Chloroethene *(0.5ppb) | 0.5 | ug/l |
| Vinyl Chloride/Chloroethene * (25ppb) | 0.5 | ug/l |
| Bromomethane | 0.5 | ug/l |
| Trichloromonofluoromethane | 0.5 | ug/l |
| Ethyl Ether/Diethyl Ether | 0.5 | ug/l |
| 11 Dichloroethene | 0.5 | ug/l |
| Acetone | 2 | ug/l |
| Iodomethane/Methyl Iodide | 0.5 | ug/l |
| Carbon Disulphide | 0.5 | ug/l |
| Allyl Chloride | 0.5 | ug/l |
| Methylene Chloride/DCM | 5 | ug/l |
| 2-Propenenitrile/Acrylonitrile | 2 | ug/l |
| Chloroacetonitrile | 0.5 | ug/l |
| Nitrobenzene | 0.5 | ug/l |
| Propanenitrile | 10 | ug/l |
| Hexachlorobutadiene | 0.5 | ug/l |
| Trans-1,2 Dichloroethene | 0.5 | ug/l |
| MtBE | 0.5 | ug/l |
| 11 Dichloroethane | 0.5 | ug/l |
| 22 Dichloropropane | 0.5 | ug/l |
| cis-12 Dichloroethene | 0.5 | ug/l |
| 2-Butanone | 5 | ug/l |
| Methyl Acrylate | 5 | ug/l |
| Bromochloromethane | 0.5 | ug/l |
| Methacrylonitrile | 5 | ug/l |
| Tetrahydrofuran | 5 | ug/l |
| Chloroform* | 1 | ug/l |
| 111 Trichloroethane | 0.5 | ug/l |
| 1-Chlorobutane | 0.5 | ug/l |
| Carbon Tetrachloride | 0.5 | ug/l |
| 11 Dichloropropene | 0.5 | ug/l |
| Benzene | 0.1 | ug/l |
| 12 Dichloroethane ) | 0.1 | ug/l |
| Trichloroethylene/ Trichloroethene | 0.1 | ug/l |
| 12 Dichloropropane | 0.5 | ug/l |
| Dibromomethane | 0.5 | ug/l |
| Methyl Methacrylate | 0.5 | ug/l |
| Bromodichloromethane* | 2 | ug/l |
| 13 Dichloropropene,cis | 2 | ug/l |

## APPENDIX 2 ; LIST 1, 2 Organics

SVOCs: (Semi Volatile base Neutrals)
Std Method 6410 B Liquid-Liquid Extraction GC/MS.

| Parameter | limit of detection | units |
|---|---|---|
| Endosulfan II | 1 | ug/l |
| 4,4'-DDD | 1 | ug/l |
| Benzidine | 1 | ug/l |
| 4,4'-DDT | 1 | ug/l |
| Endosulfan sulfate | 1 | ug/l |
| Endrin aldehyde | 1 | ug/l |
| Butyl benzyl phthalate | 1 | ug/l |
| bis(2-Ethylhexyl) phthalate | 1 | ug/l |
| Chrysene | 1 | ug/l |
| Benzo(a)anthracene | 1 | ug/l |
| 3,3'-Dichlorobenzidine | 1 | ug/l |
| Di-n-octyl phthalate | 1 | ug/l |
| Benzo(b)fluoranthene | 1 | ug/l |
| Benzo(k)fluoranthene | 1 | ug/l |
| Benzo(a)pyrene | 1 | ug/l |
| Indeno(1,2,3-cd)pyrene | 1 | ug/l |
| Dibenzo(a,h)anthracene | 1 | ug/l |
| Benzo(ghi)perylene | 1 | ug/l |
| N-Nitrosodimethylamine | 1 | ug/l |
| Chlordane | 1 | ug/l |
| Toxapene | 1 | ug/l |
| PCB 1016 | 1 | ug/l |
| PCB 1221 | 1 | ug/l |
| PCB 1232 | 1 | ug/l |
| PCB 1242 | 1 | ug/l |
| PCB 1248 | 1 | ug/l |
| PCB 1254 | 1 | ug/l |
| PCB 1260 | 1 | ug/l |

**VOCs : Std Method 6210 D-Purge and Trap Capillary Column GCMS.Screening per USEPA 524.2 list.**

| Parameter | limit of detection | units |
|---|---|---|
| MIBK/4 Methyl 2 Pentanone | 2 | ug/l |
| Toluene | 0.5 | ug/l |
| 13 Dichloropropene,trans | 2 | ug/l |
| Ethyl Methacrylate | 2 | ug/l |
| 112 Trichloroethane | 0.5 | ug/l |
| Tetrachloroethylene/ Tetrachloroethene* | 0.1 | ug/l |
| Tetrachloroethylene/ Tetrachloroethene* | 0.1 | ug/l |
| 13 Dichloropropane | 0.5 | ug/l |
| 2-Hexanone | 1 | ug/l |
| Dibromochloromethane * | 1 | ug/l |
| 12 Dibromoethane | 0.5 | ug/l |
| Chlorobenzene | 0.5 | ug/l |
| 1112 Tetrachloroethane | 2 | ug/l |
| Ethyl Benzene | 0.5 | ug/l |
| m & p Xylene | 0.5 | ug/l |
| o Xylene | 0.5 | ug/l |
| Styrene | 2 | ug/l |
| Bromoform * | 1 | ug/l |
| Isopropyl Benzene | 0.5 | ug/l |
| Bromobenzene | 0.5 | ug/l |
| 1122 Tetrachloroethane | 0.5 | ug/l |
| 123 Trichloropropane | 2 | ug/l |
| Trans 14 Dichloro 2 Butene, tran | 2 | ug/l |
| Propyl Benzene | 0.5 | ug/l |
| 2-Chlorotoluene | 0.5 | ug/l |
| 4 Chlorotoluene | 0.5 | ug/l |
| 135 Trimethylbenzene | 0.5 | ug/l |
| Tert Butyl Benzene | 0.5 | ug/l |
| 124 Trimethylbenzene | 0.5 | ug/l |
| Sec Butyl Benzene | 0.5 | ug/l |
| 13 Dichlorobenzene | 0.5 | ug/l |
| P Isopropyltoluene | 0.5 | ug/l |
| 14 Dichlorobenzene | 0.5 | ug/l |
| 12 Dichlorobenzene | 0.5 | ug/l |
| N Butyl Benzene | 0.5 | ug/l |
| Hexachloroethane | 5 | ug/l |
| 12 Dibromo 3 Chloropropane | 2 | ug/l |
| 124 Trichlorobenzene | 0.5 | ug/l |
| Napthhalene | 2 | ug/l |
| 123 Trichlorobenzene | 0.5 | ug/l |
| Toluene | 0.5 | ug/l |
| 13 Dichloropropene,trans | 2 | ug/l |
| Ethyl Methacrylate | 2 | ug/l |

**APPENDIX 2 ; LIST 1, 2 Organics**

SVOCs: (Semi Volatile base Neutrals)
Std Method 6410 B Liquid-Liquid Extraction
GC/MS.

| ***Parameter*** | ***limit of detection*** | ***units*** |
|---|---|---|
| | | |
| | | |

**VOCs : Std Method 6210 D-Purge and Trap Capillary Column GCMS.Screening per USEPA 524.2 list.**

| ***Parameter*** | ***limit of detection*** | ***units*** |
|---|---|---|
| 112 Trichloroethane | 0.5 | ug/l |
| Tetrachloroethylene/ Tetrachloroethene* | 0.1 | ug/l |

## Ground Water Results – North Kerry Landfill 2015

Kerry County Council - All Laboratory Results Report (Environment)

*** Please note that in accordance with Quality assurance procedures some of this data may be provisional and may be subject to further revision. This data is not validated until issued in report form signed by Senior Executive Chemist or another approved signatory***



| Product | Product Version | Project | SAMPLING POINT | Sampling Point | Sample No. | COA Link | Sampled Date | Sampled Time | Sampled By | Sample Type | Test List | Comments | Sample Status | Certificate of Authorisation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| GRD_WATER | 1 | North Kerry Landfill | NORTH_KERRY_LANDFILL_BH2 | North_Kerry_Landfill Groundwater :Borehole No 2 | 2015/0663 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0663_v1.pdf | 12-Feb-15 | 14:00 | TS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0663_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 2 | 2015/2842 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2842_v1.pdf | 08-Jul-15 | 12:42 | AS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2842_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 2 | 2015/4678 | | 11-Nov-15 | 12:45 | AS | LANDFILL | 130_NKL_GRD_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_BH3 | North_Kerry_Landfill Groundwater :Borehole No 3 | 2015/0664 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0664_v1.pdf | 12-Feb-15 | 14:10 | TS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0664_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 3 | 2015/0670QA | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0670QA_v1.pdf | 12-Feb-15 | 14:12 | TS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0670QA_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 3 | 2015/2843 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2843_v1.pdf | 08-Jul-15 | 15:05 | AS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2843_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 3 | 2015/4679 | | 11-Nov-15 | 11:30 | TS | LANDFILL | 130_NKL_GRD_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_BH4 | North_Kerry_Landfill Groundwater :Borehole No 4 | 2015/0665 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0665_v1.pdf | 12-Feb-15 | 10:55 | TS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0665_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 4 | 2015/2844 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2844_v1.pdf | 08-Jul-15 | 14:24 | AS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2844_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 4 | 2015/4680 | | 11-Nov-15 | 14:15 | AS | LANDFILL | 130_NKL_GRD_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_BH5 | North_Kerry_Landfill Groundwater :Borehole No 5 | 2015/0666 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0666_v1.pdf | 12-Feb-15 | 13:35 | TS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0666_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 5 | 2015/2845 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2845_v1.pdf | 08-Jul-15 | 13:25 | AS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2845_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 5 | 2015/4681 | | 11-Nov-15 | 12:16 | AS | LANDFILL | 130_NKL_GRD_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_BH6 | North_Kerry_Landfill Groundwater :Borehole No 6 | 2015/0667 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0667_v1.pdf | 12-Feb-15 | 12:40 | TS | LANDFILL | 130_NKL_GRD_QUART | BH6 Now called GWML E3 | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0667_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 6 | 2015/2846 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2846_v1.pdf | 08-Jul-15 | 10:40 | AS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2846_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Borehole No 6 | 2015/4682 | | 11-Nov-15 | 13:00 | TS | LANDFILL | 130_NKL_GRD_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_GWML_E1 | North_Kerry_Landfill Groundwater :GWML E1 | 2015/0662 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0662_v1.pdf | 12-Feb-15 | 13:00 | TS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0662_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :GWML E1 | 2015/2841 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2841_v1.pdf | 08-Jul-15 | 10:30 | AS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2841_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :GWML E1 | 2015/4677 | | 11-Nov-15 | 13:50 | AS | LANDFILL | 130_NKL_GRD_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_OMAHONY | North_Kerry_Landfill Groundwater :Dennis O'Mahony | 2015/0668 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0668_v1.pdf | 12-Feb-15 | 11:20 | TS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0668_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Dennis O'Mahony | 2015/2847 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2847_v1.pdf | 08-Jul-15 | 14:32 | AS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2847_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Dennis O'Mahony | 2015/4683 | | 11-Nov-15 | 14:33 | AS | LANDFILL | 130_NKL_GRD_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_SUGRUE | North_Kerry_Landfill Groundwater :Gerry Sugrue | 2015/0669 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0669_v1.pdf | 12-Feb-15 | 16:00 | TS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0669_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Gerry Sugrue | 2015/2848 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2848_v1.pdf | 08-Jul-15 | 9:36 | AS | LANDFILL | 130_NKL_GRD_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2848_v1.pdf |
| | | | | North_Kerry_Landfill Groundwater :Gerry Sugrue | 2015/4684 | | 11-Nov-15 | 14:55 | TS | LANDFILL | 130_NKL_GRD_ANNUAL | | Not Authorised | |

| Analysis | 001_COLOUR | 002_TURBIDITY | 003_ODOUR | 005A_TEMP_FIELD | 006_PH | | 007A_CONDUCTIVITY20C | 011_TOTAL_HARDNESS | 013C_BOD | 014_COD | 015_TOC | 016_FLUORIDE_ISE | 021K_NITRITE | 022K_AMMONIA | | 025_PHOSPHATE_SRP | 028K_CHLORIDE | 028K_SULPHATE | 031_SOLIDS_WW | 033K_TON | 036_DO_MG_L | 037_SUSPENDED_SOLIDS | 052_TOTAL_NITROGEN | 057_SOLIDS_TOTAL_DISS | 065_ALKANITY_TOTAL | 082_VIS_INSPECTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | Colour | Turbidity | Odour | Temperature | pH | | Conductivity | Total Hardness | B.O.D. | C.O.D. | TOC | Fluoride | Nitrite | Ammonia | | Phosphorus (MRP) | Chloride | Sulphate | Total Solids | TON | Dissolved Oxygen | Suspended Solids | Total Nitrogen | Total Dissolved Solids (180°C) | Alkalinity | Visual Inspection |
| Reported Min. Value | | | | | | 6.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Max Value | | | | | | 9.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Units | HAZEN | NTU | NONE | DEG_C | PH | PH | USCM | MGCACO3L | BOD | MGL | MGL | MGL_F | MGLN | MGLN | MGLN | MGL | MGL | MGL | MGL | MGLN | MGL | MGL | MGLN | MGL | MGCACO3L | NONE |
| 2015/0663 | 41 | 1.04 | Normal | 9.7 | 6.7 | | 371 | 170.0 | | | 1.6 | | | 0.02 | | | 21.9 | | | | 3.0 | | | | | Clear |
| 2015/2842 | 31 | 0.88 | Not Detected | 12.0 | 6.6 | | 165 | 26.0 | | | <1.0 | | | <0.02 | | | 41.3 | | | | 6.6 | | | | | Clear |
| 2015/4678 | 13 | 15.40 | Not Detected | 10.3 | 6.0 | | 162 | 30.0 | | | <1.0 | <0.1 | | <0.05 | | <0.005 | 43.9 | <5 | 105 | 0.93 | 6.3 | | | 105 | 18 | Clear |
| 2015/0664 | 13 | 2.64 | Normal | 5.7 | 5.4 | | 175 | 53.0 | | | 0.6 | | | <0.02 | | | 44.8 | | | | 3.6 | | | | | Clear |
| 2015/0670QA | 45 | 9.67 | Normal | 5.7 | 6.8 | | 371 | 164.0 | | | 1.9 | | | 0.03 | | | 22.4 | | | | 3.0 | | | | | Clear |
| 2015/2843 | 6 | 0.44 | Not Detected | 14.6 | 5.6 | | 386 | 180.0 | | | 2.1 | | | 0.02 | | | 29.6 | | | | 1.6 | | | | | Clear |
| 2015/4679 | 57 | 14.90 | Not Detected | 11.1 | 6.9 | | 324 | 152.0 | | | 10.7 | <0.1 | | <0.05 | | <0.005 | 24.4 | 8.0 | 201 | 0.99 | 7.0 | | | 201 | 136 | clear |
| 2015/0665 | 9 | 2.25 | Normal | 8.6 | 6.0 | | 197 | 86.0 | | | 0.9 | | | <0.02 | | | 20.5 | | | | 3.6 | | | | | Clear |
| 2015/2844 | 26 | 0.44 | Not Detected | 11.3 | 6.4 | | 194 | 77.0 | | | 1.3 | | | <0.02 | | | 19.3 | | | | 5.8 | | | | | Clear |
| 2015/4680 | 35 | 8.31 | Not Detected | 9.3 | 6.1 | | 190 | 69.0 | | | 1.1 | 0.1 | | <0.05 | | 0.03 | 21.6 | <5 | 118 | 0.57 | 3.5 | | | 118 | 69 | Clear |
| 2015/0666 | 700 | 1.97 | Metallic | 8.2 | 5.7 | | 153 | 52.0 | | | 12.8 | | | 0.57 | | | 26.6 | | | | 7.6 | | | | | Cloudy/Fe colour |
| 2015/2845 | 2940 | 236.00 | Metallic | 11.7 | 6.0 | | 191 | 26.0 | | | 37.2 | | | 0.61 | | | 27.3 | | | | 3.5 | | | | | Iron Oxide/Sediment |
| 2015/4681 | 411 | 1180.00 | Metallic | 11.2 | 5.7 | | 146 | 36.0 | | | 77.1 | <0.1 | | 0.39 | | 0.01 | 26.7 | 5.3 | 112 | <0.5 | 6.5 | | | 112 | 32 | Iron Oxide / Cloudy |
| 2015/0667 | 40 | 1.88 | Normal | 8.3 | 5.6 | | 146 | 50.0 | | | 1.8 | | | 0.02 | | | 25.4 | | | | 4.6 | | | | | Clear |
| 2015/2846 | 46 | 1.42 | Not Detected | 11.0 | 5.8 | | 147 | 46.0 | | | 1.1 | | | <0.02 | | | 24.6 | | | | 3.3 | | | | | Clear |
| 2015/4682 | 38 | 24.20 | Not Detected | 10.9 | 5.9 | | 156 | 42.0 | | | 2.1 | <0.1 | | <0.05 | | <0.005 | 27.9 | <5 | 77 | <0.5 | 1.5 | | | 77 | 38 | clear |
| 2015/0662 | 454 | 1.37 | Normal | 9.4 | 6.3 | | 206 | 92.0 | | | 2.4 | | | <0.02 | | | 27.3 | | | | 1.9 | | | | | Cloudy/coloured |
| 2015/2841 | 2590 | 36.30 | Not Detected | 10.5 | 6.9 | | 195 | 74.0 | | | 10.2 | | | <0.02 | | | 19.7 | | | | 3.5 | | | | | Brown Colour/Cloudy/Sediment |
| 2015/4677 | 34 | 23.40 | Not Detected | 11.7 | 7.0 | | 202 | 85.0 | | | 5.4 | <0.1 | | <0.05 | | <0.005 | 16.3 | 8.3 | 133 | 1.12 | 7.4 | | | 133 | 76 | Clear |
| 2015/0668 | 86 | 8.13 | Normal | 5.2 | 5.6 | | 102 | 60.0 | | | 4.5 | | | <0.02 | | | 15.2 | | | | 2.8 | | | | | Clear |
| 2015/2847 | 49 | 5.27 | Not Detected | 13.4 | 5.7 | | 112 | 34.0 | | | 4.0 | | | 0.06 | | | 15.1 | | | | 1.6 | | | | | Clear |
| 2015/4683 | 95 | 4.69 | Not Detected | 11.1 | 5.7 | | 87 | 25.0 | | | 9.0 | <0.1 | | <0.05 | | <0.005 | 15.2 | <5 | 69 | <0.5 | 1.8 | | | 69 | 24 | Clear |
| 2015/0669 | 2 | 0.44 | Normal | 5.2 | 5.4 | | 168 | 58.0 | | | 0.6 | | | 0.02 | | | 31.6 | | | | 5.8 | | | | | Clear |
| 2015/2848 | 10 | 0.32 | Not Detected | 14.2 | 5.6 | | 183 | 73.0 | | | <1.0 | | | <0.02 | | | 31.6 | | | | 6.0 | | | | | Clear |
| 2015/4684 | <5 | 0.39 | Not Detected | 11.9 | 5.6 | | 177 | 52.0 | | | <1.0 | <0.1 | | <0.05 | | <0.005 | 34.6 | 6.5 | 121 | 4.01 | 8.3 | | | 121 | 20 | clear |

## Surface Water Laboratory Results – North Kerry Landfill 2015

Kerry County Council - All Laboratory Results Report (Environment)

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| Product | Product Version | Project | SAMPLING POINT | Sampling Point | Sample No. | COA Link | Sampled Date | Sampled Time | Sampled By | Sample Type | Test List | Comments | Sample Status | Certificate of Authorisation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SURF_WATER | 1 | North Kerry Landfill | NORTH_KERRY_LANDFILL_SP | North_Kerry_Landfill Surface water: general SP | 2015/0080 | \\doc_server\COA\KCC_ENVIRON\2015\Dec\2015-0080_v1.pdf | 12-Jan-15 | 14:55 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | Constructed Wetland - Pond 1 | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Dec\2015-0080_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: general SP | 2015/0081 | \\doc_server\COA\KCC_ENVIRON\2015\Dec\2015-0081_v1.pdf | 12-Jan-15 | 14:50 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | Constructed Wetland - Pond 2 | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Dec\2015-0081_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: general SP | 2015/0082 | \\doc_server\COA\KCC_ENVIRON\2015\Dec\2015-0082_v1.pdf | 12-Jan-15 | 14:45 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | Constructed Wetland - Pond 3 | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Dec\2015-0082_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: general SP | 2015/2315 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-2315_v1.pdf | 28-May-15 | 16:15 | AS | LANDFILL | 130_NKL_CW_SURF | NKL Constructed wetlands Pond 1 | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-2315_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: general SP | 2015/2316 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-2316_v1.pdf | 28-May-15 | 16:12 | AS | LANDFILL | 130_NKL_CW_SURF | NKL Constructed wetlands Pond 2 | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-2316_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: general SP | 2015/2317 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-2317_v1.pdf | 28-May-15 | 16:09 | AS | LANDFILL | 130_NKL_CW_SURF | NKL Constructed wetlands Pond 3 | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-2317_v1.pdf |
| | | | NORTH_KERRY_LANDFILL_SW1 | North_Kerry_Landfill Surface water: SW-1 | 2015/0067 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0067_v1.pdf | 12-Jan-15 | 13:51 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0067_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/0649 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0649_v1.pdf | 12-Feb-15 | 11:05 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0649_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/1325 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1325_v1.pdf | 30-Mar-15 | 13:17 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1325_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/1830 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1830_v1.pdf | 27-Apr-15 | 15:33 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1830_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/2318 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2318_v1.pdf | 28-May-15 | 15:06 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2318_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/2828 | \\doc_server\COA\KCC_ENVIRON\2015\Dec\2015-2828_v2.pdf | 08-Jul-15 | 14:14 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Dec\2015-2828_v2.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/3206 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3206_v1.pdf | 06-Aug-15 | 12:58 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3206_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/3218QA | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3218QA_v1.pdf | 06-Aug-15 | 12:58 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3218QA_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/4070 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4070_v1.pdf | 30-Sep-15 | 12:04 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4070_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/4388 | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4388_v1.pdf | 21-Oct-15 | 15:01 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4388_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/4664 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4664_v1.pdf | 11-Nov-15 | 14:05 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4664_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-1 | 2015/5183 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5183_v1.pdf | 21-Dec-15 | 11:20 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5183_v1.pdf |
| | | | NORTH_KERRY_LANDFILL_SW2 | North_Kerry_Landfill Surface water: SW-2 | 2015/0068 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0068_v1.pdf | 12-Jan-15 | 13:47 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0068_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-2 | 2015/0650 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0650_v1.pdf | 12-Feb-15 | 11:45 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0650_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-2 | 2015/1326 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1326_v1.pdf | 30-Mar-15 | 12:09 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1326_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-2 | 2015/1831 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1831_v1.pdf | 27-Apr-15 | 15:27 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1831_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-2 | 2015/2319 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2319_v1.pdf | 28-May-15 | 14:59 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2319_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-2 | 2015/2829 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-2829_v1.pdf | 08-Jul-15 | 14:02 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-2829_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-2 | 2015/3207 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3207_v1.pdf | 06-Aug-15 | 12:51 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3207_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-2 | 2015/4665 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4665_v1.pdf | 11-Nov-15 | 14:30 | TS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4665_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SW-2 | 2015/5184 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5184_v1.pdf | 21-Dec-15 | 11:15 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5184_v1.pdf |
| | | | NORTH_KERRY_LANDFILL_SW3 | North_Kerry_Landfill Surface water: SW-3 | 2015/0069 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0069_v1.pdf | 12-Jan-15 | 13:40 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0069_v1.pdf |

| Analysis | 001_COLOUR | 002_TURBIDITY | 003_ODOUR | 005A_TEMP_FIELD | 006_PH | | 007A_CONDUCTIVITY20C | 011_TOTAL_HARDNESS | 013C_BOD | 014_COD | 015_TOC | 016_FLUORIDE_ISE | 021K_NITRITE | 022K_AMMONIA | | 025_PHOSPHATE_SRP | 028K_CHLORIDE | 028K_SULPHATE | 031_SOLIDS_WW | 033K_TON | 036_DO_MG_L | 037_SUSPENDED_SOLIDS | 052_TOTAL_NITROGEN | 057_SOLIDS_TOTAL_DISS | 065_ALKALINITY_TOTAL | 082_VIS_INSPECTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | Colour | Turbidity | Odour | Temperature | pH | | Conductivity | Total Hardness | B.O.D. | C.O.D. | TOC | Fluoride | Nitrite | Ammonia | | Phosphorus (MRP) | Chloride | Sulphate | Total Solids | TON | Dissolved Oxygen | Suspended Solids | Total Nitrogen | Total Dissolved Solids (180°C) | Alkalinity | Visual Inspection |
| Reported | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Min. Value | | | | | | 6.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Max Value | | | | | | 9.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Units | HAZEN | NTU | NONE | DEG_C | PH | PH | USCM | MGCACO3L | BOD | MGL | MGL | MGL_F | MGLN | MGLN | MGLN | MGL | MGL | MGL | MGL | MGLN | MGL | MGL | MGLN | MGL | MGCACO3L | NONE |
| 2015/0080 | | | Normal | 5.7 | | 6.6 | 171 | | 1.0 | 32 | 7.1 | | 0.476 | | 0.02 | 0.01 | | | | <0.12 | 7.9 | <1 | 1.37 | | | Clear |
| 2015/0081 | | | Normal | 5.9 | | 6.6 | 166 | | <1.0 | 21 | 6.9 | | <0.013 | | 0.10 | 0.01 | | | | 0.17 | 5.2 | <1 | 1.91 | | | Clear |
| 2015/0082 | | | Normal | 5.6 | | 6.6 | 164 | | <1.0 | 22 | 7.2 | | <0.013 | | 0.03 | <0.005 | | | | <0.12 | 7.6 | <1 | 1.23 | | | Clear |
| 2015/2315 | | | Not Detected | 14.6 | | 6.8 | 123 | | 4.9 | 38 | 13.4 | | <0.013 | | 0.24 | 0.03 | | | | <0.12 | 9.4 | 9 | 1.52 | | | Brown Colour |
| 2015/2316 | | | Not Detected | 12.5 | | 6.5 | 92 | | 1.6 | 44 | 13.1 | | <0.013 | | 0.09 | 0.03 | | | | <0.12 | 5.6 | 5 | 1.17 | | | Clear |
| 2015/2317 | | | Not Detected | 15.6 | | 7.1 | 89 | | 3.1 | 56 | 12.5 | | <0.013 | | 0.05 | 0.09 | | | | <0.12 | 9.5 | 6 | <1.03 | | | Clear |
| 2015/0067 | | | Normal | 5.7 | | | | | | | | | | | | | | | | | | <1 | | | | Slight Brown Colour |
| 2015/0649 | | | Normal | 4.5 | | 7.4 | 124 | | <1.0 | 37 | | | | | 0.02 | | 23.1 | | | | 11.6 | <1 | | | | Clear |
| 2015/1325 | | | Normal | 6.4 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |
| 2015/1830 | | | Normal | 8.5 | | | | | | | | | | | | | | | | | | 4 | | | | Clear |
| 2015/2318 | | | Not Detected | 10.3 | | | | | | | | | | | <0.02 | | | | | | | 2 | | | | Brown Colour |
| 2015/2828 | | | Not Detected | 12.8 | | 6.6 | 97 | | <1.3 | 87 | | | | | <0.02 | | 19.6 | | | | 9.0 | 70 | | | | Brown Colour/Sediment |
| 2015/3206 | | | Not Detected | 13.0 | | | | | | | | | | | | | | | | | | 2 | | | | Brown Colour |
| 2015/3218QA | | | Not Detected | 13.0 | | | | | | | | | | | | | | | | | | <1 | | | | Brown Colour |
| 2015/4070 | | | Not Detected | 13.0 | | | | | | | | | | | | | | | | | | 3 | | | | Clear |
| 2015/4388 | | | Not Detected | 12.6 | | | | | | | | | | | | | | | | | | 6 | | | | Some Sediment |
| 2015/4664 | | | Not Detected | 10.3 | | 6.0 | 67 | | 1.6 | 110 | | | | | <0.05 | 0.01 | 17.0 | <5 | | <0.5 | 10.2 | 7 | | | 9 | Brown Colour / Some Sediment |
| 2015/5183 | | | Not Detected | 9.5 | | | | | | | | | | | | | | | | | | 2 | | | | Brown Colour |
| 2015/0068 | | | Normal | 6.0 | | | | | | | | | | | | | | | | | | <1 | | | | Brown Colour |
| 2015/0650 | | | Normal | 4.5 | | 4.0 | 118 | | <1.0 | 42 | | | | | 0.02 | | 29.2 | | | | 11.6 | <1 | | | | Clear |
| 2015/1326 | | | Normal | 6.7 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |
| 2015/1831 | | | Normal | 7.4 | | | | | | | | | | | | | | | | | | 6 | | | | Brown Colour |
| 2015/2319 | | | Not Detected | 10.2 | | | | | | | | | | | 0.03 | | | | | | | 3 | | | | Brown Colour |
| 2015/2829 | | | Not Detected | 13.4 | | 3.9 | 121 | | <1.3 | 202 | | | | | 0.02 | | 24.2 | | | | 9.7 | 14 | | | | Brown Colour |
| 2015/3207 | | | Not Detected | 14.0 | | | | | | | | | | | | | | | | | | 1 | | | | Brown Colour |
| 2015/4665 | | | Normal | 10.7 | | 4.2 | 82 | | <1.3 | 108 | | | | | 0.06 | 0.02 | 18.9 | 6.1 | | <0.5 | 10.6 | 1 | | | < 5 | coloured/clear/riverlike |
| 2015/5184 | | | Not Detected | 9.5 | | | | | | | | | | | | | | | | | | 4 | | | | Brown Colour |
| 2015/0069 | | | Normal | 5.9 | | | | | | | | | | | | | | | | | | 2 | | | | Slight Brown Colour |

| Product | Product Version | Project | SAMPLING POINT | Sampling Point | Sample No. | COA Link | Sampled Date | Sampled Time | Sampled By | Sample Type | Test List | Comments | Sample Status | Certificate of Authorisation | Analysis / Parameter | 001_COLOUR Colour | 002_TURBIDITY Turbidity | 003_ODOUR Odour | 005A_TEMP_FIELD Temperature | 006_PH pH | | 007A_CONDUCTIVITY20C Conductivity | 011_TOTAL_HARDNESS Total Hardness | 013C_BOD B.O.D. | 014_COD C.O.D. | 015_TOC TOC | 016_FLUORIDE_ISE Fluoride | 021K_NITRITE Nitrite | 022K_AMMONIA Ammonia | | 025_PHOSPHATE_SRP Phosphorus (MRP) | 028K_CHLORIDE Chloride | 028K_SULPHATE Sulphate | 031_SOLIDS_WW Total Solids | 033K_TON TON | 036_DO_MG_L Dissolved Oxygen | 037_SUSPENDED_SOLIDS Suspended Solids | 052_TOTAL_NITROGEN Total Nitrogen | 057_SOLIDS_TOTAL_DISS Total Dissolved Solids (180°C) | 065_ALKANITY_TOTAL Alkalinity | 082_VIS_INSPECTION Visual Inspection |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Reported | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | Min. Value | | | | | | 6.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | Max Value | | | | | | 9.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | Units | HAZEN | NTU | NONE | DEG_C | PH | PH | USCM | MGCACO3L | BOD | MGL | MGL | MGL_F | MGLN | MGLN | MGLN | MGL | MGL | MGL | MGL | MGLN | MGL | MGL | MGLN | MGL | MGCACO3L | NONE |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/0651 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0651_v1.pdf | 12-Feb-15 | 12:05 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0651_v1.pdf | | | | Normal | 5.3 | | 6.7 | 113 | | 1.0 | 42 | | | | | 0.02 | | 25.4 | | | | 11.9 | <1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/0652QA | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0652QA_v1.pdf | 12-Feb-15 | 12:07 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0652QA_v1.pdf | | | | Normal | 5.3 | | 7.0 | 113 | | <1.0 | 41 | | | | | 0.02 | | 25.6 | | | | 11.9 | <1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/1327 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1327_v1.pdf | 30-Mar-15 | 12:05 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1327_v1.pdf | | | | Normal | 6.5 | | | | | | | | | | | | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/1832 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1832_v1.pdf | 27-Apr-15 | 15:20 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1832_v1.pdf | | | | Normal | 9.9 | | | | | | | | | | | | | | | | | | 2 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/2320 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2320_v1.pdf | 28-May-15 | 14:52 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2320_v1.pdf | | | | Not Detected | 10.2 | | | | | | | | | | | 0.03 | | | | | | | 4 | | | | Brown Colour |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/2830 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2830_v1.pdf | 08-Jul-15 | 13:54 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2830_v1.pdf | | | | Not Detected | 13.1 | | 6.3 | 87 | | <1.3 | 81 | | | | | 0.02 | | 19.0 | | | | 10.0 | 3 | | | | Brown Colour |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/3208 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3208_v1.pdf | 06-Aug-15 | 12:45 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3208_v1.pdf | | | | Not Detected | 14.0 | | | | | | | | | | | | | | | | | | 2 | | | | Brown Colour |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/4072 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4072_v1.pdf | 30-Sep-15 | 11:45 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4072_v1.pdf | | | | Not Detected | 12.0 | | | | | | | | | | | | | | | | | | 4 | | | | Brown Colour |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/4390 | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4390_v1.pdf | 21-Oct-15 | 14:45 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4390_v1.pdf | | | | Not Detected | 12.5 | | | | | | | | | | | | | | | | | | 5 | | | | Slight Brown Colour |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/4666 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4666_v1.pdf | 11-Nov-15 | 13:55 | TS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4666_v1.pdf | | | | Normal | 10.7 | | 5.7 | 74 | | 1.3 | 89 | | | | | <0.05 | 0.03 | 19.5 | <5 | | <0.5 | 10.7 | 4 | | | 9 | coloured/clear/riverlike |
| | | | | North_Kerry_Landfill Surface water: SW-3 | 2015/5185 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5185_v1.pdf | 21-Dec-15 | 11:05 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5185_v1.pdf | | | | Not Detected | 9.8 | | | | | | | | | | | | | | | | | | 4 | | | | Brown Colour |
| | | | NORTH_KERRY_LANDFILL_SWML10 | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/0074 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0074_v1.pdf | 12-Jan-15 | 15:00 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0074_v1.pdf | | | | Normal | 5.9 | | | | | | | | | | | 0.03 | | | | | | | 6 | | | | Slightly Cloudy |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/0079QA | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0079QA_v1.pdf | 12-Jan-15 | 15:00 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0079QA_v1.pdf | | | | Normal | 5.9 | | | | | | | | | | | 0.03 | | | | | | | 6 | | | | Slightly Cloudy |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/0657 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0657_v1.pdf | 12-Feb-15 | 13:10 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0657_v1.pdf | | | | Normal | 5.1 | | 7.8 | 241 | | 1.1 | 31 | | | | | 0.02 | | 24.3 | | | | 11.6 | 1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/1332 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1332_v1.pdf | 30-Mar-15 | 13:05 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1332_v1.pdf | | | | Normal | 7.2 | | | | | | | | | | | 0.02 | | | | | | | 12 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/1837 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1837_v1.pdf | 27-Apr-15 | 16:00 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1837_v1.pdf | | | | Normal | 11.2 | | | | | | | | | | | <0.02 | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/2325 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2325_v1.pdf | 28-May-15 | 15:22 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2325_v1.pdf | | | | Not Detected | 10.4 | | | | | | | | | | | 0.02 | | | | | | | 2 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/2330QA | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2330QA_v1.pdf | 28-May-15 | 15:22 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2330QA_v1.pdf | | | | Not Detected | 10.4 | | | | | | | | | | | <0.02 | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/2835 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2835_v1.pdf | 08-Jul-15 | 13:43 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2835_v1.pdf | | | | Not Detected | 14.4 | | 7.8 | 233 | | <1.3 | 25 | | | | | 0.02 | | 15.3 | | | | 9.3 | 1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/3213 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3213_v1.pdf | 06-Aug-15 | 14:10 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3213_v1.pdf | | | | Not Detected | 13.0 | | | | | | | | | | | 0.02 | | | | | | | 4 | | | | Brown Colour/Sediment |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/4077 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4077_v1.pdf | 30-Sep-15 | 13:27 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4077_v1.pdf | | | | Not Detected | 13.0 | | | | | | | | | | | <0.05 | | | | | | | 6 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/4082QA | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4082QA_v1.pdf | 30-Sep-15 | 13:27 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4082QA_v1.pdf | | | | Not Detected | 13.0 | | | | | | | | | | | <0.05 | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/4395 | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4395_v1.pdf | 21-Oct-15 | 16:00 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | Sampled from lagoon | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4395_v1.pdf | | | | Not Detected | 13.0 | | | | | | | | | | | <0.05 | | | | | | | 3 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/4400QA | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4400QA_v1.pdf | 21-Oct-15 | 16:00 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | Sampled from lagoon | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4400QA_v1.pdf | | | | Not Detected | 13.0 | | | | | | | | | | | <0.05 | | | | | | | 2 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/4671 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4671_v1.pdf | 11-Nov-15 | 12:10 | TS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4671_v1.pdf | | | | Normal | 11.4 | | 7.3 | 194 | | 2.1 | 47 | | | | | <0.05 | <0.005 | 14.8 | 5.1 | | <0.5 | 10.2 | 8 | | | 79 | sl.coloured/clear/riverlike |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/4676QA | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4676QA_v1.pdf | 11-Nov-15 | 12:12 | TS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4676QA_v1.pdf | | | | Normal | 11.4 | | 7.2 | 193 | | 1.4 | 47 | | | | | <0.05 | 0.01 | 14.3 | <5 | | <0.5 | 10.2 | 5 | | | 81 | sl.coloured/clear/riverlike |
| | | | | North_Kerry_Landfill Surface water: SWML-10(Eastern Lagoon outlet) | 2015/5190 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5190_v1.pdf | 21-Dec-15 | 11:53 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5190_v1.pdf | | | | Not Detected | 9.0 | | | | | | | | | | | <0.05 | | | | | | | 8 | | | | Slightly Cloudy |
| | | | NORTH_KERRY_LANDFILL_SWML11 | North_Kerry_Landfill Surface water: SWML-11 | 2015/0075 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0075_v1.pdf | 12-Jan-15 | 15:03 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0075_v1.pdf | | | | Normal | 5.9 | | | | | | | | | | | | | | | | | | 6 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-11 | 2015/0658 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0658_v1.pdf | 12-Feb-15 | 13:15 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0658_v1.pdf | | | | Normal | 5.7 | | 7.8 | 240 | | <1.0 | 31 | | | | | 0.02 | | 24.3 | | | | 11.3 | 3 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-11 | 2015/1333 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1333_v1.pdf | 30-Mar-15 | 13:12 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1333_v1.pdf | | | | Normal | 7.2 | | | | | | | | | | | | | | | | | | 11 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-11 | 2015/1838 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1838_v1.pdf | 27-Apr-15 | 16:02 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1838_v1.pdf | | | | Normal | 11.3 | | | | | | | | | | | | | | | | | | 14 | | | | Clear |

| Product | Product Version | Project | SAMPLING POINT | Sampling Point | Sample No. | COA Link | Sampled Date | Sampled Time | Sampled By | Sample Type | Test List | Comments | Sample Status | Certificate of Authorisation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | North_Kerry_Landfill Surface water: SWML-11 | 2015/4672 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4672_v1.pdf | 11-Nov-15 | 12:20 | TS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4672_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-11 | 2015/5191 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5191_v1.pdf | 21-Dec-15 | 11:57 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5191_v1.pdf |
| | | | NORTH_KERRY_LANDFILL_SWML2 | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/0070 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0070_v1.pdf | 12-Jan-15 | 14:12 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0070_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/0653 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0653_v1.pdf | 12-Feb-15 | 15:20 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0653_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/1328 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1328_v1.pdf | 30-Mar-15 | 13:42 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1328_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/1833 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1833_v1.pdf | 27-Apr-15 | 16:40 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1833_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/2321 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2321_v1.pdf | 28-May-15 | 15:42 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2321_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/2831 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2831_v1.pdf | 08-Jul-15 | 11:50 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2831_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/3209 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3209_v1.pdf | 06-Aug-15 | 13:07 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3209_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/4073 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4073_v1.pdf | 30-Sep-15 | 12:28 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | Not Flowing | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4073_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/4391 | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4391_v1.pdf | 21-Oct-15 | 15:34 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | Sampled from lagoon | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4391_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/4667 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4667_v1.pdf | 11-Nov-15 | 11:10 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | Sampled from Lagoon | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4667_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-2(Western Lagoon outlet) | 2015/5186 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5186_v1.pdf | 21-Dec-15 | 11:27 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5186_v1.pdf |
| | | | NORTH_KERRY_LANDFILL_SWML3 | North_Kerry_Landfill Surface water: SWML-3 | 2015/0071 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0071_v1.pdf | 12-Jan-15 | 14:17 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0071_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-3 | 2015/1329 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1329_v1.pdf | 30-Mar-15 | 13:38 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1329_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-3 | 2015/2832 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2832_v1.pdf | 08-Jul-15 | 12:35 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2832_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-3 | 2015/3210 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3210_v1.pdf | 06-Aug-15 | 13:12 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3210_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-3 | 2015/4668 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4668_v1.pdf | 11-Nov-15 | 11:05 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4668_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-3 | 2015/5187 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5187_v1.pdf | 21-Dec-15 | 11:32 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5187_v1.pdf |
| | | | NORTH_KERRY_LANDFILL_SWML4 | North_Kerry_Landfill Surface water: SWML-4 | 2015/3211 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3211_v1.pdf | 06-Aug-15 | 13:16 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3211_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-4 | 2015/4669 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4669_v1.pdf | 11-Nov-15 | 11:21 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4669_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-4 | 2015/5188 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5188_v1.pdf | 21-Dec-15 | 11:40 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5188_v1.pdf |
| | | | NORTH_KERRY_LANDFILL_SWML5 | North_Kerry_Landfill Surface water: SWML-5 | 2015/0073 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0073_v1.pdf | 12-Jan-15 | 14:23 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0073_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-5 | 2015/1331 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1331_v1.pdf | 30-Mar-15 | 13:30 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1331_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-5 | 2015/2834 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2834_v1.pdf | 08-Jul-15 | 12:45 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2834_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-5 | 2015/4670 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4670_v1.pdf | 11-Nov-15 | 11:27 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4670_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-5 | 2015/5189 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5189_v1.pdf | 21-Dec-15 | 11:45 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5189_v1.pdf |
| | | | NORTH_KERRY_LANDFILL_SWMLE1 | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/0078 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0078_v1.pdf | 12-Jan-15 | 14:02 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0078_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/0661 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0661_v1.pdf | 12-Feb-15 | 12:20 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0661_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/1336 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1336_v1.pdf | 30-Mar-15 | 13:51 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1336_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/1839 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1839_v1.pdf | 27-Apr-15 | 16:50 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1839_v1.pdf |

| Analysis | 001_COLOUR | 002_TURBIDITY | 003_ODOUR | 005A_TEMP_FIELD | 006_PH | | 007A_CONDUCTIVITY20C | 011_TOTAL_HARDNESS | 013C_BOD | 014_COD | 015_TOC | 016_FLUORIDE_ISE | 021K_NITRITE | 022K_AMMONIA | | 025_PHOSPHATE_SRP | 028K_CHLORIDE | 028K_SULPHATE | 031_SOLIDS_WW | 033K_TON | 036_DO_MG_L | 037_SUSPENDED_SOLIDS | 052_TOTAL_NITROGEN | 057_SOLIDS_TOTAL_DISS | 065_ALKALINITY_TOTAL | 082_VIS_INSPECTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | Colour | Turbidity | Odour | Temperature | pH | | Conductivity | Total Hardness | B.O.D. | C.O.D. | TOC | Fluoride | Nitrite | Ammonia | | Phosphorus (MRP) | Chloride | Sulphate | Total Solids | TON | Dissolved Oxygen | Suspended Solids | Total Nitrogen | Total Dissolved Solids (180°C) | Alkalinity | Visual Inspection |
| Reported | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Min. Value | | | | | | 6.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Max Value | | | | | | 9.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Units | HAZEN | NTU | NONE | DEG_C | PH | PH | USCM | MGCACO3L | BOD | MGL | MGL | MGL_F | MGLN | MGLN | MGLN | MGL | MGL | MGL | MGL | MGLN | MGL | MGL | MGLN | MGL | MGCACO3L | NONE |
| 2015/4672 | | | Normal | 11.3 | | 6.8 | 193 | | 1.4 | 44 | | | | | 0.06 | <0.005 | 15.1 | <5 | | <0.5 | 10.1 | 6 | | | 77 | sl.coloured/clear/riverlike |
| 2015/5191 | | | Not Detected | 9.0 | | | | | | | | | | | | | | | | | | 6 | | | | Slightly Cloudy |
| 2015/0070 | | | Normal | 5.5 | | | | | | | | | | | <0.02 | | | | | | | 2 | | | | Clear |
| 2015/0653 | | | Normal | 5.1 | | 8.1 | 229 | | 1.4 | 26 | | | | | <0.02 | | 22.7 | | | | 12.3 | 5 | | | | Clear |
| 2015/1328 | | | Normal | 6.9 | | | | | | | | | | | | | | | | | | 16 | | | | Sligtly Cloudy |
| 2015/1833 | | | Normal | 10.5 | | | | | | | | | | | 0.02 | | | | | | | 15 | | | | Clear |
| 2015/2321 | | | Not Detected | 10.5 | | | | | | | | | | | <0.02 | | | | | | | 4 | | | | Clear |
| 2015/2831 | | | Not Detected | 15.2 | | 6.8 | 199 | | 2.8 | 17 | | | | | 0.02 | | 10.6 | | | | 6.8 | 14 | | | | Slight Sediment |
| 2015/3209 | | | Not Detected | 14.5 | | | | | | | | | | | 0.03 | | | | | | | 4 | | | | Clear |
| 2015/4073 | | | Not Detected | 11.5 | | | | | | | | | | | <0.05 | | | | | | | <1 | | | | Clear |
| 2015/4391 | | | Not Detected | 13.0 | | | | | | | | | | | <0.05 | | | | | | | 4 | | | | Clear |
| 2015/4667 | | | Not Detected | 11.3 | | 7.6 | 193 | | 1.4 | 23 | | | | | <0.05 | <0.005 | 9.6 | <5 | | <0.5 | 9.0 | 7 | | | 86 | Clear |
| 2015/5186 | | | Not Detected | 9.0 | | | | | | | | | | | 0.08 | | | | | | | <1 | | | | Clear |
| 2015/0071 | | | Normal | 6.0 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |
| 2015/1329 | | | Normal | 6.7 | | | | | | | | | | | | | | | | | | 12 | | | | Clear |
| 2015/2832 | | | Not Detected | 13.1 | | 7.9 | 316 | | <1.3 | 19 | | | | | 0.02 | | 14.0 | | | | 9.7 | 2 | | | | Clear |
| 2015/3210 | | | Not Detected | 13.5 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |
| 2015/4668 | | | Not Detected | 11.2 | | 6.8 | 218 | | <1.3 | 27 | | | | | <0.05 | <0.005 | 12.2 | <5 | | 0.62 | 9.3 | 4 | | | 99 | Clear |
| 2015/5187 | | | Not Detected | 8.5 | | | | | | | | | | | | | | | | | | 4 | | | | Cloudy |
| 2015/3211 | | | Not Detected | 13.5 | | | | | | | | | | | | | | | | | | 3 | | | | Clear |
| 2015/4669 | | | Not Detected | 11.7 | | 6.5 | 226 | | <1.3 | 27 | | | | | <0.05 | <0.005 | 13.8 | <5 | | <0.5 | 6.7 | <1 | | | 100 | Clear |
| 2015/5188 | | | Not Detected | 10.0 | | | | | | | | | | | | | | | | | | 10 | | | | Clear |
| 2015/0073 | | | Normal | 6.0 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |
| 2015/1331 | | | Normal | 6.7 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |
| 2015/2834 | | | Not Detected | 13.0 | | 7.5 | 223 | | <1.3 | 31 | | | | | <0.02 | | 9.4 | | | | 9.1 | <1 | | | | Clear |
| 2015/4670 | | | Not Detected | 11.9 | | 7.5 | 252 | | <1.3 | 81 | | | | | 0.06 | <0.005 | 12.0 | 7.0 | | <0.5 | 9.0 | 4 | | | 116 | Clear |
| 2015/5189 | | | Not Detected | 10.0 | | | | | | | | | | | | | | | | | | 2 | | | | Slightly Cloudy |
| 2015/0078 | | | Normal | 6.1 | | | | | | | | | | | <0.02 | | | | | | | 36 | | | | Cloudy |
| 2015/0661 | | | Normal | 5.4 | | 7.5 | 218 | | 1.3 | 32 | | | | | 0.02 | | 23.8 | | | | 10.9 | 16 | | | | Clear |
| 2015/1336 | | | Normal | 6.8 | | | | | | | | | | | <0.02 | | | | | | | 36 | | | | Cloudy |
| 2015/1839 | | | Normal | 10.6 | | | | | | | | | | | 0.02 | | | | | | | 6 | | | | Clear |

| Product | Product Version | Project | SAMPLING POINT | Sampling Point | Sample No. | COA Link | Sampled Date | Sampled Time | Sampled By | Sample Type | Test List | Comments | Sample Status | Certificate of Authorisation | Analysis | 001_COLOUR | 002_TURBIDITY | 003_ODOUR | 005A_TEMP_FIELD | 006_PH | | 007A_CONDUCTIVITY20C | 011_TOTAL_HARDNESS | 013C_BOD | 014_COD | 015_TOC | 016_FLUORIDE_ISE | 021K_NITRITE | 022K_AMMONIA | | 025_PHOSPHATE_SRP | 028K_CHLORIDE | 028K_SULPHATE | 031_SOLIDS_WW | 033K_TON | 036_DO_MG_L | 037_SUSPENDED_SOLIDS | 052_TOTAL_NITROGEN | 057_SOLIDS_TOTAL_DISS | 065_ALKANITY_TOTAL | 082_VIS_INSPECTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | Parameter | Colour | Turbidity | Odour | Temperature | pH | | Conductivity | Total Hardness | B.O.D. | C.O.D. | TOC | Fluoride | Nitrite | Ammonia | | Phosphorus (MRP) | Chloride | Sulphate | Total Solids | TON | Dissolved Oxygen | Suspended Solids | Total Nitrogen | Total Dissolved Solids (180°C) | Alkalinity | Visual Inspection |
| | | | | | | | | | | | | | | | Reported | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | Min. Value | | | | | | 6.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | Max Value | | | | | | 9.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| | | | | | | | | | | | | | | | Units | HAZEN | NTU | NONE | DEG_C | PH | PH | USCM | MGCACO3L | BOD | MGL | MGL | MGL_F | MGLN | MGLN | MGLN | MGL | MGL | MGL | MGL | MGLN | MGL | MGL | MGLN | MGL | MGCACO3L | NONE |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/1842QA | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1842QA_v1.pdf | 27-Apr-15 | 16:50 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1842QA_v1.pdf | | | | Normal | 10.6 | | | | | | | | | | | 0.02 | | | | | | | <1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/2329 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2329_v1.pdf | 28-May-15 | 15:16 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2329_v1.pdf | | | | Not Detected | 10.4 | | | | | | | | | | | <0.02 | | | | | | | 8 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/2839 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2839_v1.pdf | 08-Jul-15 | 10:48 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2839_v1.pdf | | | | Not Detected | 13.7 | | 8.2 | 194 | | 1.4 | 21 | | | | | 0.04 | | 14.6 | | | | 9.7 | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/2840QA | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2840QA_v1.pdf | 08-Jul-15 | 10:48 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2840QA_v1.pdf | | | | Not Detected | 13.7 | | 8.3 | 194 | | <1.3 | 25 | | | | | <0.02 | | 14.6 | | | | 9.7 | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/3212 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3212_v1.pdf | 06-Aug-15 | 13:21 | AS | LANDFILL | 130_NKL_SURF_MONTH | Slow Flow | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3212_v1.pdf | | | | Not Detected | 13.5 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/3215 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3215_v1.pdf | 06-Aug-15 | 14:18 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3215_v1.pdf | | | | Not Detected | 16.0 | | | | | | | | | | | <0.02 | | | | | | | 17 | | | | Cloudy |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/4081 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4081_v1.pdf | 30-Sep-15 | 12:15 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | Not Flowing | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4081_v1.pdf | | | | Not Detected | 12.0 | | | | | | | | | | | <0.05 | | | | | | | 6 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/4399 | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4399_v1.pdf | 21-Oct-15 | 16:10 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4399_v1.pdf | | | | Not Detected | 12.0 | | | | | | | | | | | <0.05 | | | | | | | 6 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/4675 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4675_v1.pdf | 11-Nov-15 | 13:00 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4675_v1.pdf | | | | Not Detected | 12.0 | | 7.4 | 174 | | <1.3 | 25 | | | | | <0.05 | <0.005 | 11.4 | 6.3 | | <0.5 | 9.8 | 15 | | | 73 | Cloudy |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/5192 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5192_v1.pdf | 21-Dec-15 | 12:06 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5192_v1.pdf | | | | Not Detected | 9.0 | | | | | | | | | | | <0.05 | | | | | | | 22 | | | | Cloudy |
| | | | | North_Kerry_Landfill Surface water: SWML-E1(Northern Lagoon) | 2015/5193QA | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5193QA_v1.pdf | 21-Dec-15 | 12:06 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5193QA_v1.pdf | | | | Not Detected | 9.0 | | | | | | | | | | | <0.05 | | | | | | | 20 | | | | Cloudy |
| | | | NORTH_KERRY_LANDFILL_W1 | North_Kerry_Landfill Surface water: W1 | 2015/0076 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0076_v1.pdf | 12-Jan-15 | 13:30 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0076_v1.pdf | | | | Normal | 5.9 | | | | | | | | | | | | | | | | | | 2 | | | | Slight Brown Colour |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/0659 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0659_v1.pdf | 12-Feb-15 | 10:20 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0659_v1.pdf | | | | Normal | 5.5 | | 7.7 | 128 | | <1.0 | 27 | | | | | 0.03 | | 26.7 | | | | 11.5 | 1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/1334 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1334_v1.pdf | 30-Mar-15 | 11:50 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1334_v1.pdf | | | | Normal | 6.8 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/1840 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1840_v1.pdf | 27-Apr-15 | 14:58 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1840_v1.pdf | | | | Normal | 10.2 | | | | | | | | | | | | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/2327 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2327_v1.pdf | 28-May-15 | 14:40 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2327_v1.pdf | | | | Not Detected | 10.2 | | | | | | | | | | | <0.02 | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/2837 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2837_v1.pdf | 08-Jul-15 | 10:12 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2837_v1.pdf | | | | Not Detected | 12.2 | | 6.9 | 88 | | <1.3 | 73 | | | | | 0.02 | | 19.2 | | | | 10.2 | 2 | | | | Slight Brown Colour |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/3216 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3216_v1.pdf | 06-Aug-15 | 12:30 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3216_v1.pdf | | | | Not Detected | 13.0 | | | | | | | | | | | | | | | | | | <1 | | | | Brown Colour |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/4079 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4079_v1.pdf | 30-Sep-15 | 11:20 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4079_v1.pdf | | | | Not Detected | 11.5 | | | | | | | | | | | | | | | | | | 8 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/4397 | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4397_v1.pdf | 21-Oct-15 | 14:20 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4397_v1.pdf | | | | Not Detected | 11.7 | | | | | | | | | | | | | | | | | | 5 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/4673 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4673_v1.pdf | 11-Nov-15 | 14:58 | AS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4673_v1.pdf | | | | Not Detected | 10.7 | | 6.9 | 85 | | 1.6 | 88 | | | | | <0.05 | 0.01 | 18.4 | <5 | | <0.5 | 10.4 | 3 | | | 17 | Brown Colour |
| | | | | North_Kerry_Landfill Surface water: W1 | 2015/5194 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5194_v1.pdf | 21-Dec-15 | 10:52 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5194_v1.pdf | | | | Not Detected | 9.5 | | | | | | | | | | | | | | | | | | 2 | | | | Brown Colour |
| | | | NORTH_KERRY_LANDFILL_W2 | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/0077 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0077_v1.pdf | 12-Jan-15 | 15:14 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-0077_v1.pdf | | | | Normal | 6.0 | | | | | | | | | | | | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/0660 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0660_v1.pdf | 12-Feb-15 | 16:10 | TS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0660_v1.pdf | | | | Normal | 6.8 | | 7.4 | 154 | | <1.0 | 26 | | | | | 0.03 | | 29.8 | | | | 11.5 | 1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/1335 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1335_v1.pdf | 30-Mar-15 | 14:00 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1335_v1.pdf | | | | Normal | 8.0 | | | | | | | | | | | | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/1337QA | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1337QA_v1.pdf | 30-Mar-15 | 14:00 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1337QA_v1.pdf | | | | Normal | 8.0 | | | | | | | | | | | | | | | | | | 4 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/1841 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1841_v1.pdf | 27-Apr-15 | 14:46 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-1841_v1.pdf | | | | Normal | 10.4 | | | | | | | | | | | | | | | | | | 1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/2328 | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2328_v1.pdf | 28-May-15 | 16:32 | AS | LANDFILL | 130_NKL_SURF_SS_AMMO | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jun\2015-2328_v1.pdf | | | | Not Detected | 10.6 | | | | | | | | | | | 0.02 | | | | | | | 2 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/2838 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2838_v1.pdf | 08-Jul-15 | 9:30 | AS | LANDFILL | 130_NKL_SURF_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2838_v1.pdf | | | | Not Detected | 12.8 | | 7.4 | 133 | | <1.3 | 42 | | | | | <0.02 | | 23.2 | | | | 10.1 | <1 | | | | Clear |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/3217 | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3217_v1.pdf | 06-Aug-15 | 14:40 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Sep\2015-3217_v1.pdf | | | | Not Detected | 14.5 | | | | | | | | | | | | | | | | | | 2 | | | | Brown Colour |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/4080 | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4080_v1.pdf | 30-Sep-15 | 11:00 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Oct\2015-4080_v1.pdf | | | | Not Detected | 12.0 | | | | | | | | | | | | | | | | | | <1 | | | | Clear |

| Product | Product Version | Project | SAMPLING POINT | Sampling Point | Sample No. | COA Link | Sampled Date | Sampled Time | Sampled By | Sample Type | Test List | Comments | Sample Status | Certifficate of Authorisation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/4398 | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4398_v1.pdf | 21-Oct-15 | 14:00 | AS | LANDFILL | 130_NKL_SURF_MONTH | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Nov\2015-4398_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/4674 | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4674_v1.pdf | 11-Nov-15 | 15:10 | TS | LANDFILL | 130_NKL_SURF_ANNUAL | | Authorised | \\doc_server\coa\KCC_ENVIRON\2016\Mar\2015-4674_v1.pdf |
| | | | | North_Kerry_Landfill Surface water: W2(O'Brennan's Br. R.Lee) | 2015/5195 | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5195_v1.pdf | 21-Dec-15 | 10:40 | AS | LANDFILL | 130_NKL_SURF_MONTH | River in flood | Authorised | \\doc_server\COA\KCC_ENVIRON\2016\Jan\2015-5195_v1.pdf |

| Analysis | 001_COLOUR | 002_TURBIDITY | 003_ODOUR | 005A_TEMP_FIELD | 006_PH | 006_PH | 007A_CONDUCTIVITY20C | 011_TOTAL_HARDNESS | 013C_BOD | 014_COD | 015_TOC | 016_FLUORIDE_ISE | 021K_NITRITE | 022K_AMMONIA | 022K_AMMONIA | 025_PHOSPHATE_SRP | 028K_CHLORIDE | 028K_SULPHATE | 031_SOLIDS_WW | 033K_TON | 036_DO_MG_L | 037_SUSPENDED_SOLIDS | 052_TOTAL_NITROGEN | 057_SOLIDS_TOTAL_DISS | 065_ALKANITY_TOTAL | 082_VIS_INSPECTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | Colour | Turbidity | Odour | Temperature | pH | pH | Conductivity | Total Hardness | B.O.D. | C.O.D. | TOC | Fluoride | Nitrite | Ammonia | Ammonia | Phosphorus (MRP) | Chloride | Sulphate | Total Solids | TON | Dissolved Oxygen | Suspended Solids | Total Nitrogen | Total Dissolved Solids (180°C) | Alkalinity | Visual Inspection |
| Reported | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Min. Value | | | | | | 6.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Max Value | | | | | | 9.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Units | HAZEN | NTU | NONE | DEG_C | PH | PH | USCM | MGCACO3L | BOD | MGL | MGL | MGL_F | MGLN | MGLN | MGLN | MGL | MGL | MGL | MGL | MGLN | MGL | MGL | MGLN | MGL | MGCACO3L | NONE |
| 2015/4398 | | | Not Detected | 11.9 | | | | | | | | | | | | | | | | | | 2 | | | | Clear |
| 2015/4674 | | | Normal | 11.4 | | 7.0 | 121 | | 1.3 | 59 | | | | | <0.05 | 0.01 | 24.1 | <5 | | 0.63 | 10.9 | 8 | | | 23 | coloured/clear/riverlike |
| 2015/5195 | | | Not Detected | 9.5 | | | | | | | | | | | <0.05 | | | | | | | 24 | | | | Brown Colour |

## Leachate Laboratory Results – North Kerry Landfill 2015

Kerry County Council - All Laboratory Results Report (Environment)

**** Please note that in accordance with Quality assurance procedures some of this data may be provisional and may be subject to further revision. This data is not validated until issued in report form signed by Senior Executive Chemist or another approved signatory***



| Product | Product Version | Project | SAMPLING POINT | Sampling Point | Sample No. | COA Link | Sampled Date | Sampled Time | Sampled By | Sample Type | Test List | Comments | Sample Status | Certificate of Authorisation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LEACHATE | 1 | North Kerry Landfill | NORTH_KERRY_LANDFILL_LD1 | North_Kerry_Landfill Leachate: LD-1 | 2015/0671 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0671_v1.pdf | 12-Feb-15 | 15:00 | TS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0671_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LD-1 | 2015/2849 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2849_v1.pdf | 08-Jul-15 | 12:07 | AS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2849_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LD-1 | 2015/4685 | | 11-Nov-15 | 10:55 | TS | LANDFILL | 130_NKL_LEC_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_LD2 | North_Kerry_Landfill Leachate: LD-2 | 2015/0672 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0672_v1.pdf | 12-Feb-15 | 15:05 | TS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0672_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LD-2 | 2015/2850 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2850_v1.pdf | 08-Jul-15 | 12:10 | AS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2850_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LD-2 | 2015/4686 | | 11-Nov-15 | 11:05 | TS | LANDFILL | 130_NKL_LEC_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_LD3 | North_Kerry_Landfill Leachate: LD-3 | 2015/0673 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0673_v1.pdf | 12-Feb-15 | 15:10 | TS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0673_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LD-3 | 2015/2851 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2851_v1.pdf | 08-Jul-15 | 12:13 | AS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2851_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LD-3 | 2015/4687 | | 11-Nov-15 | 11:15 | TS | LANDFILL | 130_NKL_LEC_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_LL1 | North_Kerry_Landfill Leachate: LL 1 | 2015/0674 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0674_v1.pdf | 12-Feb-15 | 15:30 | TS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0674_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LL 1 | 2015/2852 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2852_v1.pdf | 08-Jul-15 | 12:16 | AS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2852_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LL 1 | 2015/4688 | | 11-Nov-15 | 11:50 | TS | LANDFILL | 130_NKL_LEC_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_LL2 | North_Kerry_Landfill Leachate: LL 2 | 2015/0675 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0675_v1.pdf | 12-Feb-15 | 15:35 | TS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0675_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LL 2 | 2015/2853 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2853_v1.pdf | 08-Jul-15 | 12:20 | AS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2853_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LL 2 | 2015/4689 | | 11-Nov-15 | 12:50 | TS | LANDFILL | 130_NKL_LEC_ANNUAL | | Not Authorised | |
| | | | NORTH_KERRY_LANDFILL_LL3 | North_Kerry_Landfill Leachate: LL 3 | 2015/0676 | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0676_v1.pdf | 12-Feb-15 | 13:25 | TS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Feb\2015-0676_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LL 3 | 2015/2854 | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2854_v1.pdf | 08-Jul-15 | 11:40 | AS | LANDFILL | 130_NKL_LEC_QUART | | Authorised | \\doc_server\COA\KCC_ENVIRON\2015\Jul\2015-2854_v1.pdf |
| | | | | North_Kerry_Landfill Leachate: LL 3 | 2015/4690 | | 11-Nov-15 | 12:35 | TS | LANDFILL | 130_NKL_LEC_ANNUAL | | Not Authorised | |

| Analysis | 001_COLOUR | 002_TURBIDITY | 003_ODOUR | 005A_TEMP_FIELD | 006_PH | | 007A_CONDUCTIVITY20C | 011_TOTAL_HARDNESS | 013C_BOD | 014_COD | 015_TOC | 016_FLUORIDE_ISE | 021K_NITRITE | 022K_AMMONIA | | 025_PHOSPHATE_SRP | 028K_CHLORIDE | 028K_SULPHATE | 031_SOLIDS_WW | 033K_TON | 036_DO_MG_L | 037_SUSPENDED_SOLIDS | 052_TOTAL_NITROGEN | 057_SOLIDS_TOTAL_DISS | 065_ALKANITY_TOTAL | 082_VIS_INSPECTION |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Parameter | Colour | Turbidity | Odour | Temperature | pH | | Conductivity | Total Hardness | B.O.D. | C.O.D. | TOC | Fluoride | Nitrite | Ammonia | | Phosphorus (MRP) | Chloride | Sulphate | Total Solids | TON | Dissolved Oxygen | Suspended Solids | Total Nitrogen | Total Dissolved Solids (180°C) | Alkalinity | Visual Inspection |
| Reported Name | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Min. Value | | | | | | 6.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Max Value | | | | | | 9.0 | | | | | | | | | 0.0 | | | | | | | | | | | |
| Units | HAZEN | NTU | NONE | DEG_C | PH | PH | USCM | MGCACO3L | BOD | MGL | MGL | MGL_F | MGLN | MGLN | MGLN | MGL | MGL | MGL | MGL | MGLN | MGL | MGL | MGLN | MGL | MGCACO3L | NONE |
| 2015/0671 | | | Leachate | 9.0 | | | | | | | | | | | | | | | | | | | | | | dirty/brownish |
| 2015/2849 | | | Not Detected | 12.2 | | | | | | | | | | | | | | | | | | | | | | Brown Colour |
| 2015/4685 | | | Leachate | 11.4 | 6.3 | | 292 | | 4.2 | 76 | | <0.1 | | 3.79 | | 0.01 | 34.6 | <5 | | <0.5 | | | | | | coloured/brownish |
| 2015/0672 | | | Normal | 9.7 | | | | | | | | | | | | | | | | | | | | | | Clear |
| 2015/2850 | | | Not Detected | 12.0 | | | | | | | | | | | | | | | | | | | | | | Clear |
| 2015/4686 | | | Sweet | 11.0 | 7.6 | | 429 | | <1.3 | 26 | | <0.1 | | <0.05 | | 0.01 | 24.9 | <5 | | 1.52 | | | | | | clear |
| 2015/0673 | | | Normal | 9.0 | | | | | | | | | | | | | | | | | | | | | | Clear |
| 2015/2851 | | | Not Detected | 12.5 | | | | | | | | | | | | | | | | | | | | | | Clear |
| 2015/4687 | | | Not Detected | 10.2 | 7.5 | | 782 | | <1.3 | 20 | | <0.1 | | <0.05 | | 0.13 | 61.6 | 31.0 | | 49.57 | | | | | | clear/bits of sediment |
| 2015/0674 | | | Leachate | 9.0 | | | | | | | | | | | | | | | | | | | | | | dirty/blackish |
| 2015/2852 | | | Leachate | 14.1 | | | | | | | | | | | | | | | | | | | | | | Brown Colour |
| 2015/4688 | | | Leachate | 12.8 | 7.4 | | 2570 | | 53 | 313 | | <0.1 | | 142.00 | | 0.05 | 259.6 | <5 | | <0.5 | | | | | | brownish/coloured |
| 2015/0675 | | | Leachate | 8.8 | | | | | | | | | | | | | | | | | | | | | | dirty/blackish |
| 2015/2853 | | | Leachate | 14.3 | | | | | | | | | | | | | | | | | | | | | | Brown/Black Colour |
| 2015/4689 | | | Leachate | 12.5 | 7.4 | | 2800 | | 50 | 314 | | 0.1 | | 160.00 | | 0.10 | 318.8 | 66.2 | | 0.93 | | | | | | brownish/coloured |
| 2015/0676 | | | Musty | 5.0 | | | | | | | | | | | | | | | | | | | | | | cloudy/coloured |
| 2015/2854 | | | Not Detected | 12.6 | | | | | | | | | | | | | | | | | | | | | | Cloudy |
| 2015/4690 | | | Not Detected | 11.4 | 7.5 | | 106 | | 1.3 | <10 | | <0.1 | | 0.05 | | 0.01 | 6.2 | <5 | | <0.5 | | | | | | clear |

# *Appendix C: Engine Stack Monitoring Testing*

| | |
|---|---|
| **Report Title** | Air Emissions Compliance Monitoring Emissions Report |
| **Company address** | Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath |
| **Stack Emissions Testing Report Commissioned by** | B9 Power |
| **Facility Name** | North Kerry Landfill Site, Muingnaminnane, Tralee, Co. Kerry |
| **Contact Person** | Ruth Baker |
| **EPA Licence Number** | W0001-03 |
| **Licence Holder** | North Kerry Landfill, E1 |
| **Stack Reference Number** | E1 |
| **Dates of the Monitoring Campaign** | 24/09/2015 |
| **Job Reference Number** | NOKETL1240915 / 2015379 |
| **Report Written By** | Dr. John Casey |
| **Report Approved by** | Dr. Brian Sheridan |
| **Stack Testing Team** | Dr. John Casey |
| **Report Date** | 24/09/2015 |
| **Report Type** | Test Report Compliance Monitoring |
| **Version** | 1 |
| **Signature of Approver** | Brian Sheridan<br>Technical Manager |

## Contents

# 1. Executive Summary

## *I. Monitoring Objectives*

**Overall Aim of the monitoring Campaign**

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

**Special Requirements**

There were no special requirements.

**Target Parameters**

| |
|---|
| Total Particulate Matter (TPM) |
| Carbon Monoxide (CO) |
| Oxides of Nitrogen (NOx) as $NO_2$ |
| Sulphur Dioxide ($SO_2$) |
| Stack Gas Temperature |
| Volume ($m^3.h^{-1}$) |

**Emission Limit Values**

| Emission Limit Values / Mass Emissions Limit Values | $mg.m^{-3}$ | $kg.h^{-1}$ |
|---|---|---|
| TPM | 130 | - |
| CO | - | - |
| NOx as $NO_2$ | 500 | - |
| $SO_2$ | - | - |
| Stack Gas Temperature | - | - |
| Volume ($m^3.h^{-1}$) | 3,000 | - |

**Reference Conditions**

| Reference Conditions | Value |
|---|---|
| Oxygen Reference % | 5 |
| Temperature $^{o}C$ | 273.15 |
| Total Pressure kPa | 101.3 |
| Moisture % | Yes |

**Executive Summary**

**Overall Results**

| | **Concentration** | | | | | **Mass Emission** | |
|---|---|---|---|---|---|---|---|
| **Parameter** | **Units** | **Result** | **MU +/-** | **Limit** | **Compliant** | **Units** | **Result** |
| Total Particulate Matter (TPM) | $mg.m^{-3}$ | 8.65 | 0.60 | 130 | Yes | $kg.h^{-1}$ | 0.006 |
| Carbon Monoxide (CO) | $mg.m^{-3}$ | 1115.27 | 69.33 | - | N/A | $kg.h^{-1}$ | 0.813 |
| Oxides of Nitrogen (NOx) as $NO_2$ | $mg.m^{-3}$ | 440.69 | 34.28 | 500 | Yes | $kg.h^{-1}$ | 0.321 |
| Sulphur Dioxide ($SO_2$) | $mg.m^{-3}$ | 294.22 | 19.81 | - | Yes | $kg.h^{-1}$ | 0.214 |
| Oxygen (%) | % v/v | 8.03 | 0.15 | - | N/A | - | - |
| Stack Gas Temperature | K | 721.15 | - | - | N/A | - | - |
| Stack Gas Velocity | $m.s^{-1}$ | 23.44 | - | - | N/A | - | - |
| Volumetric Flow Rate | $m^3.h^{-1}$ | 905 | - | - | N/A | - | - |
| Volumetric Flow Rate (Ref.) | $m^3.h^{-1}$ | 729 | - | 3,000 | Yes | - | - |

**Accreditation details**

| | |
|---|---|
| Air Scientific Limited | INAB319T |
| External Analytical Laboratory | UKAS1549 |
| Other | - |

**Executive Summary**

**Monitoring Dates & Times**

| Parameter | Run | Location ID | Sampling Dates | Sampling Time On | Sampling Time Off | Duration (mins.) |
|---|---|---|---|---|---|---|
| Total Particulate Matter (TPM) | Run 1 | E1 | 24/09/2015 | 09:50:00 | 10:20:00 | 00:30:00 |
| | Run 2 | | | | | |
| | Run 3 | | | | | |
| Carbon Monoxide (CO) | Run 1 | E1 | 24/09/2015 | 09:08:00 | 09:42:00 | 00:34:00 |
| | Run 2 | | | | | |
| | Run 3 | | | | | |
| Oxides of Nitrogen (NOx) as $NO_2$ | Run 1 | E1 | 24/09/2015 | 09:08:00 | 09:42:00 | 00:34:00 |
| | Run 2 | | | | | |
| | Run 3 | | | | | |
| Sulphur Dioxide ($SO_2$) | Run 1 | E1 | 24/09/2015 | 9:08:00 | 9:42:00 | 00:34:00 |
| | Run 2 | | | | | |
| | Run 3 | | | | | |
| Oxygen (%) | | E1 | 24/09/2015 | 09:08:00 | 09:42:00 | 00:34:00 |

**Process details**

| Parameter | |
|---|---|
| **Process status** | Normal |
| **Capacity (per/hour) (if applicable)** | N/a |
| **Continuous or Batch Process** | Continuous |
| **Feedstock** | LFG |
| **Abatement System** | No |
| **Abatement Systems Running Status** | N/A |
| **Fuel** | LFG |
| **Plume Appearance** | Yes |
| **Other information** | None |

**Monitoring, Equipment & Analytical Methods**

| | Monitoring | | | | Analysis | |
|---|---|---|---|---|---|---|
| **Parameter** | **Standard** | **Technical Procedure** | **Accredited Testing** | **Testing Lab** | **Analytical Technique** | **Analysis Lab** |
| Total Particulate Matter (TPM) | EN13284-1:2002 | SOP 2000 | Yes | AirSci | Gravimetric | RPS |
| Carbon Monoxide (CO) | EN15058:2006 | SOP 2004 | Yes | AirSci | NCIR By Horiba PG-250 | AirSci |
| Oxides of Nitrogen (NOx) | EN14792:2006 | SOP 2002 | Yes | AirSci | Chemiluminescence | AirSci |
| Sulphur Dioxide (SO2) | TGN 21 | SOP 2012 | Yes | AirSci | NDIR Absorption | AirSci |
| Oxygen (%) | EN14789:2005 | SOP 2008 | Yes | AirSci | Paramagnetic | AirSci |
| Stack Gas Temperature | EN16911:2013 | SOP 2005 | Yes | AirSci | Thermocouple | AirSci |
| Stack Gas Velocity | EN16911:2013 | SOP 2005 | Yes | AirSci | Pitot tubes | AirSci |

**List of Equipment**

| ID | Item of Equipment | Manufacturer | Serial No. |
|---|---|---|---|
| ASLTM12EQ509 | 3010 MinfiFID | Signal Instruments | 16764 |
| ASLTM12EQ514 | ISO Stack EF Kinetic Sampler | TCR Tecora | 709344A & 7093500 |
| ASLTM12EQ517 | Testo 400 Gas Pressure Vacumn and Flow | Testo | 00828828/305 |
| ASLTM12EQ520 | Buhler Sample Gas Cooler | Buhler Technologies | 100063602044367-001 |
| ASLTM13EQ504 | Horiba PG2500 Portable Flue Gas Analzer | Horiba | 41432840053 |
| ASLTM13EQ506 | S TYPE PITOT TUBE | Tecora | O710 |
| ASLTM13EQ509 | 10 metre industrial heated sample line (Temp controller box 1 & 2) | Neptech | 13B088 |
| ASLTM14EQ507 | Stanley 5m Measuring Tape | Stanley | 30-696 |
| ASLTM14EQ512 | GemRed Electronic Level 0 to 180 Degrees | GemRed | 8088 |
| ASLTM14EQ516 | 6" Digital Calliper | Stanley | 052013w |

**Sampling Deviations**

| Parameter | Deviation |
|---|---|
| **Standard ID** | EN16911 - in accordance with MID6911-1 |
| **Standard ID** | - |
| **Standard ID** | - |
| **Standard ID** | - |

**Reference Documents**

| | |
|---|---|
| Risk Assessment (RA) | SOP1011 |
| Site Review (SR) | SOP1015 |
| Site Specific Protocol (SSP) | SOP1015 |

**Executive Summary**

**Suitability of sampling location**

| General Information | Value |
|---|---|
| Permanent/Temporary | Temporary |
| Inside/ Outside | Outside |

| Platform Details | | |
|---|---|---|
| **Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements** | **Value** | **Comment** |
| Sufficient Working area to manipulate probe and measuring instruments | Yes | - |
| Platform has 2 handrails (approx. 0.5m & 1.0 m high) | Yes | - |
| Platform has vertical base boards (approx. 0.25 m high) | Yes | - |
| Platform has chains / self closing gates at top of ladders | Yes | - |
| There are no obstructions present which hamper insertion of sampling equipment | No | - |
| Safe Access Available | Yes | - |
| Easy Access Available | Yes | - |

| Sampling Location / Platform Improvement Recommendations |
|---|
| None |

| BSEN 15259 Homogeneity Test Requirements |
|---|
| 1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack |
| **E.g. Select Option**<br>**1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack**<br>**2: Test results were obtained from previous Homogeneity test carried out by ASL**<br>**3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor**<br>**4: Other: Enter Description** |

**Stack diagram**

2. 

## *II. Appendix I Monitoring Personnel & Equipment*

**Stack Emissions Monitoring Personnel**

| | | |
|---|---|---|
| **Team Leader** | **Name** | John Casey |
| | **Qualifications** | PhD. (Eng.), MSc. (Agr.), B. Agr. Sc. |
| | **System approval** | Air Scientific Limited Approved |
| | | - |

### *III. Appendix II Stack Details & flow characteristics*

**Preliminary stack survey calculations**

| **General Stack Details** | | |
|---|---|---|
| **Stack details** | **Units** | **Value** |
| Date of survey | | 24/09/2015 |
| Time of survey | | 09:05 |
| Type | | Circular |
| Stack Diameter / Depth, D | m | 0.20 |
| Stack Width, W | m | - |
| Average Stack Gas Temp., Ta | C | 448 |
| Average Static Pressure, P static | kPa | 0.1 |
| Average Barometric Pressure, Pb | kPa | 100.9 |
| Type of Pitot | | S |
| Are Water Droplets Present ? | | No |
| Average Pitot Tube Calibration Coeff, Cp | | 0.84 |
| Negative flow | | No |
| Highly homogeneous flow stream/gas velocity | | Yes |

| | | |
|---|---|---|
| Sample Port Size | mm | 100 |
| Initial Pitot Leak Check | Pa | 270 |
| Final Pitot Leak Check | Pa | 273 |
| Orientation of Duct | | Vertical |
| Pitot Tube Cp | | 0.998 |
| Number of Lines Available | | 1 |
| Number of Lines Used | | 1 |

| **Sampling Line A** | | | | | | |
|---|---|---|---|---|---|---|
| **Point** | **Distance to duct (m)** | **Pa** | **Temp °C** | **Velocity (m/s)** | **Oxygen (%)** | **Angle of Swirl** |
| 1 | 0.01 | - | - | - | - | - |
| 2 | 0.05 | 183 | - | 23.0 | - | <15 |
| 3 | 0.15 | 196 | - | 23.8 | - | <15 |
| 4 | 0.19 | - | - | - | - | - |
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |
| 8 | - | - | - | - | - | - |
| 9 | - | - | - | - | - | - |
| 10 | - | - | - | - | - | - |
| Average | - | 189.50 | - | 23.44 | - | <15 |
| Min | - | 183 | - | 23.04 | - | <15 |
| Max | - | 196 | - | 23.84 | - | <15 |

| Sampling Line B | | | | | | |
|---|---|---|---|---|---|---|
| **Point** | **Distance to duct (m)** | **Pa** | **Temp °C** | **Velocity (m/s)** | **Oxygen (%)** | **Angle of Swirl** |
| 1 | - | - | - | - | - | - |
| 2 | - | - | - | - | - | <15 |
| 3 | - | - | - | - | - | <15 |
| 4 | - | - | - | - | - | - |
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |
| 8 | - | - | - | - | - | - |
| 9 | - | - | - | - | - | - |
| 10 | - | - | - | - | - | - |
| Average | - | - | - | - | - | - |
| Min | - | - | - | - | - | - |
| Max | - | - | - | - | - | - |

| Component | Conc. ppm | Conc. Dry % v/v | Conc. Wet % v/v | Molar Mass |
|---|---|---|---|---|
| Carbon Dioxide $CO_2$ | - | 8.8 | - | 44.01 |
| Oxygen $O_2$ | - | 8.1 | - | 32 |
| Nitrogen $N_2$ | - | 83.1 | - | 28.1 |
| Moisture ($H_2O$) | - | - | 9.6 | 18.02 |
| | | | | |
| **Reference Conditions** | **Units** | **Numbers** | | |
| Temperature | $^{o}C$ | 273.15 | | |
| Total Pressure | kPa | 101.3 | | |
| Moisture | % | - | | |
| Oxygen (Dry) | % | 5 | | |

| **Stack Gas Composition & Molecular Weights** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **Component** | **Molar Mass M** | **Density Kg/m$^3$ p** | **Conc. Dry % v/v** | **Dry Volume Fraction r** | **Dry Conc. kg/m$^3$ pi** | **Conc. wet % v/v** | **Wet Volume Fraction r** | **Wet Conc.kg/m$^3$ pi** |
| Carbon Dioxide $CO_2$ | 44.01 | 1.96 | 8.8 | 0.088 | 0.17 | 7.96 | 0.08 | 0.16 |
| Oxygen $O_2$ | 32 | 1.43 | 8.1 | 0.081 | 0.12 | 7.32 | 0.07 | 0.10 |
| Nitrogen $N_2$ | 28.1 | 1.25 | 83.1 | 0.831 | 1.04 | 75.12 | 0.75 | 0.94 |
| Moisture ($H_2O$) | 18.02 | 0.80 | - | - | - | 9.6 | 0.10 | 0.08 |
| | - | - | - | - | - | - | - | - |
| where p=M/22.41 | - | - | - | - | - | - | - | - |
| pi = r x p | - | - | - | - | - | - | - | - |

| **Calculation of Stack Gas Densities** | | |
|---|---|---|
| | | |
| **Determinand** | **Units** | **Result** |
| Dry Density (STP), P STD | $kg.m^{-3}$ | 1.330 |
| Wet Density (STP), P STW | $kg.m^{-3}$ | 1.284 |
| Dry Density (Actual), P Actual | $kg.m^{-3}$ | 0.502 |
| Average wet Density (Actual), P ActualW | $kg.m^{-3}$ | 0.485 |
| | | |
| | | |
| **Where** | | |
| P STD = sum of component concentrations, kg/m3 (excluding water vapour) | - | - |
| P STW = (P STD + pi of H2O) / ( 1 + (pi of H2O / 0.8036)) | - | - |
| P actual = P STD x (T STP / (P STP)) x (Pa / Ta) | - | - |
| P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta) | - | - |



Air Scientific

| Sampling Plane Validation Criteria | Value | Units | Requirement | Compliance | Method |
|---|---|---|---|---|---|
| Lowest Differential Pressure | 183 | Pa | >5 Pa | Yes | EN16911:2013 |
| Lowest Gas Velocity | 23.04 | m/s | - | N/A | - |
| Highest Gas Velocity | 23.84 | m/s | - | N/A | - |
| Ratio of Above | 1.03 | :1 | <3:1 | Yes | EN16911:2013 |
| Mean Velocity | 23.44 | m/s | - | N/A | - |
| Angle of flow with regard to duct axis | <15 | degrees | < 15 | Yes | EN16911:2013 |
| No local negative flow | No | - | - | Yes | - |
| Homogeneous flow stream/gas velocity | Yes | - | - | Yes | - |

| Calculation of stack Gas Velocity, V | |
|---|---|
| Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP ) / Density) | - |
| | |
| **Where** | |
| Kpt = Pitot tube calibration coefficient | 0.84 |
| Compressibility correction factor, assumed at a constant 0.998 | 0.998 |

| Gas Volumetric Flowrate | Units | Result |
|---|---|---|
| Gas Volumetric Flow Rate (Actual) | $m^3.h^{-1}$ | 2652 |
| Gas Volumetric Flow Rate (STP, Wet) | $m^3. h^{-1}$ | 1001 |
| Gas Volumetric Flowrate (STP, Dry) | $m^3. h^{-1}$ | 905 |
| Gas Volumetric Flowrate REF to Oxygen | $m^3. h^{-1}$ | 729 |

***IV. Appendix 3 Individual parameter sampling details and results***

**Total Particulate Matter : Sampling details and results**

| | | | | | |
|---|---|---|---|---|---|
| ***Run 1*** | | | **Time On** | 09:50:00 | - |
| ***Stack ID*** | E1 | - | **Time Off** | 10:20:00 | - |
| ***Filter ID*** | 608 | - | **Uncertainty Data** | - | - |
| **Start Dry Gas Meter** | - | Nm3 | **Temperature at Pump** | 27.1 | Deg C |
| **Finish Dry Gas Meter** | - | Nm3 | **Pressure at Pump** | 100.8 | kPa |
| **Average Stack Temperature** | 448 | degrees | **Air Volume at Pump** | 0.445 | $m^3$ |
| ***Moisture Content*** | 9.60 | % | **Humidity at Pumps** | 0.1 | % |
| ***Stack Flow Rate STP, Dry*** | 905 | $m^3 \cdot h^{-1}$ | **Filter Weight** | 2.5 | mg |
| ***Volume of Air Sampled*** | 0.4 | $m^{3\ (VgN)}$ | **Front End Weight** | 0.3 | mg |
| | | | | | |
| ***Balance Calibration*** | **Weight** | | | | |
| 300.0 | - | g | - | - | - |
| 500.0 | - | g | - | - | - |
| 1000.0 | - | g | - | - | - |
| **Inpinger Weights** | **Initial** | **Final** | **Difference** | | |
| 1 | - | - | - | - | - |
| 2 | - | - | - | - | - |
| 3 | - | - | - | - | - |
| 4 | - | - | - | - | - |
| **Volume of Air Sampled** | - | Nm3 | 0 | - | - |
| **Moisture Content (EN 14790)** | - | % | - | - | - |
| | | | | | |
| **Leak Check Results** | **Result** | - | **% Leak** | | |
| **Before Blank** | 0.1 | l/min | 0.3 | - | - |
| **After Blank** | 0.18 | l/min | 0.5 | - | - |
| **Before Sample 1** | 0.13 | l/min | 0.3 | - | - |
| **After Sample 1** | 0.1 | l/min | 0.3 | - | - |
| **Average Flow Rate** | 40 | l/min | 0.5 | - | - |
| **Standard Maximum** | 0.8 | l/min | 2% | - | - |
| **Back Pressure** | - | bar | - | - | - |
| **Leak check acceptable** | Yes | - | Yes/No | - | - |
| **Water droplets present** | No | - | Yes/No | - | - |
| | | | | | |
| **Standard Criteria to be Met** | **Result** | **Standard Requirement** | | | |
| **Angle of Flow** | <15 | <15 Degrees | | | |
| **Negative Flow in the Stack** | None | None | | | |
| **Pitot Pressure Difference** | >5Pa | >5Pa | | | |
| **Ratio of Flow Measurement** | <3:1 | <3:1 | | | |
| | | | | | |
| **Pitot Tube Leak Check** | **Result** | | | | |
| **Positive Pressure** | Pass | - | | | |
| **Negative Pressure** | Pass | - | | | |

| | | | | | |
|---|---|---|---|---|---|
| **Number of Ports** | 1 | 2 | | | |
| **Straight length before sample point** | > 5 | > 5 Hydraulic Diameters | | | |
| **Straight length after sample point** | > 5 | > 5 Hydraulic Diameters | | | |
| | | | | | |
| **Sample Calculations** | - | - | | | |
| | | | | | |
| **Blank (Filter and Front Wash Combined)** | 0.35 | mg | | | |
| **Sample 1 (Filter and Front Combined)** | 2.8 | mg | | | |
| **Volume of Air Sampled** | 0.40 | $m^3$ | | | |
| **Blank Result** | 0.88 | $mg.m^{-3}$ | | | |
| **Sample Result** | 7.00 | $mg.m^{-3}$ | | | |
| **Emission Limit Value** | 130 | $mg.m^{-3}$ | | | |
| | | | | | |
| **Blank as Percentage of ELV** | 0.7 | % | **Standard Requirement** | **<10% ELV** | - |
| | | | | | |
| **Isokinetic Criterion Compliance** | | | | | |
| Isokinetic Variation | % | 0.3 | - | - | - |
| Allowable IsoKinetic Range | % | 95-115 | - | - | - |
| Iso Kineticity Acceptable | - | Yes | - | - | - |

**Total Particulates Quality Assurance**

| **Stack ID** | E1 | - |
|---|---|---|
| | | |
| **Parameter** | **Units** | **Run 1** |
| Sampling Times | - | 09:50:00 |
| Sampling dates | - | 24/09/2015 |
| Sampling Device | - | Iso Stack Basic |
| Volume Sampled (REF.) | m3 | 0.4 |
| Filter ID Number | - | 608 |
| Probe rinse ID | - | 608W |
| Total Filter Mass | mg | 2.5 |
| Probe Rinse Solids Mass | mg | 0.3 |
| Total Mass Collected | mg | 2.8 |
| | | |
| **General information** | | |
| Standard | ISEN13284-1 | **Run 1** |
| Technical Procedure | - | 2000 |
| | | |
| Probe Material | - | Titanium |
| Filter Housing | - | Titanium |
| | | |
| Positioning of Filter | - | In-stack |
| Filter Size and Material | - | 47 |
| | | |
| Number of Sampling lines used | - | 1 |
| Number of Sampling Points used | - | 2 |

**Carbon Monoxide Quality Assurance**

| Sampling Details | | |
|---|---|---|
| **Stack ID** | E1 | - |
| | **Units** | **Run 1** |
| ***Parameter*** | | |
| **Sampling Times** | - | 09:07 |
| **Sampling Dates** | - | 24/09/2015 |
| **Instrument Range** | ppm | 1000 |
| **Span Gas Value** | ppm | 598 |
| **Acceptable Gas Range** | - | Yes |
| | | |
| ***Quality Assurance*** | **Units** | **Run 1** |
| **Conditioning Unit Temperature** | C | 2 |
| **Average Temperature** | < C | 2 |
| **Allowable Temperature** | - | 4 |
| **Temperature Acceptable** | - | Yes |
| **Pump flow rate** | l/min. | 0.4 |
| | | |
| ***Zero Drift*** | Units | **Run 1** |
| **Zero Down Sampling Line (Pre)** | ppm | 0.1 |
| **Zero Down Sampling Line (Post)** | ppm | 0.6 |
| **Zero drift** | ppm | 0.5 |
| **Allowable Zero Drift** | ppm | 11.9 |
| **Zero Drift Acceptable** | - | Yes |
| | | |
| ***Span Drift*** | Units | **Run 1** |
| **Span Down Sampling Line (Pre)** | ppm | 599 |
| **Span Down Sampling Line (Post)** | ppm | 602 |
| **Span Drift** | ppm | 3 |
| **Allowable Span Drift** | ppm | 11.9 |
| **Span Drift Acceptable (Y/N)** | - | Yes |
| | | |
| ***Leak Check*** | | |
| **Span Gas Conc.** | ppm | 598 |
| **Recorded Conc. down Line** | ppm | 599 |
| **Leak check acceptable (< 2%)** | (Y/N) | Yes |
| | | |
| **Test Conditions** | **Units** | **Run 1** |
| **Run Ambient Temperature Range** | C | 10 |

**Carbon Monoxide Results & Sampling details**

| Parameter | Units | Run 1 |
|---|---|---|
| Concentration | $mg.m^{-3}$ | 902.76 |
| Uncertainty | $mg.m^{-3}$ | 69.33 |
| Mass Emission | kg.h | 0.81 |

| **General Sampling Information** | |
|---|---|
| | |
| **Parameter** | **Value** |
| Standard | EN15058 |
| Technical Procedure | SOP2004 |
| | |
| Probe material | SS |
| Filtration Type/Size | PTFE |
| Heated Head Filter Used | Yes |
| Heated Line Temperature | 190 |
| | |
| Span Gas Reference Number | ASLTM14ING522 |
| Span Gas Expiry Date | Jan-17 |
| Span Gas Start Pressure (bar) | 50 |
| Gas Cylinder Concentration (ppm) | 598 |
| Span Gas Uncertainty (%) | <2 |
| Zero Gas Type | Nitrogen |
| | |
| Number of Sampling Lines Used | 1 |
| Number of Sampling Points Used | 1 |
| Sample Point I.D's | E1 |
| | |
| **Reference Conditions** | |
| Temperature (K) | 273.15 |
| Pressure (kPa) | 101.3 |
| Gas (Wet or Dry) | Dry |
| Oxygen | 5 |



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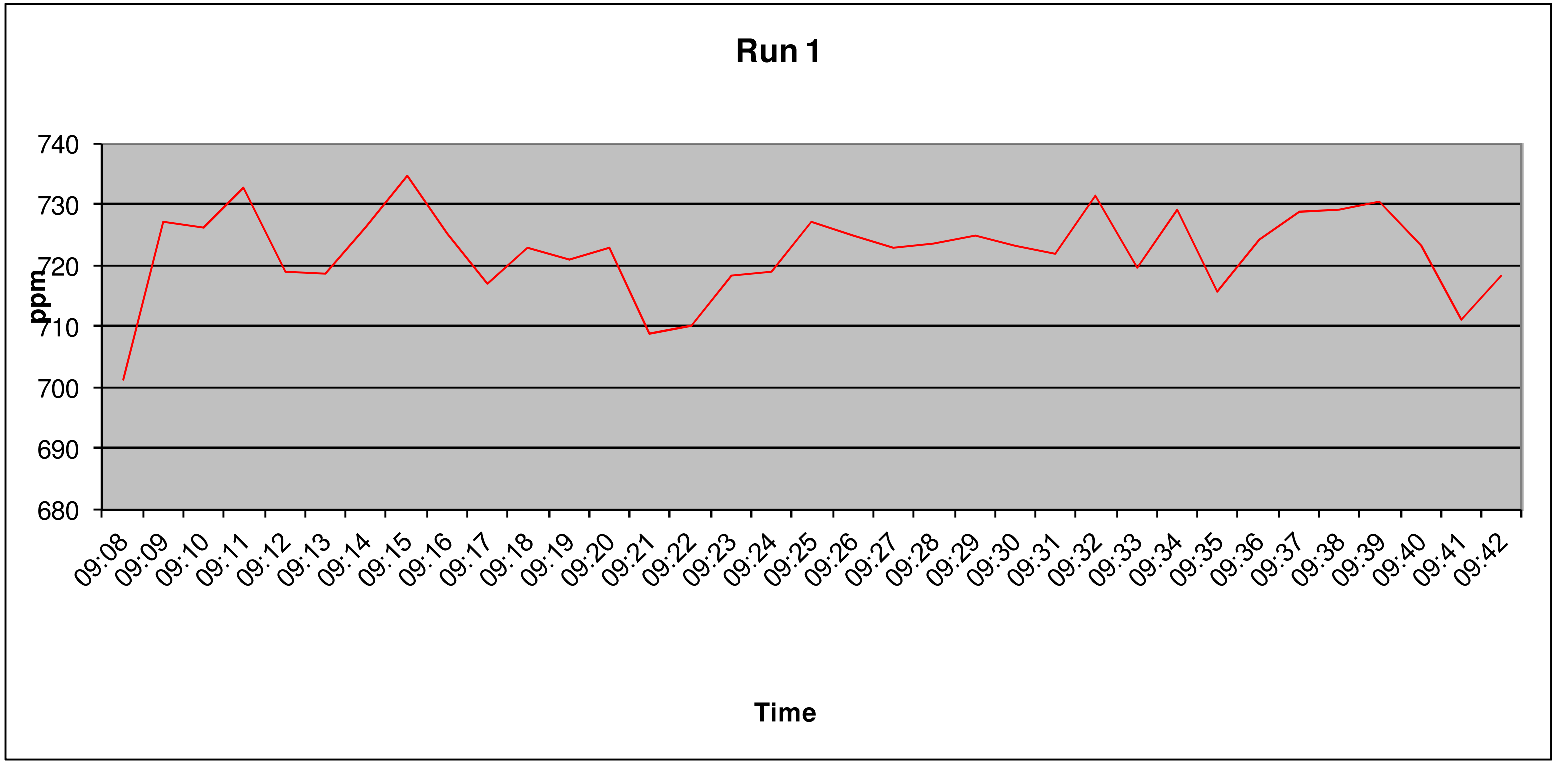
**Carbon Monoxide Trend**



**Carbon Monoxide Measurement Uncertainty**

| | Units | Run 1 |
|---|---|---|
| Measured Quantities | | |
| Certified Range of Analyser | ppm | 1.36 to 1000 |
| Operational Range of Analyser | ppm | 1000 |
| Measured Reading | ppm | 722.21 |
| | | |
| Measured Quantities | **Units** | **Run 1** |
| Nonlinearity | % | 0.9 |
| Temperature Dependent Zero drift | % | 0.14 |
| Temperature Dependent Span drift | % | -0.12 |
| Cross-sensitivity | % | 0.08 |
| Leak | % | 0 |
| Calibration Gas Uncertainty | % | <2 |
| | | |
| **Parameter** | **Units** | **Run 1** |
| Combined uncertainty | $mg.m^{-3}$ | 11.55 |
| Expanded uncertainty | $mg.m^{-3}$ | 23.10 |
| | | |
| **Uncertainty corrected to std conds.** | $mg.m^{-3}$ | 69.33 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of ELV | -- |
| **Expanded uncertainty expressed with a level of confidence of 95%** | $mg.m^{-3}$ | 69.33 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of value | 7.68 |
| | | |
| **Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions** | | |

**Oxides of Nitrogen Quality Assurance**

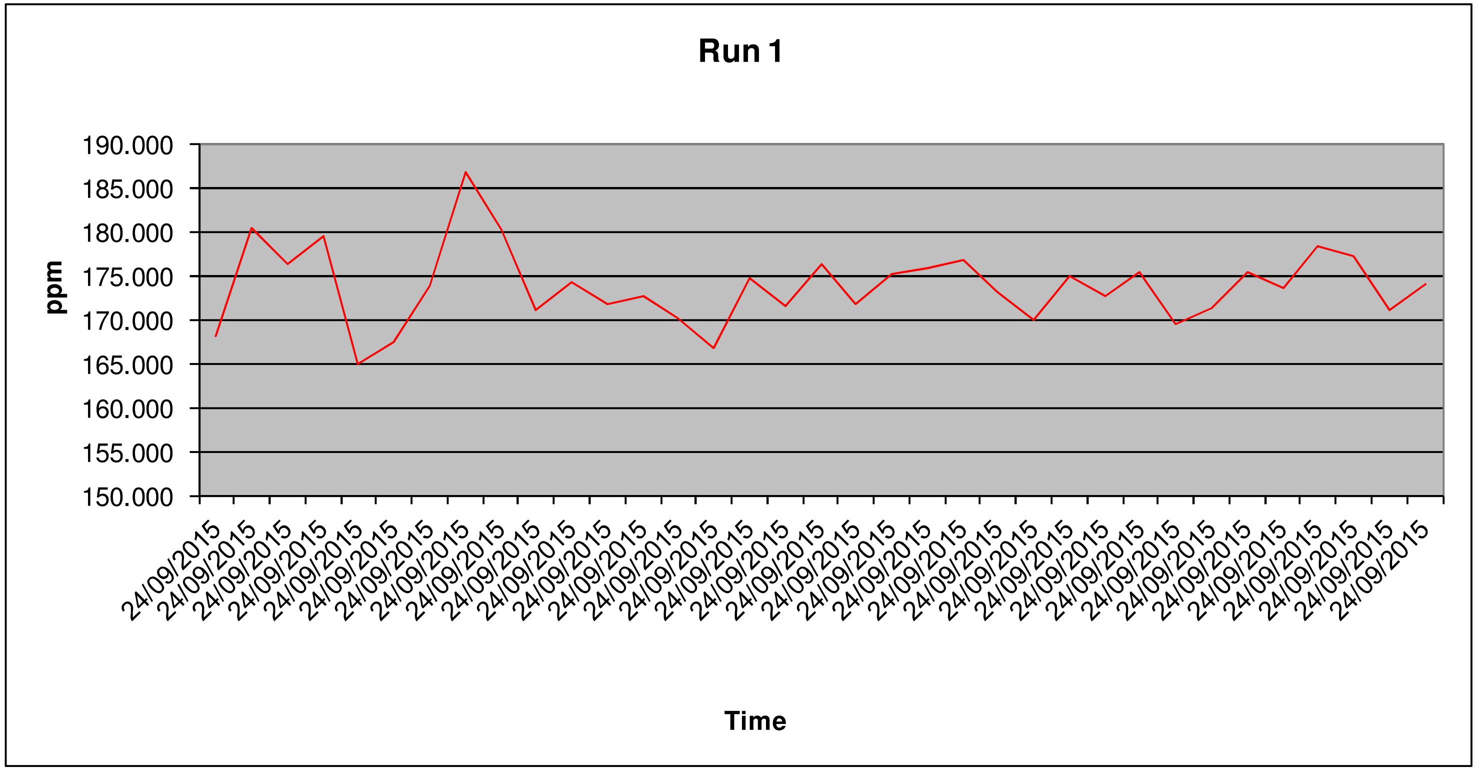
| **Sampling Details** | | |
|---|---|---|
| **Stack ID** | E1 | - |
| | **Units** | **Run 1** |
| ***Parameter*** | | |
| **Sampling Times** | - | 09:07 |
| **Sampling Dates** | - | 24/09/2015 |
| **Instrument Range** | ppm | 250 |
| **Span Gas Value** | ppm | 159 |
| **Acceptable Gas Range** | - | Yes |
| | | |
| ***Quality Assurance*** | **Units** | **Run 1** |
| **Conditioning Unit Temperature** | C | 2 |
| **Average Temperature** | < C | 2 |
| **Allowable Temperature** | - | 4 |
| **Temperature Acceptable** | - | Yes |
| **Pump flow rate** | l/min. | 0.4 |
| | | |
| ***Zero Drift*** | Units | **Run 1** |
| **Zero Down Sampling Line (Pre)** | ppm | 0.1 |
| **Zero Down Sampling Line (Post)** | ppm | 0.3 |
| **Zero drift** | ppm | 0.2 |
| **Allowable Zero Drift** | ppm | 3.1 |
| **Zero Drift Acceptable** | - | Yes |
| | | |
| ***Span Drift*** | Units | **Run 1** |
| **Span Down Sampling Line (Pre)** | ppm | 159.1 |
| **Span Down Sampling Line (Post)** | ppm | 159.3 |
| **Span Drift** | ppm | 0.2 |
| **Allowable Span Drift** | ppm | 3.1 |
| **Span Drift Acceptable (Y/N)** | - | Yes |
| | | |
| ***Leak Check*** | | |
| **Span Gas Conc.** | ppm | 159 |
| **Recorded Conc. down Line** | ppm | 159.1 |
| **Leak check acceptable (< 2%)** | (Y/N) | Yes |
| | | |
| **Test Conditions** | **Units** | **Run 1** |
| **Run Ambient Temperature Range** | C | 10 |
| **NOx Converter Efficiency** | % | 95.7 |

**Oxides of Nitrogen Results & Sampling details**

| Parameter | Units | Run 1 |
|---|---|---|
| Concentration | $mg.m^{-3}$ | 356.72 |
| Uncertainty | $mg.m^{-3}$ | 34.28 |
| Mass Emission | $kg.h^{-1}$ | 0.32 |

| General Sampling Information | |
|---|---|
| | |
| **Parameter** | **Value** |
| Standard | EN14792 |
| Technical Procedure | SOP2002 |
| | |
| Probe material | SS |
| Filtration Type/Size | PTFE |
| Heated Head Filter Used | Yes |
| Heated Line Temperature | 190 |
| Date & Result of last converter check | 95.7 04/12/2014 |
| | |
| Span Gas Reference Number | ASLTM15ING517 |
| Span Gas Expiry Date | Nov-15 |
| Span Gas Start Pressure (bar) | 40 |
| Gas Cylinder Concentration (ppm) | 159 |
| Span Gas Uncertainty (%) | <2 |
| Zero Gas Type | Nitrogen |
| | |
| Number of Sampling Lines Used | 1 |
| Number of Sampling Points Used | 1 |
| Sample Point I.D's | E1 |
| | |
| Reference Conditions | |
| Temperature (K) | 273.15 |
| Pressure (kPa) | 101.3 |
| Gas (Wet or Dry) | Dry |
| Oxygen | 5 |

**Oxides of Nitrogen Trend**



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**Oxides of Nitrogen Measurement Uncertainty**

| | | |
|---|---|---|
| Measured Quantities | **Units** | **Run 1** |
| Nonlinearity | % | 1.4 |
| Temperature Dependent Zero drift | % | -0.04 |
| Temperature Dependent Span drift | % | -0.25 |
| Cross-sensitivity | % | 0.5 |
| Leak | % | 0 |
| Calibration Gas Uncertainty | % | <2 |
| Mass Flow Controllers (Dilution) Uncertainty | % | <1 |
| NOx Converter Efficiency | % | 95.7 |
| | | |
| **Parameter** | **Units** | **Run 1** |
| Combined uncertainty | $mg.m^{-3}$ | 9.89 |
| Expanded uncertainty | $mg.m^{-3}$ | 19.77 |
| | | |
| **Uncertainty corrected to std conds.** | $mg.m^{-3}$ | 34.28 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of ELV | 6.86 |
| **Expanded uncertainty expressed with a level of confidence of 95%** | $mg.m^{-3}$ | 34.28 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of value | 9.61 |
| | | |
| | | |
| **Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions** | | |

**Sulphur Dioxide Quality Assurance**

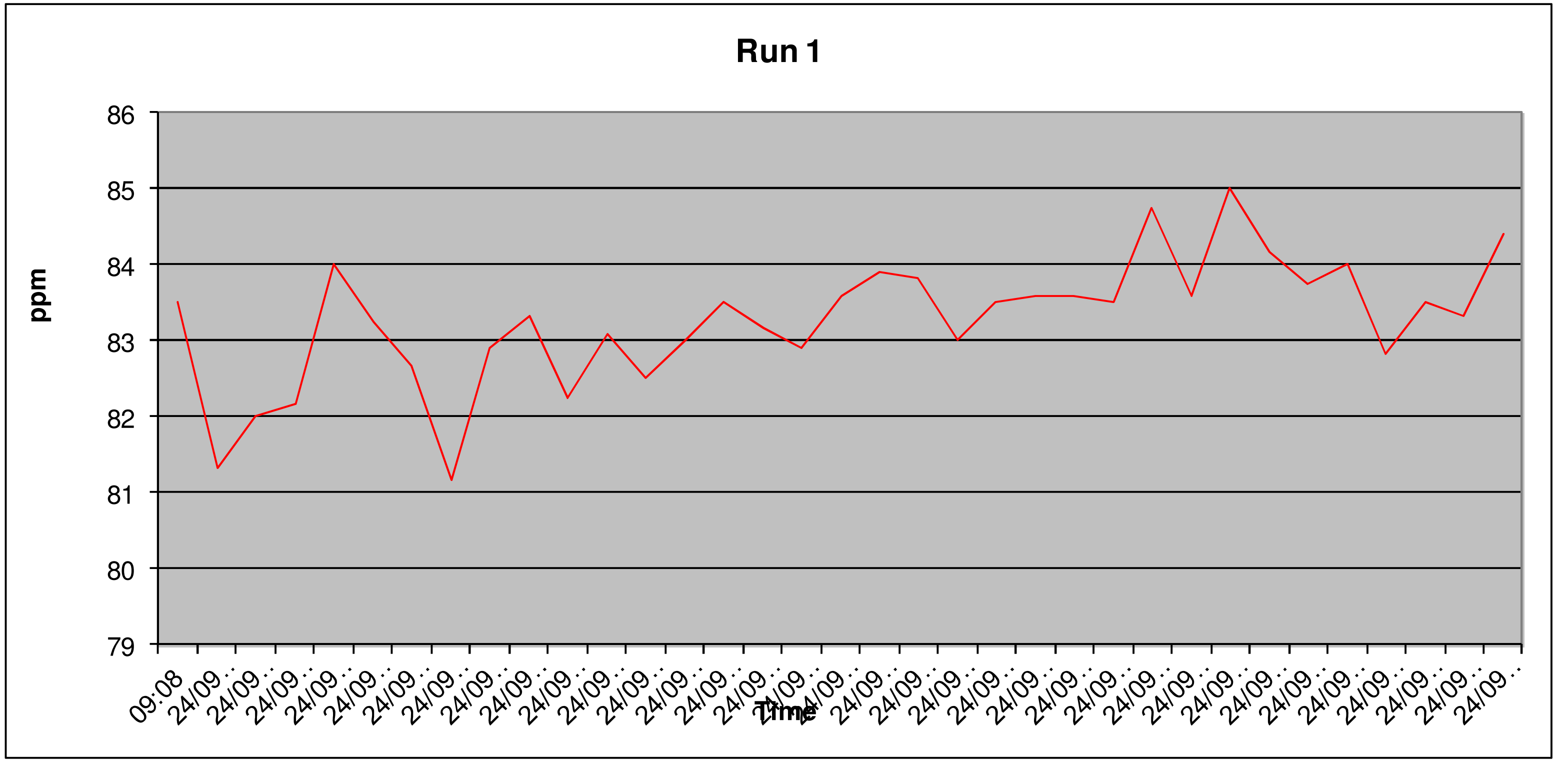
| Sampling Details | | |
|---|---|---|
| Stack ID | E1 | - |
| | **Units** | **Run 1** |
| *Parameter* | | |
| Sampling Times | - | 10:55 |
| Sampling Dates | - | 24/09/2015 |
| Instrument Range | ppm | 1000 |
| Span Gas Value | ppm | 501 |
| Acceptable Gas Range | - | Yes |
| | - | - |
| *Quality Assurance* | **Units** | **Run 1** |
| Conditioning Unit Temperature | C | 2 |
| Average Temperature | < C | 2 |
| Allowable Temperature | - | 4 |
| Temperature Acceptable | - | Yes |
| Pump flow rate | l/min. | 0.4 |
| | - | - |
| *Zero Drift* | Units | **Run 1** |
| Zero Down Sampling Line (Pre) | ppm | 3.1 |
| Zero Down Sampling Line (Post) | ppm | 11.2 |
| Zero drift | ppm | 8.1 |
| Allowable Zero Drift | ppm | 25.6 |
| Zero Drift Acceptable | - | Yes |
| | - | - |
| *Span Drift* | Units | **Run 1** |
| Span Down Sampling Line (Pre) | ppm | 512 |
| Span Down Sampling Line (Post) | ppm | 521 |
| Span Drift | ppm | 9 |
| Allowable Span Drift | ppm | 25 |
| Span Drift Acceptable (Y/N) | - | Yes |
| | - | - |
| *Leak Check* | | |
| Span Gas Conc. | ppm | 501 |
| Recorded Conc. down Line | ppm | 512 |
| Leak check acceptable (< 2%) | (Y/N) | Yes |
| | - | - |
| Test Conditions | **Units** | **Run 1** |
| Run Ambient Temperature Range | C | 10 |

**Sulphur Dioxide Results & Sampling details**

| Parameter | Units | Run 1 |
|---|---|---|
| Concentration | $mg.m^{-3}$ | 238.16 |
| Uncertainty | $mg.m^{-3}$ | 19.81 |
| Mass Emission | kg.h | 0.21 |

| **General Sampling Information** | |
|---|---|
| | |
| **Parameter** | **Value** |
| Standard | TGN 21 |
| Technical Procedure | 2012 |
| | |
| Probe material | SS |
| Filtration Type/Size | PTFE |
| Heated Head Filter Used | Yes |
| Heated Line Temperature | 190 |
| Date & Result of last converter check | - |
| | |
| Span Gas Reference Number | ASLTM15ING502 |
| Span Gas Expiry Date | Jan-16 |
| Span Gas Start Pressure (bar) | 10 |
| Gas Cylinder Concentration (ppm) | 501 |
| Span Gas Uncertainty (%) | <2 |
| Zero Gas Type | N |
| | |
| Number of Sampling Lines Used | 1 |
| Number of Sampling Points Used | 1 |
| Sample Point I.D's | E1 |
| | |
| **Reference Conditions** | |
| Temperature (K) | 273.15 |
| Pressure (kPa) | 101.3 |
| Gas (Wet or Dry) | Dry |
| Oxygen | 5 |

**Sulphur Dioxide Trend**



**Sulphur Dioxide Measurement Uncertainty**

| | **Units** | **Run 1** |
|---|---|---|
| Measured Quantities | | |
| Certified Range of Analyser | ppm | 2.14 to 1000 |
| Operational Range of Analyser | ppm | 1000 |
| Measured Reading | ppm | 83.27 |
| | | |
| Measured Quantities | **Units** | **Run 1** |
| Nonlinearity | % | 0.8 |
| Temperature Dependent Zero drift | % | 0.8 |
| Temperature Dependent Span drift | % | 2 |
| Cross-sensitivity | % | 1.5 |
| Leak | % | 0 |
| Calibration Gas Uncertainty | % | <2 % |
| | | |
| **Parameter** | **Units** | **Run 1** |
| Combined uncertainty | $mg.m^{-3}$ | 4.32 |
| Expanded uncertainty | $mg.m^{-3}$ | 8.64 |
| | | |
| **Uncertainty corrected to std conds.** | $mg.m^{-3}$ | 19.81 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of ELV | -- |
| **Expanded uncertainty expressed with a level of confidence of 95%** | $mg.m^{-3}$ | 19.81 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of value | 8.32 |
| | | |
| **Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions** | | |

## *Appendix D: Flare Stack Monitoring Results*

| | |
|---|---|
| **Report Title** | Air Emissions Compliance Monitoring Emissions Report |
| **Company address** | Air Scientific Ltd., 32 DeGranville Court, Dublin road, Trim, Co. Meath |
| **Stack Emissions Testing Report Commissioned by** | B9 Power |
| **Facility Name** | North Kerry Landfill Site, Muingnaminnane, Tralee, Co. Kerry |
| **Contact Person** | Ruth Baker |
| **EPA Licence Number** | W0001-03 |
| **Licence Holder** | North Kerry Landfill, F1 |
| **Stack Reference Number** | F1 |
| **Dates of the Monitoring Campaign** | 24/09/2015 |
| **Job Reference Number** | NOKETL1240915 / 2015379 |
| **Report Written By** | Dr. John Casey |
| **Report Approved by** | Dr. Brian Sheridan |
| **Stack Testing Team** | Dr. John Casey |
| **Report Date** | 12/10/2015 |
| **Report Type** | Test Report Compliance Monitoring |
| **Version** | 1 |
| **Signature of Approver** | Brian Sheridan<br>Technical Manager |

## Contents

# 1. Executive Summary

## *I. Monitoring Objectives*

**Overall Aim of the monitoring Campaign**

The aim of the monitoring campaign was to demonstrate compliance with a set of emission limit values as specified in the site licence.

**Special Requirements**

There were no special requirements.

**Target Parameters**

| |
|---|
| Carbon Monoxide (CO) |
| Oxides of Nitrogen (NOx) as $NO_2$ |
| Total Volatile Organic Carbon (TOC) |
| Sulphur Dioxide ($SO_2$) |
| Stack Gas Temperature |
| Volume ($m^3.h^{-1}$) |

**Emission Limit Values**

| Emission Limit Values / Mass Emissions Limit Values | $mg.m^{-3}$ | $kg.h^{-1}$ |
|---|---|---|
| CO | - | - |
| NOx as $NO_2$ | 150 | - |
| TOC | 10 | - |
| $SO_2$ | - | - |
| Stack Gas Temperature | - | - |
| Volume ($m^3.h^{-1}$) | 3,000 | - |

**Reference Conditions**

| Reference Conditions | Value |
|---|---|
| Oxygen Reference % | 3 |
| Temperature °C | 273.15 |
| Total Pressure kPa | 101.3 |
| Moisture % | Yes |

**Executive Summary**

**Overall Results**

| | Concentration | | | | |
|---|---|---|---|---|---|
| **Parameter** | **Units** | **Result** | **MU +/-** | **Limit** | **Compliant** |
| Carbon Monoxide (CO) | $mg.m^{-3}$ | -0.79 | 2.43 | - | N/A |
| Oxides of Nitrogen (NOx) as $NO_2$ | $mg.m^{-3}$ | 106.10 | 8.12 | 150 | Yes |
| Total Volatile Organic Carbon (VOC) | $mgC.m^{-3}$ | 3.44 | 0.60 | 10 | Yes |
| Sulphur Dioxide ($SO_2$) | $mg.m^{-3}$ | 17.06 | 7.38 | - | N/A |
| Oxygen (%) | % v/v | 6.71 | 0.14 | - | N/A |
| Stack Gas Temperature | K | 1278.15 | - | - | N/A |

**Accreditation details**

| | |
|---|---|
| Air Scientific Limited | INAB319T |
| External Analytical Laboratory | - |
| Other | - |

**Executive Summary**

**Monitoring Dates & Times**

| Parameter | Run | Location ID | Sampling Dates | Sampling Time On | Sampling Time Off | Duration (mins.) |
|---|---|---|---|---|---|---|
| Carbon Monoxide (CO) | Run 1 | F1 | 24/09/2015 | 10:56:00 | 11:28:00 | 00:32:00 |
| | Run 2 | | | | | |
| | Run 3 | | | | | |
| Oxides of Nitrogen (NOx) as $NO_2$ | Run 1 | F1 | 24/09/2015 | 10:56:00 | 11:28:00 | 00:32:00 |
| | Run 2 | | | | | |
| | Run 3 | | | | | |
| Total Volatile Organic Carbon (VOC) | Run 1 | F1 | 24/09/2015 | 10:56:23 | 11:28:23 | 00:32:00 |
| | Run 2 | | | | | |
| | Run 3 | | | | | |
| Sulphur Dioxide ($SO_2$) | Run 1 | F1 | 24/09/2015 | 10:56:00 | 11:28:00 | 00:32:00 |
| | Run 2 | | | | | |
| | Run 3 | | | | | |
| Oxygen (%) | | F1 | 24/09/2015 | 10:56:00 | 11:28:00 | 00:32:00 |

**Process details**

| Parameter | |
|---|---|
| **Process status** | Normal |
| **Capacity (per/hour) (if applicable)** | N/a |
| **Continuous or Batch Process** | Continuous |
| **Feedstock** | LFG |
| **Abatement System** | No |
| **Abatement Systems Running Status** | N/A |
| **Fuel** | LFG |
| **Plume Appearance** | Yes |
| **Other information** | None |

**Monitoring, Equipment & Analytical Methods**

| | Monitoring | | | | Analysis | |
|---|---|---|---|---|---|---|
| **Parameter** | **Standard** | **Technical Procedure** | **Accredited Testing** | **Testing Lab** | **Analytical Technique** | **Analysis Lab** |
| Carbon Monoxide (CO) | EN15058:2006 | SOP 2004 | Yes | AirSci | NCIR By Horiba PG-250 | AirSci |
| Oxides of Nitrogen (NOx) | EN14792:2006 | SOP 2002 | Yes | AirSci | Chemiluminescence | AirSci |
| Total Volatile Organic Carbon (TOC) | EN12619:2013 | SOP 2009 | Yes | AirSci | Flame Ionisation Detection | AirSci |
| Sulphur Dioxide (SO2) | TGN 21 | SOP 2012 | Yes | AirSci | NDIR Absorption | AirSci |
| Oxygen (%) | EN14789:2005 | SOP 2008 | Yes | AirSci | Paramagnetic | AirSci |
| Stack Gas Temperature | EN16911:2013 | SOP 2005 | No | AirSci | Thermocouple | AirSci |

**List of Equipment**

| ID | Item of Equipment | Manufacturer | Serial No. |
|---|---|---|---|
| ASLTM12EQ509 | 3010 MinfiFID | Signal Instruments | 16764 |
| ASLTM12EQ517 | Testo 400 Gas Pressure Vacumn and Flow | Testo | 00828828/305 |
| ASLTM13EQ504 | Horiba PG2500 Portable Flue Gas Analzer | Horiba | 41432840053 |
| ASLTM13EQ509 | 10 metre industrial heated sample line (Temp controller box 1 & 2) | Neptech | 13B088 |

**Sampling Deviations**

| Parameter | Deviation |
|---|---|
| **Standard ID** | Flow measurement not possible |
| **Standard ID** | EN12619 Uncertainty >10% of ELV |
| **Standard ID** | - |
| **Standard ID** | - |

**Reference Documents**

| | |
|---|---|
| Risk Assessment (RA) | SOP1011 |
| Site Review (SR) | SOP1015 |
| Site Specific Protocol (SSP) | SOP1015 |

**Executive Summary**

**Suitability of sampling location**

| General Information | Value |
|---|---|
| Permanent/Temporary | Temporary |
| Inside/ Outside | Outside |

| Platform Details | | |
|---|---|---|
| **Irish EPA Technical Guidance Note AG1 / BS EN 15259 Platform Requirements** | **Value** | **Comment** |
| Sufficient Working area to manipulate probe and measuring instruments | Yes | - |
| Platform has 2 handrails (approx. 0.5m & 1.0 m high) | Yes | - |
| Platform has vertical base boards (approx. 0.25 m high) | Yes | - |
| Platform has chains / self closing gates at top of ladders | Yes | - |
| There are no obstructions present which hamper insertion of sampling equipment | No | - |
| Safe Access Available | Yes | - |
| Easy Access Available | Yes | - |

| Sampling Location / Platform Improvement Recommendations |
|---|
| None |

| BSEN 15259 Homogeneity Test Requirements |
|---|
| 1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack |
| **E.g. Select Option**<br>**1: There is no requirement to perform a BSEN15259 Homogenity Test on this stack**<br>**2: Test results were obtained from previous Homogeneity test carried out by ASL**<br>**3: Test results were obtained from previous Homogeneity test carried out by Alternative contractor**<br>**4: Other: Enter Description** |

**Stack diagram**

2. 

## *II. Appendix I Monitoring Personnel & Equipment*

**Stack Emissions Monitoring Personnel**

| | | |
|---|---|---|
| **Team Leader** | **Name** | John Casey |
| | **Qualifications** | PhD. (Eng.), MSc. (Agr.), B. Agr. Sc. |
| | **System approval** | Air Scientific Limited Approved |
| | | - |

### *III. Appendix II Stack Details & flow characteristics*

**Preliminary stack survey calculations**

| **General Stack Details** | | |
|---|---|---|
| **Stack details** | **Units** | **Value** |
| Date of survey | | 24/09/2015 |
| Time of survey | | 11:00 |
| Type | | Circular |
| Stack Diameter / Depth, D | m | - |
| Stack Width, W | m | - |
| Average Stack Gas Temp., Ta | C | 1005 |
| Average Static Pressure, P static | kPa | - |
| Average Barometric Pressure, Pb | kPa | - |
| Type of Pitot | | - |
| Are Water Droplets Present ? | | - |
| Average Pitot Tube Calibration Coeff, Cp | | - |
| Negative flow | | - |
| Highly homogeneous flow stream/gas velocity | | Yes |

| | | |
|---|---|---|
| Sample Port Size | mm | 25 |
| Initial Pitot Leak Check | Pa | - |
| Final Pitot Leak Check | Pa | - |
| Orientation of Duct | | Vertical |
| Pitot Tube Cp | | 0.998 |
| Number of Lines Available | | 1 |
| Number of Lines Used | | 1 |

| **Sampling Line A** | | | | | | |
|---|---|---|---|---|---|---|
| **Point** | **Distance to duct (m)** | **Pa** | **Temp °C** | **Velocity (m/s)** | **Oxygen (%)** | **Angle of Swirl** |
| 1 | - | - | - | - | - | - |
| 2 | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - |
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |
| 8 | - | - | - | - | - | - |
| 9 | - | - | - | - | - | - |
| 10 | - | - | - | - | - | - |
| Average | - | - | - | - | - | - |
| Min | - | - | - | - | - | - |
| Max | - | - | - | - | - | - |

| **Sampling Line B** | | | | | | |
|---|---|---|---|---|---|---|
| **Point** | **Distance to duct (m)** | **Pa** | **Temp °C** | **Velocity (m/s)** | **Oxygen (%)** | **Angle of Swirl** |
| 1 | - | - | - | - | - | - |
| 2 | - | - | - | - | - | - |
| 3 | - | - | - | - | - | - |
| 4 | - | - | - | - | - | - |
| 5 | - | - | - | - | - | - |
| 6 | - | - | - | - | - | - |
| 7 | - | - | - | - | - | - |
| 8 | - | - | - | - | - | - |
| 9 | - | - | - | - | - | - |
| 10 | - | - | - | - | - | - |
| Average | - | - | - | - | - | - |
| Min | - | - | - | - | - | - |
| Max | - | - | - | - | - | - |

| Component | Conc. ppm | Conc. Dry % v/v | Conc. Wet % v/v | Molar Mass |
|---|---|---|---|---|
| Carbon Dioxide $CO_2$ | - | 10.1 | - | 44.01 |
| Oxygen $O_2$ | - | 6.2 | - | 32 |
| Nitrogen $N_2$ | - | 83.7 | - | 28.1 |
| Moisture ($H_2O$) | - | - | 9.8 | 18.02 |

| Reference Conditions | Units | Numbers |
|---|---|---|
| Temperature | °C | 273.15 |
| Total Pressure | kPa | 101.3 |
| Moisture | % | - |
| Oxygen (Dry) | % | 3 |

| **Stack Gas Composition & Molecular Weights** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| **Component** | **Molar Mass M** | **Density Kg/m$^3$ p** | **Conc. Dry % v/v** | **Dry Volume Fraction r** | **Dry Conc. kg/m$^3$ pi** | **Conc. wet % v/v** | **Wet Volume Fraction r** | **Wet Conc.kg/m$^3$ pi** |
| Carbon Dioxide $CO_2$ | 44.01 | 1.96 | 10.1 | 0.101 | 0.20 | 9.11 | 0.09 | 0.18 |
| Oxygen $O_2$ | 32 | 1.43 | 6.2 | 0.062 | 0.09 | 5.59 | 0.06 | 0.08 |
| Nitrogen $N_2$ | 28.1 | 1.25 | 83.7 | 0.837 | 1.05 | 75.50 | 0.75 | 0.95 |
| Moisture ($H_2O$) | 18.02 | 0.80 | - | - | - | 9.8 | 0.10 | 0.08 |
| | - | - | - | - | - | - | - | - |
| where p=M/22.41 | - | - | - | - | - | - | - | - |
| pi = r x p | - | - | - | - | - | - | - | - |

| **Calculation of Stack Gas Densities** | | |
|---|---|---|
| | | |
| **Determinand** | **Units** | **Result** |
| Dry Density (STP), P STD | $kg.m^{-3}$ | 1.336 |
| Wet Density (STP), P STW | $kg.m^{-3}$ | 1.289 |
| Dry Density (Actual), P Actual | $kg.m^{-3}$ | - |
| Average wet Density (Actual), P ActualW | $kg.m^{-3}$ | - |
| | | |
| | | |
| **Where** | | |
| P STD = sum of component concentrations, kg/m3 (excluding water vapour) | - | - |
| P STW = (P STD + pi of H2O) / ( 1 + (pi of H2O / 0.8036)) | - | - |
| P actual = P STD x (T STP / (P STP)) x (Pa / Ta) | - | - |
| P actual W (at each sampling point) = P STW x (Ts / Ps) x (Pa / Ta) | - | - |

| Sampling Plane Validation Criteria | Value | Units | Requirement | Compliance | Method |
|---|---|---|---|---|---|
| Lowest Differential Pressure | - | Pa | >5 Pa | N/A | EN16911:2013 |
| Lowest Gas Velocity | - | m/s | - | N/A | - |
| Highest Gas Velocity | - | m/s | - | N/A | - |
| Ratio of Above | - | :1 | <3:1 | N/A | EN16911:2013 |
| Mean Velocity | - | m/s | - | N/A | - |
| Angle of flow with regard to duct axis | - | degrees | < 15 | N/A | EN16911:2013 |
| No local negative flow | - | - | - | N/A | - |
| Homogeneous flow stream/gas velocity | - | - | - | N/A | - |

| | |
|---|---|
| **Calculation of stack Gas Velocity, V** | |
| Velocity at Traverse Point, V = Kcp * Sqroot ((2 * DP ) / Density) | - |
| | |
| **Where** | |
| Kpt = Pitot tube calibration coefficient | - |
| Compressibility correction factor, assumed at a constant 0.998 | 0.998 |

| Gas Volumetric Flowrate | Units | Result |
|---|---|---|
| Gas Volumetric Flow Rate (Actual) | $m^3.h^{-1}$ | - |
| Gas Volumetric Flow Rate (STP, Wet) | $m^3. h^{-1}$ | - |
| Gas Volumetric Flowrate (STP, Dry) | $m^3. h^{-1}$ | - |
| Gas Volumetric Flowrate REF to Oxygen | $m^3. h^{-1}$ | - |

***IV. Appendix 3 Individual parameter sampling details and results***

**Carbon Monoxide Quality Assurance**

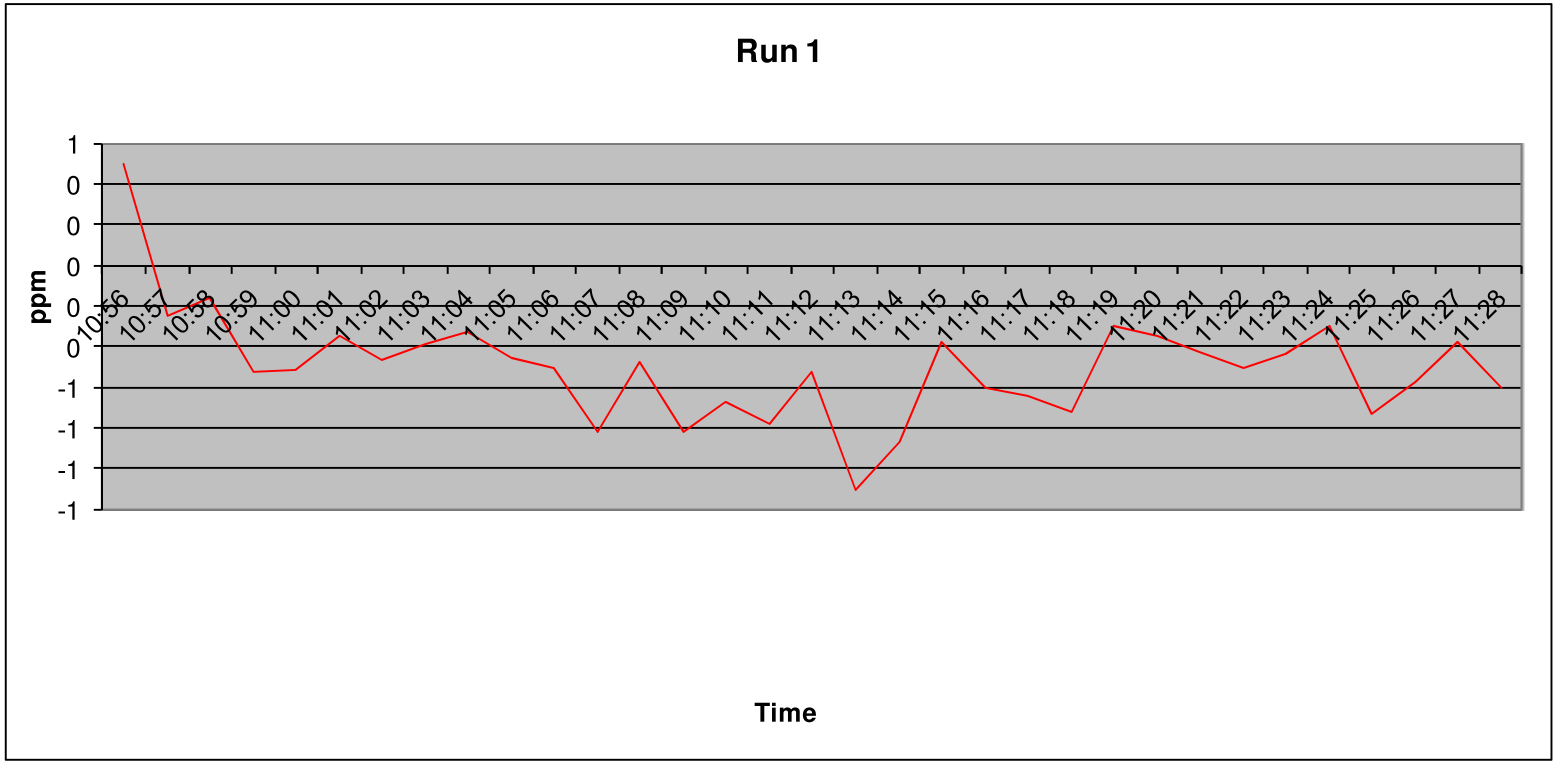
| **Sampling Details** | | |
|---|---|---|
| **Stack ID** | F1 | - |
| | **Units** | **Run 1** |
| ***Parameter*** | | |
| **Sampling Times** | - | 10:55 |
| **Sampling Dates** | - | 24/01/2015 |
| **Instrument Range** | ppm | 200 |
| **Span Gas Value** | ppm | 151 |
| **Acceptable Gas Range** | - | Yes |
| | | |
| ***Quality Assurance*** | **Units** | **Run 1** |
| **Conditioning Unit Temperature** | C | 2 |
| **Average Temperature** | < C | 2 |
| **Allowable Temperature** | - | 4 |
| **Temperature Acceptable** | - | Yes |
| **Pump flow rate** | l/min. | 0.4 |
| | | |
| ***Zero Drift*** | Units | **Run 1** |
| **Zero Down Sampling Line (Pre)** | ppm | 0.1 |
| **Zero Down Sampling Line (Post)** | ppm | 0.3 |
| **Zero drift** | ppm | 0.2 |
| **Allowable Zero Drift** | ppm | 3 |
| **Zero Drift Acceptable** | - | Yes |
| | | |
| ***Span Drift*** | Units | **Run 1** |
| **Span Down Sampling Line (Pre)** | ppm | 151 |
| **Span Down Sampling Line (Post)** | ppm | 151.8 |
| **Span Drift** | ppm | 0.8 |
| **Allowable Span Drift** | ppm | 3 |
| **Span Drift Acceptable (Y/N)** | - | Yes |
| | | |
| ***Leak Check*** | | |
| **Span Gas Conc.** | ppm | 151 |
| **Recorded Conc. down Line** | ppm | 151 |
| **Leak check acceptable (< 2%)** | (Y/N) | Yes |
| | | |
| **Test Conditions** | **Units** | **Run 1** |
| **Run Ambient Temperature Range** | C | 10 |

**Carbon Monoxide Results & Sampling details**

| Parameter | Units | Run 1 |
|---|---|---|
| Concentration | $mg.m^{-3}$ | -0.63 |
| Uncertainty | $mg.m^{-3}$ | 2.43 |
| Mass Emission | kg.h | -- |

| General Sampling Information | |
|---|---|
| | |
| **Parameter** | **Value** |
| Standard | EN15058 |
| Technical Procedure | SOP2004 |
| | |
| Probe material | SS |
| Filtration Type/Size | PTFE |
| Heated Head Filter Used | Yes |
| Heated Line Temperature | 190 |
| | |
| Span Gas Reference Number | ASLTM15ING509 |
| Span Gas Expiry Date | Nov-17 |
| Span Gas Start Pressure (bar) | 30 |
| Gas Cylinder Concentration (ppm) | 151 |
| Span Gas Uncertainty (%) | <2 |
| Zero Gas Type | Nitrogen |
| | |
| Number of Sampling Lines Used | 1 |
| Number of Sampling Points Used | 1 |
| Sample Point I.D's | F1 |
| | |
| **Reference Conditions** | |
| Temperature (K) | 273.15 |
| Pressure (kPa) | 101.3 |
| Gas (Wet or Dry) | Dry |
| Oxygen | 3 |

**Carbon Monoxide Trend**



**Carbon Monoxide Measurement Uncertainty**

| | **Units** | **Run 1** |
|---|---|---|
| Measured Quantities | | |
| Certified Range of Analyser | ppm | 1.36 to 1000 |
| Operational Range of Analyser | ppm | 200 |
| Measured Reading | ppm | -0.50 |
| | | |
| Measured Quantities | **Units** | **Run 1** |
| Nonlinearity | % | 0.9 |
| Temperature Dependent Zero drift | % | 0.14 |
| Temperature Dependent Span drift | % | -0.12 |
| Cross-sensitivity | % | 0.08 |
| Leak | % | 0 |
| Calibration Gas Uncertainty | % | <2 |
| | | |
| **Parameter** | **Units** | **Run 1** |
| Combined uncertainty | $mg.m^{-3}$ | 0.96 |
| Expanded uncertainty | $mg.m^{-3}$ | 1.92 |
| | | |
| **Uncertainty corrected to std conds.** | $mg.m^{-3}$ | 2.43 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of ELV | -- |
| **Expanded uncertainty expressed with a level of confidence of 95%** | $mg.m^{-3}$ | 2.43 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of value | -- |
| | | |
| **Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions** | | |

**Oxides of Nitrogen Quality Assurance**

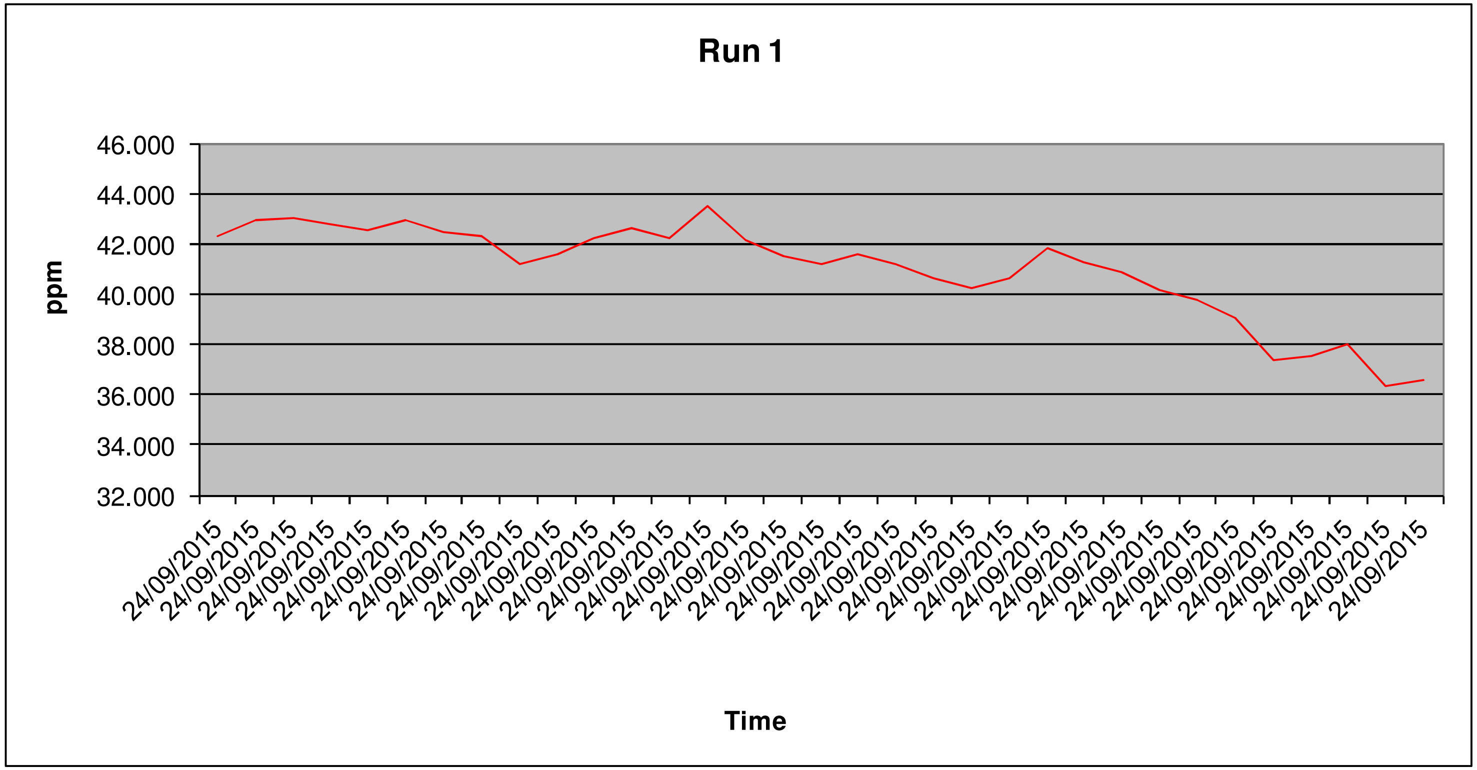
| **Sampling Details** | | |
|---|---|---|
| **Stack ID** | F1 | - |
| | **Units** | **Run 1** |
| ***Parameter*** | | |
| **Sampling Times** | - | 10:55 |
| **Sampling Dates** | - | 24/09/2015 |
| **Instrument Range** | ppm | 250 |
| **Span Gas Value** | ppm | 159 |
| **Acceptable Gas Range** | - | Yes |
| | | |
| ***Quality Assurance*** | **Units** | **Run 1** |
| **Conditioning Unit Temperature** | C | 2 |
| **Average Temperature** | < C | 2 |
| **Allowable Temperature** | - | 4 |
| **Temperature Acceptable** | - | Yes |
| **Pump flow rate** | l/min. | 0.4 |
| | | |
| ***Zero Drift*** | Units | **Run 1** |
| **Zero Down Sampling Line (Pre)** | ppm | 0.1 |
| **Zero Down Sampling Line (Post)** | ppm | 0.4 |
| **Zero drift** | ppm | 0.3 |
| **Allowable Zero Drift** | ppm | 3.1 |
| **Zero Drift Acceptable** | - | Yes |
| | | |
| ***Span Drift*** | Units | **Run 1** |
| **Span Down Sampling Line (Pre)** | ppm | 159.3 |
| **Span Down Sampling Line (Post)** | ppm | 159.1 |
| **Span Drift** | ppm | 0.2 |
| **Allowable Span Drift** | ppm | 3.1 |
| **Span Drift Acceptable (Y/N)** | - | Yes |
| | | |
| ***Leak Check*** | | |
| **Span Gas Conc.** | ppm | 159 |
| **Recorded Conc. down Line** | ppm | 159.3 |
| **Leak check acceptable (< 2%)** | (Y/N) | Yes |
| | | |
| **Test Conditions** | **Units** | **Run 1** |
| **Run Ambient Temperature Range** | C | 10 |
| **NOx Converter Efficiency** | % | 95.7 |

**Oxides of Nitrogen Results & Sampling details**

| Parameter | Units | Run 1 |
|---|---|---|
| Concentration | $mg.m^{-3}$ | 84.13 |
| Uncertainty | $mg.m^{-3}$ | 8.12 |
| Mass Emission | $kg.h^{-1}$ | -- |

| General Sampling Information | |
|---|---|
| | |
| **Parameter** | **Value** |
| Standard | EN14792 |
| Technical Procedure | SOP2002 |
| | |
| Probe material | SS |
| Filtration Type/Size | PTFE |
| Heated Head Filter Used | Yes |
| Heated Line Temperature | 190 |
| Date & Result of last converter check | 95.7 04/12/2014 |
| | |
| Span Gas Reference Number | ASLTM15ING517 |
| Span Gas Expiry Date | Nov-15 |
| Span Gas Start Pressure (bar) | 40 |
| Gas Cylinder Concentration (ppm) | 159 |
| Span Gas Uncertainty (%) | <2 |
| Zero Gas Type | Nitrogen |
| | |
| Number of Sampling Lines Used | 1 |
| Number of Sampling Points Used | 1 |
| Sample Point I.D's | F1 |
| | |
| Reference Conditions | |
| Temperature (K) | 273.15 |
| Pressure (kPa) | 101.3 |
| Gas (Wet or Dry) | Dry |
| Oxygen | 3 |

**Oxides of Nitrogen Trend**



**Oxides of Nitrogen Measurement Uncertainty**

| | | |
|---|---|---|
| Measured Quantities | **Units** | **Run 1** |
| Nonlinearity | % | 1.4 |
| Temperature Dependent Zero drift | % | -0.04 |
| Temperature Dependent Span drift | % | -0.25 |
| Cross-sensitivity | % | 0.5 |
| Leak | % | 0 |
| Calibration Gas Uncertainty | % | <2 |
| Mass Flow Controllers (Dilution) Uncertainty | % | <1 |
| NOx Converter Efficiency | % | 95.7 |
| | | |
| **Parameter** | **Units** | **Run 1** |
| Combined uncertainty | $mg.m^{-3}$ | 2.45 |
| Expanded uncertainty | $mg.m^{-3}$ | 4.90 |
| | | |
| **Uncertainty corrected to std conds.** | $mg.m^{-3}$ | 8.12 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of ELV | 5.42 |
| **Expanded uncertainty expressed with a level of confidence of 95%** | $mg.m^{-3}$ | 8.12 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of value | 9.66 |
| | | |
| | | |
| **Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions** | | |

**Total Volatile Organic Carbon Quality Assurance**

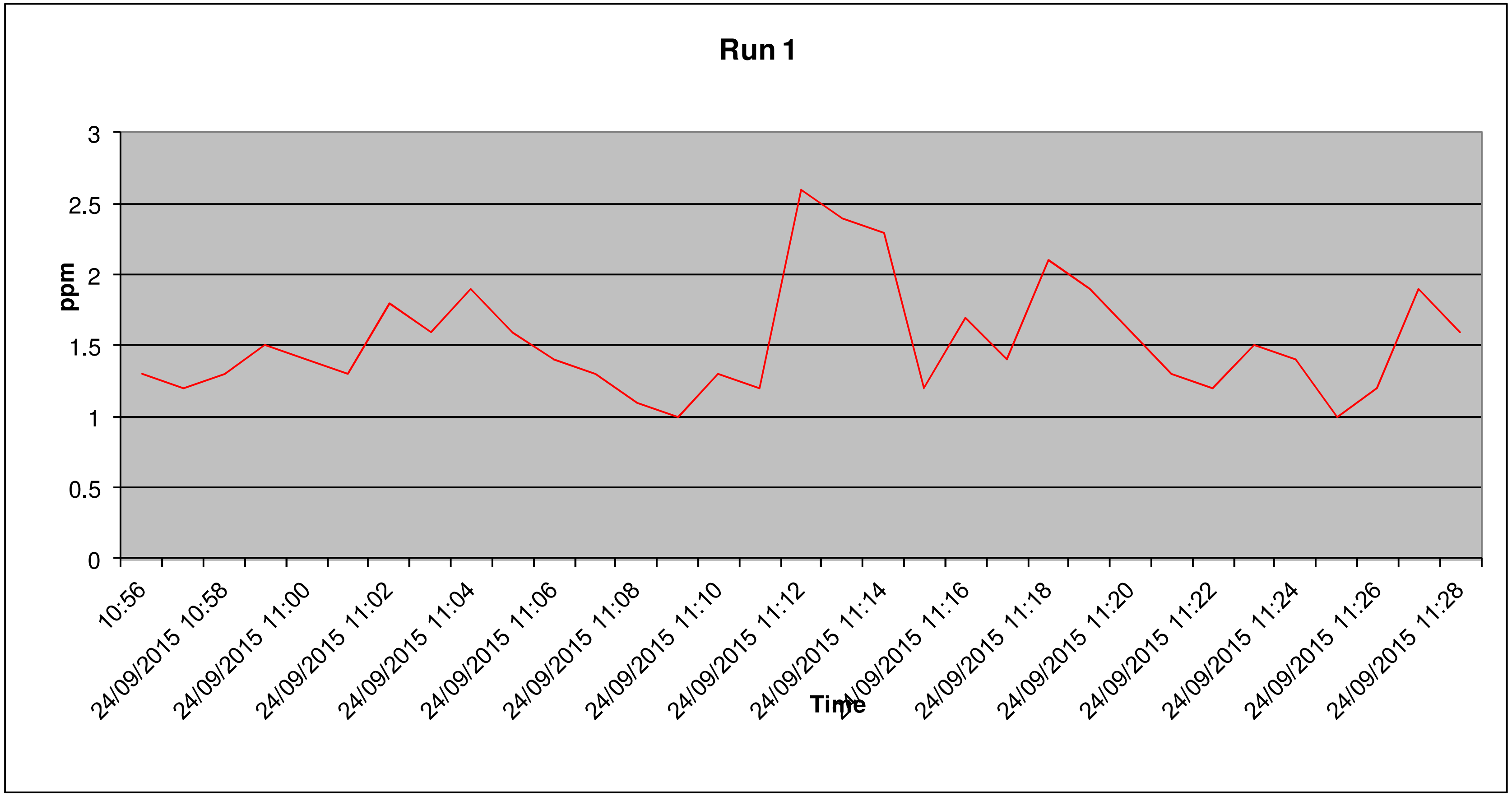
| **Sampling Details** | | |
|---|---|---|
| **Stack ID** | F1 | - |
| | **Units** | **Run 1** |
| ***Parameter*** | | |
| **Sampling Times** | - | 10:56 |
| **Sampling Dates** | - | 24/09/2015 |
| **Instrument Range** | ppm | 100 |
| **Span Gas Value** | ppm | 81 |
| **Acceptable Gas Range** | - | Yes |
| | | |
| ***Quality Assurance*** | **Units** | **Run 1** |
| **Oven Temperature** | C | 190 |
| **Average Temperature** | < C | - |
| **Temperature Acceptable** | - | Yes |
| **Sample line temperature** | C | 190 |
| | | |
| ***Zero Drift*** | Units | **Run 1** |
| **Zero Down Sampling Line (Pre)** | ppm | 0.1 |
| **Zero Down Sampling Line (Post)** | ppm | 0.3 |
| **Zero drift** | ppm | 0.2 |
| **Allowable Zero Drift** | ppm | 1.6 |
| **Zero Drift Acceptable** | - | Yes |
| | | |
| ***Span Drift*** | Units | **Run 1** |
| **Span Down Sampling Line (Pre)** | ppm | 81.1 |
| **Span Down Sampling Line (Post)** | ppm | 81.8 |
| **Span Drift** | ppm | 0.7 |
| **Allowable Span Drift** | ppm | 1.6 |
| **Span Drift Acceptable (Y/N)** | - | Yes |
| | | |
| ***Leak Check*** | | |
| **Span Gas Conc.** | ppm | 81 |
| **Recorded Conc. down Line** | ppm | 81.1 |
| **Leak check acceptable (< 2%)** | (Y/N) | Yes |

**Total Volatile Organic Carbon Results and Sampling Details**

| Parameter | Units | Run 1 |
|---|---|---|
| Concentration | $mgC.m^{-3}$ | 2.73 |
| Uncertainty | $mgC.m^{-3}$ | 0.60 |
| Mass Emission | $kg.h^{-1}$ | -- |

| **General Sampling Information** | |
|---|---|
| | |
| **Parameter** | **Value** |
| Standard | EN12619 |
| Technical Procedure | SOP2009 |
| | |
| Probe material | SS |
| Filtration Type/Size | PTFE |
| Heated Head Filter Used | Yes |
| Heated Line Temperature | 190 |
| | |
| Span Gas Reference Number | ASLTM15ING513 |
| Span Gas Expiry Date | 01/11/2017 |
| Span Gas Start Pressure (bar) | 50 |
| Gas Cylinder Concentration (ppm) | 81 |
| Span Gas Uncertainty (%) | <2 |
| Zero Gas Type | Ambient |
| | |
| Number of Sampling Lines Used | 1 |
| Number of Sampling Points Used | 1 |
| Sample Point I.D's | F1 |
| | |
| Reference Conditions | - |
| Temperature (K) | 273.15 |
| Pressure (kPa) | 101.3 |
| Gas (Wet or Dry) | Dry |
| Oxygen | 3 |

**Total Volatile Organic Carbon Trend**



**Total Volatile Organic Carbon Measurement Uncertainty**

| | **Units** | **Run 1** |
|---|---|---|
| **Measured Quantities** | | |
| Certified Range of Analyser | ppm | 0.5 to 1000 |
| Operational Range of Analyser | ppm | 100 |
| Measured Reading | ppm | 1.53 |
| | | |
| **Measured Quantities** | Units | **Run 1** |
| Nonlinearity | % | 0.068 |
| Temperature Dependent Zero drift | % | 0.3 |
| Temperature Dependent Span drift | % | 0.3 |
| Cross-sensitivity | % | - |
| Leak | % | <2 |
| Calibration Gas uncertainty | % | <2 |
| | | |
| **Parameter** | Units | **Run 1** |
| Combined uncertainty | $mg.m^{-3}$ | 0.3 |
| Expanded uncertainty | $mg.m^{-3}$ | 0.6 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of ELV | 10.92 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of value | 21.85 |
| **Expanded uncertainty expressed with a level of confidence of 95%** | $mg.m^{-3}$ | 0.60 |
| | | |
| | | - |
| | | |
| **Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions** | | |

**Sulphur Dioxide Quality Assurance**

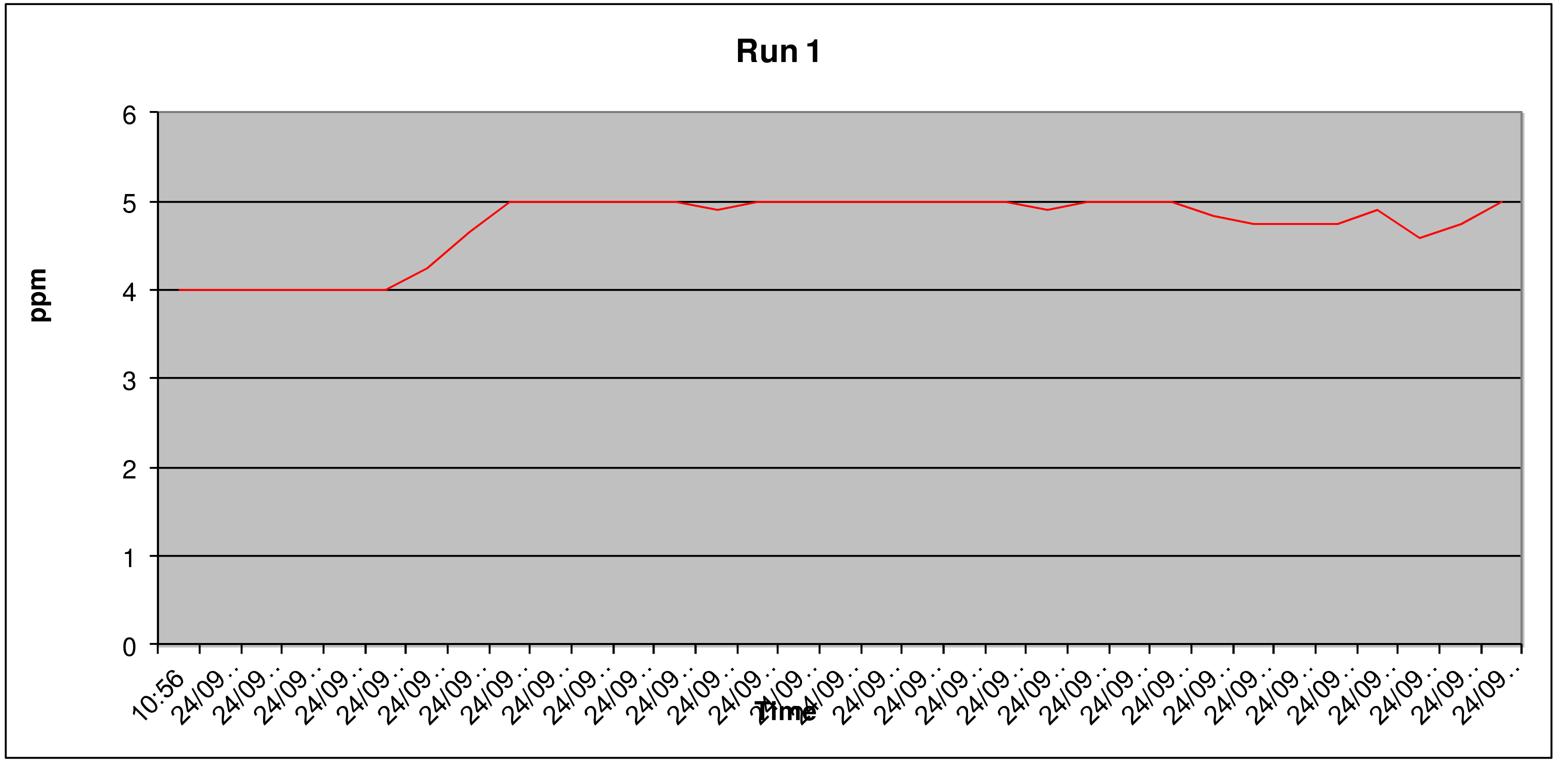
| Sampling Details | | |
|---|---|---|
| **Stack ID** | F1 | - |
| | **Units** | **Run 1** |
| ***Parameter*** | | |
| **Sampling Times** | - | 10:55 |
| **Sampling Dates** | - | 24/09/2015 |
| **Instrument Range** | ppm | 1000 |
| **Span Gas Value** | ppm | 501 |
| **Acceptable Gas Range** | - | Yes |
| | - | - |
| ***Quality Assurance*** | **Units** | **Run 1** |
| **Conditioning Unit Temperature** | C | 2 |
| **Average Temperature** | < C | 2 |
| **Allowable Temperature** | - | 4 |
| **Temperature Acceptable** | - | Yes |
| **Pump flow rate** | l/min. | 0.4 |
| | - | - |
| ***Zero Drift*** | Units | **Run 1** |
| **Zero Down Sampling Line (Pre)** | ppm | 1.8 |
| **Zero Down Sampling Line (Post)** | ppm | 4 |
| **Zero drift** | ppm | 2.9 |
| **Allowable Zero Drift** | ppm | 25 |
| **Zero Drift Acceptable** | - | Yes |
| | - | - |
| ***Span Drift*** | Units | **Run 1** |
| **Span Down Sampling Line (Pre)** | ppm | 508 |
| **Span Down Sampling Line (Post)** | ppm | 523 |
| **Span Drift** | ppm | 15 |
| **Allowable Span Drift** | ppm | 25 |
| **Span Drift Acceptable (Y/N)** | - | Yes |
| | - | - |
| ***Leak Check*** | | |
| **Span Gas Conc.** | ppm | 501 |
| **Recorded Conc. down Line** | ppm | 508 |
| **Leak check acceptable (< 2%)** | (Y/N) | Yes |
| | - | - |
| **Test Conditions** | **Units** | **Run 1** |
| **Run Ambient Temperature Range** | C | 10 |

**Sulphur Dioxide Results & Sampling details**

| Parameter | Units | Run 1 |
|---|---|---|
| Concentration | $mg.m^{-3}$ | 13.53 |
| Uncertainty | $mg.m^{-3}$ | 7.38 |
| Mass Emission | kg.h | -- |

| **General Sampling Information** | |
|---|---|
| | |
| **Parameter** | **Value** |
| Standard | TGN 21 |
| Technical Procedure | 2012 |
| | |
| Probe material | SS |
| Filtration Type/Size | PTFE |
| Heated Head Filter Used | Yes |
| Heated Line Temperature | 190 |
| Date & Result of last converter check | - |
| | |
| Span Gas Reference Number | ASLTM15ING502 |
| Span Gas Expiry Date | Jan-16 |
| Span Gas Start Pressure (bar) | 10 |
| Gas Cylinder Concentration (ppm) | 501 |
| Span Gas Uncertainty (%) | <2 |
| Zero Gas Type | N |
| | |
| Number of Sampling Lines Used | 1 |
| Number of Sampling Points Used | 1 |
| Sample Point I.D's | F1 |
| | |
| **Reference Conditions** | |
| Temperature (K) | 273.15 |
| Pressure (kPa) | 101.3 |
| Gas (Wet or Dry) | Dry |
| Oxygen | 3 |

**Sulphur Dioxide Trend**



**Sulphur Dioxide Measurement Uncertainty**

| | **Units** | **Run 1** |
|---|---|---|
| Measured Quantities | | |
| Certified Range of Analyser | ppm | 2.14 to 1000 |
| Operational Range of Analyser | ppm | 500 |
| Measured Reading | ppm | 4.73 |
| | | |
| Measured Quantities | **Units** | **Run 1** |
| Nonlinearity | % | 0.8 |
| Temperature Dependent Zero drift | % | 0.8 |
| Temperature Dependent Span drift | % | 2 |
| Cross-sensitivity | % | 1.5 |
| Leak | % | 0 |
| Calibration Gas Uncertainty | % | <2 % |
| | | |
| **Parameter** | **Units** | **Run 1** |
| Combined uncertainty | $mg.m^{-3}$ | 2.89 |
| Expanded uncertainty | $mg.m^{-3}$ | 5.77 |
| | | |
| **Uncertainty corrected to std conds.** | $mg.m^{-3}$ | 7.38 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of ELV | -- |
| **Expanded uncertainty expressed with a level of confidence of 95%** | $mg.m^{-3}$ | 7.38 |
| | | |
| **Expanded uncertainty expressed with a level of confidence of 95%** | % of value | 54.54 |
| | | |
| **Requirement in standard is for uncertainty to be < 10% at ELV at standard conditions** | | |

# *Appendix E: Monthly Balancing Records – Gas field*

# NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model Serial No GM09053
Date: 30/01/2015
Weather: Dry/cold 1001mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 56 | 27 | 2.9 | 13.5 | 2 | -3 | 5% | |
| | 1.4 | 62 | 25.7 | 2 | 5 | 0 | -4 | 5% | |
| | | | | | | | | | |
| Cells 2 | 2.1 | 38 | 24 | 1.4 | 36 | 0 | -8 | 5% | |
| | 2.2 | 14.5 | 7 | 16 | 62 | 0 | -4 | 2% | |
| | 2.3 | 39.6 | 21.2 | 1.5 | 37 | 0 | -5 | 2% | |
| | | | | | | | | | |
| Cells 3 | 3.2 | 51.4 | 26 | 1.3 | 22 | 0 | -12 | 20% | |
| | 3.3 | | | | | | | | |
| | 3.4 | 43.2 | 22.3 | 0.8 | 35 | 0 | -14 | 30% | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 62 | 28 | 1.6 | 8 | 2 | -12 | 80% | |
| | 4.3 | 52 | 27 | 0.6 | 20 | 0 | -16 | 20% | |
| | 4.4 | 51 | 26 | 1.6 | 21 | 0 | -9 | 5% | |
| | | | | | | | | | |
| Cells 5 | 5.1 | 65 | 31 | 1.4 | 2 | 2 | -13 | 2% | |
| | 5.2 | 17 | 16 | 2.8 | 62 | 1 | -15 | 5% | |
| | 5.3 | 32 | 14 | 12 | 41 | 0 | -9 | 5% | |
| | 5.4 | 33 | 24 | 0.3 | 42 | 1 | -10 | 5% | |
| | | | | | | | | | |
| Cells 6 | 6.1 | 12 | 9 | 16 | 62 | 1 | -3 | 2% | |
| | 6.2 | 39 | 17 | 9 | 33 | 1 | -9 | 2% | |
| | 6.3 | 41 | 14 | 4 | 42 | 0 | 0 | 0% | |
| | 6.4 | 0.9 | 4 | 15 | 85 | 0 | 0 | 0% | |
| | | | | | | | | | |
| Cells 7 | 7.1 | 0.7 | 1.6 | 21 | 77 | 0 | 0 | 0% | |
| | 7.2 | 2 | 5 | 19 | 73 | 0 | 0 | 0% | |
| | 7.3 | 3 | 2 | 21 | 75 | 1 | 0 | 0% | |
| | 7.4 | 64 | 13 | 3 | 18 | 0 | 0 | 0% | |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | 64 | 32 | 0.9 | 2.8 | 0 | -8 | 20% | |
| | 8.2 | 60 | 31 | 0.5 | 3 | 1 | -16 | 10% | |
| | 8.3 | 53 | 31 | 0.5 | 20 | 1 | -15 | 5% | |
| | 8.4 | 0.7 | 1 | 21 | 77 | 0 | 0 | 0% | |
| | | | | | | | | | |
| Cells 9 | 9.1 | 20 | 7 | 2 | 71 | 0 | 0 | 0% | |
| | 9.2 | 45 | 25 | 0.3 | 28 | 0 | -26 | 20% | |
| | 9.3 | 12 | 5 | 3.8 | 79 | 0 | 0 | 0% | |
| | 9.4 | 20 | 4.6 | 16 | 60 | 1 | -1 | 2% | |
| | 9.6 | 0.6 | 2 | 17 | 79 | 0 | 0 | 0% | |
| | | | | | | | | | |
| Cells 10 | 10.2 | 40 | 20 | 0.4 | 40 | 1 | -8 | 5% | |
| | 10.3 | 15 | 5 | 18 | 63 | 1 | -2 | 2% | |
| | 10.4 | 39 | 23 | 0.4 | 38 | 1 | -4 | 5% | |
| | 10.5 | 55 | 26 | 0.3 | 19 | 1 | -29 | 10% | |
| | 10.6 | 35 | 16 | 2 | 47 | 0 | -2 | 2% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 54 | 31 | 0.5 | 15 | 3 | -22 | 20% | |
| | 2 | 11 | 5 | 17 | 67 | 2 | -1 | 1% | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 55 | 28 | 0.9 | 17 | 1 | -12 | 5% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 12 | 1 | 1 | 2 | 21 | 75 | 2 | -1 | 1% | |
| | 2 | 1.5 | 2 | 21 | 75 | 0 | -1 | 1% | |
| | 3 | 51 | 29 | 0.5 | 20 | 2 | -14 | 10% | |
| | 4 | 60 | 28 | 0.7 | 10 | 1 | -21 | 30% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 5 | 3 | 20 | 72 | 2 | -1 | 1% | |
| | 2 | 58 | 26 | 2.1 | 13 | 2 | -22 | 60% | |
| | 3 | 59 | 28 | 0.3 | 11 | 3 | -26 | 60% | |
| | 4 | 53 | 26 | 1.5 | 20 | 1 | -22 | 70% | |
| | 5 | 56 | 26 | 0.6 | 23 | 2 | -24 | 60% | |
| | 6 | 61 | 29 | 1.8 | 7 | 3 | -22 | 60% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 52 | 30 | 1 | 17 | 2 | -6 | 3% | |
| | 2 | 35 | 19 | 10 | 37 | 1 | -3 | 5% | |
| | 3 | 57 | 27 | 2 | 13 | 0 | -28 | 60% | |
| | 4 | 58 | 31 | 3 | 7 | 3 | -26 | 30% | |
| | 5 | 33 | 13 | 12 | 41 | 1 | -2 | 1% | |
| | 6 | 54 | 29 | 2 | 15 | 3 | -10 | 5% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 47 | 28 | 0.4 | 24 | 1 | -39 | 60% | |
| | 2 | 25 | 10 | 14 | 51 | 0 | -34 | 60% | |
| | 3 | 56 | 31 | 4 | 8 | 3 | -38 | 60% | |
| | 4 | 58 | 32 | 2.6 | 6 | 2 | -38 | 60% | |
| | 5 | 48 | 31 | 0.3 | 21 | 1 | -39 | 60% | |
| | 6 | 50 | 24 | 4 | 28 | 2 | -35 | 60% | |
| | 7 | 54 | 31 | 1.7 | 22 | 3 | -33 | 60% | |
| | 8 | 59 | 36 | 0.6 | 3 | 1 | -39 | 60% | |
| | 9 | 58 | 29 | 2.7 | 13 | 4 | -37 | 60% | |
| | 10 | 56 | 29 | 3 | 9 | 1 | -37 | 60% | |
| | 11 | 51 | 29 | 0.4 | 18 | 2 | -40 | 60% | |
| | 12 | 49 | 29 | 0.5 | 23 | 2 | -38 | 60% | |
| | | | | | | | | | |
| Cells 18 | 1 | 56 | 38 | 0.5 | 3 | 2 | -8 | 20% | |
| | 2 | 64 | 40 | 1.2 | 0 | 2 | -12 | 20% | |
| | 3 | 62 | 37 | 0.5 | 2 | 1 | -13 | 20% | |
| | 4 | 61 | 40 | 0.5 | 0 | 1 | -12 | 20% | |
| | 5 | 62 | 41 | 0.5 | 1 | 3 | -13 | 20% | |
| | | | | | | | | | |
| | | | | | | | | | |
| flare/Engine | Before | 48 | 30 | 1.6 | 20.4 | 3 | -42 | 100% | |
| Flare/Engine | After | 51 | 33 | 1.4 | 14.6 | 2 | -40 | 100% | |

# NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model | Serial No GM09053
Date: 27/02/2015
Weather: Overcast & showers 1003mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 33.6 | 12.5 | 9.2 | 44.7 | 0 | -4.87 | 2% | |
| | 1.4 | 68.7 | 21.4 | 0.4 | 9.5 | 1 | -4.71 | 5% | |
| | | | | | | | | | |
| Cells 2 | 2.1 | 16.7 | 16.8 | 1.4 | 65.1 | 1 | -0.64 | 2% | |
| | 2.2 | 0.1 | 2.7 | 18.3 | 78.9 | 0 | -0.21 | 1% | |
| | 2.3 | 9.7 | 11.5 | 7 | 71.8 | 0 | -2.41 | 2% | |
| | | | | | | | | | |
| Cells 3 | 3.2 | 24.9 | 17.8 | 0.8 | 56.5 | 1 | -5.63 | 10% | |
| | 3.3 | | | | | | | | |
| | 3.4 | 18.9 | 15.1 | 3.2 | 62.8 | 0 | -5.42 | 5% | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 30.2 | 21.2 | 1 | 47.6 | 1 | -23.91 | 20% | |
| | 4.3 | 67.5 | 28.5 | 0.2 | 3.8 | 1 | -0.4 | 1% | |
| | 4.4 | 24.2 | 17.2 | 0.9 | 57.7 | 0 | -5.37 | 5% | |
| | | | | | | | | | |
| Cells 5 | 5.1 | 68.2 | 27.5 | 1 | 3.3 | 1 | -28.74 | 60% | |
| | 5.2 | 13 | 15.2 | 4 | 67.8 | 1 | -0.38 | 1% | |
| | 5.3 | 0.2 | 2.2 | 20.3 | 77.3 | 0 | -0.25 | 1% | |
| | 5.4 | 65.4 | 21.6 | 0.8 | 12.2 | 1 | -1.4 | 2% | |
| | | | | | | | | | |
| Cells 6 | 6.1 | 0.2 | 6.5 | 13 | 80.3 | 0 | -0.42 | 1% | |
| | 6.2 | 36.4 | 15.6 | 7.3 | 40.7 | 1 | -8.6 | 2% | |
| | 6.3 | 57.2 | 9 | 6.6 | 27.2 | 1 | -11.5 | 2% | |
| | 6.4 | 0.9 | 5.5 | 17.7 | 75.9 | 1 | -0.29 | 1% | |
| | | | | | | | | | |
| Cells 7 | 7.1 | 0.8 | 3.9 | 20 | 75.3 | 0 | -6 | 2% | |
| | 7.2 | 4.8 | 2.1 | 18.8 | 74.3 | 0 | -0.26 | 0% | |
| | 7.3 | 0.2 | 2 | 20.5 | 77.3 | 1 | -1.77 | 2% | |
| | 7.4 | 34 | 3.7 | 8.8 | 53.5 | 0 | -0.97 | 1% | |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | 37 | 24.1 | 0.4 | 38.5 | 1 | -6.58 | 20% | |
| | 8.2 | 41.3 | 22.9 | 0.4 | 35.4 | 1 | -8.98 | 5% | |
| | 8.3 | 14.1 | 14 | 6.8 | 65.1 | 1 | -0.54 | 1% | |
| | 8.4 | 0.1 | 1.4 | 20.7 | 77.8 | 1 | -0.47 | 0% | |
| | | | | | | | | | |
| Cells 9 | 9.1 | 58.1 | 23.7 | 0.7 | 17.5 | 1 | -20.65 | 30% | |
| | 9.2 | 56.3 | 24 | 1 | 18.7 | 1 | -19.54 | 40% | |
| | 9.3 | 43.2 | 6.2 | 6.8 | 43.8 | 1 | -2.64 | 2% | |
| | 9.4 | 46.2 | 9.2 | 0.8 | 43.8 | 1 | -3.38 | 5% | |
| | 9.6 | 0.6 | 2 | 17 | 79 | 0 | 0 | 0% | |
| | | | | | | | | | |
| Cells 10 | 10.2 | 0.6 | 4.5 | 20.6 | 74.3 | 0 | -0.2 | 0% | |
| | 10.3 | 13.5 | 3.1 | 17.3 | 66.1 | 1 | -21.17 | 40% | |
| | 10.4 | 39 | 23 | 0.4 | 38 | 1 | -4 | 5% | |
| | 10.5 | 66.8 | 20.4 | 2.4 | 10.4 | 1 | -13.89 | 40% | |
| | 10.6 | 64.7 | 20.8 | 1.6 | 12.9 | 1 | -20.27 | 40% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 62.2 | 24 | 1.2 | 12.6 | 1 | 0.39 | 20% | |
| | 2 | 6.7 | 5.5 | 15.3 | 72.5 | 3 | -19.75 | 5% | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 30.6 | 20.8 | 1.1 | 47.5 | 1 | -4.18 | 20% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 12 | 1 | 0.7 | 6.9 | 19.1 | 73.3 | 1 | -0.22 | 2% | |
| | 2 | 0.4 | 1.9 | 20.4 | 77.3 | 1 | -0.37 | 1% | |
| | 3 | 65.8 | 22.2 | 1.4 | 10.6 | 1 | -3.92 | 5% | |
| | 4 | 13.2 | 15.7 | 2.8 | 68.3 | 1 | -9.26 | 20% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 56.5 | 19.1 | 4.3 | 20.11 | 1 | -21.86 | 20% | |
| | 2 | 64.9 | 21 | 0.9 | 13.2 | 1 | -24.03 | 20% | |
| | 3 | 69.5 | 19.7 | 1.5 | 9.3 | 1 | -21.19 | 90% | |
| | 4 | 67.7 | 22.9 | 0.7 | 8.7 | 2 | -23.13 | 80% | |
| | 5 | 16.9 | 13.3 | 1.3 | 68.5 | 4 | -21.8 | 20% | |
| | 6 | 64.9 | 23.1 | 0.7 | 11.3 | 1 | -24.28 | 60% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 8.3 | 4.8 | 17.8 | 69.1 | 0 | -6.13 | 2% | |
| | 2 | 25.6 | 12.6 | 11.1 | 50.7 | 1 | -15.8 | 5% | |
| | 3 | 40.6 | 18.1 | 6.7 | 34.6 | 1 | -22.22 | 20% | |
| | 4 | 42.4 | 21.2 | 5.5 | 30.9 | 2 | -21.43 | 30% | |
| | 5 | 0.1 | 1.6 | 21.1 | 77.2 | 1 | -1.19 | 1% | |
| | 6 | 35.5 | 17.8 | 7.8 | 38.9 | 2 | -22.12 | 5% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 68.2 | 27.5 | 1 | 3.3 | 1 | -28.74 | 60% | |
| | 2 | 23 | 12.3 | 12.6 | 52.1 | 1 | -26.79 | 60% | |
| | 3 | 54.2 | 28.9 | 3.4 | 13.5 | 0 | -27.41 | 60% | |
| | 4 | 62 | 27 | 1.5 | 9.5 | 3 | -6.62 | 60% | |
| | 5 | 66.7 | 27.2 | 1.4 | 4.7 | 1 | -28.71 | 60% | |
| | 6 | 34.1 | 15.9 | 9.3 | 40.7 | 0 | -21.45 | 60% | |
| | 7 | 57.3 | 26.8 | 1.2 | 14.7 | 5 | -7.74 | 60% | |
| | 8 | 64.1 | 29.5 | 1.4 | 5 | 1 | -25.63 | 60% | |
| | 9 | 61.7 | 26.9 | 1.6 | 9.8 | 3 | -7.67 | 60% | |
| | 10 | 51.7 | 24.5 | 4.9 | 18.9 | 1 | -27.86 | 60% | |
| | 11 | 68.5 | 26.7 | 0.2 | 4.6 | 1 | -26.95 | 60% | |
| | 12 | 60.1 | 26.4 | 0.4 | 13.1 | 0 | -28.58 | 60% | |
| | | | | | | | | | |
| Cells 17 | 1 | 58.1 | 36.5 | 1.2 | 4.2 | 1 | -22.53 | 30% | |
| | 2 | 58.1 | 33.3 | 1.7 | 6.9 | 1 | -20.6 | 30% | |
| | 3 | 58.4 | 34.9 | 1.7 | 5 | 1 | -21.77 | 30% | |
| | 4 | 58.4 | 34.6 | 1.6 | 5.4 | 2 | -22.62 | 30% | |
| | 5 | 57.8 | 36.1 | 1.3 | 4.8 | 2 | -21.45 | 30% | |
| | 6 | 57.7 | 35 | 1.5 | 5.8 | 3 | -21.87 | 30% | |
| | | | | | | | | | |
| Cells 18 | 1 | 58.3 | 35.5 | 1.4 | 4.8 | 0 | -15.44 | 20% | |
| | 2 | 57.9 | 36.4 | 1.3 | 4.4 | 1 | -20.65 | 20% | |
| | 3 | 57.9 | 36.5 | 1.2 | 4.4 | 7 | -20.47 | 20% | |
| | 4 | 54.5 | 34.7 | 2.2 | 8.6 | 1 | -11.26 | 20% | |
| | 5 | 58.3 | 35.3 | 1.5 | 4.9 | 0 | -20.92 | 20% | |
| | | | | | | | | | Total gas flow |
| Flare/Engine | Before | 43 | 28 | 2.6 | 26.4 | 0 | -28 | | 340m3/hr |
| Flare/Engine | After | 48 | 32 | 1.8 | 18.2 | 0 | -20 | | 310m3/hr |

**Comments:**

Gas flare and engine operating inconjunction with the increased suction applied is causing over extraction of the gas wells

# NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model Serial No GM09053
Date: 28/03/2015
Weather: Heavy rain 980mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 15.1 | 5.3 | 15 | 64.6 | 0 | -3 | 2% | |
| | 1.4 | 68.9 | 21 | 7 | 3.1 | 2 | -3.2 | 5% | |
| | | | | | | | | | |
| Cells 2 | 2.1 | 16.1 | 16.2 | 2.1 | 65.6 | 0 | -0.7 | 2% | |
| | 2.2 | 0.1 | 2.6 | 18.1 | 79.2 | 0 | -2 | 1% | |
| | 2.3 | 13 | 12 | 7 | 68 | 0 | -2.2 | 1% | |
| | | | | | | | | | |
| Cells 3 | 3.2 | 25.1 | 17.8 | 1 | 56.1 | 0 | -4 | 10% | |
| | 3.3 | | | | | | | | |
| | 3.4 | 18.4 | 15.2 | 3.1 | 63.4 | 0 | -5.2 | 5% | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 31 | 20.4 | 1 | 47.6 | 0 | -22 | 20% | |
| | 4.3 | 64.3 | 27.2 | 0.1 | 8.4 | 1 | -0.5 | 1% | |
| | 4.4 | 23.1 | 16.8 | 1.2 | 58.9 | 0 | -4.99 | 5% | |
| | | | | | | | | | |
| Cells 5 | 5.1 | 67.8 | 27.2 | 0.8 | 4.2 | 2 | -26.2 | 60% | |
| | 5.2 | 10.1 | 13.6 | 4 | 72.3 | 1 | -0.35 | 1% | |
| | 5.3 | 0 | 2.6 | 20.1 | 77.3 | 0 | -0.22 | 1% | |
| | 5.4 | 64.4 | 20.8 | 0.3 | 14.5 | 1 | -1.2 | 1% | |
| | | | | | | | | | |
| Cells 6 | 6.1 | 0.4 | 6.1 | 12 | 81.5 | 0 | -0.38 | 1% | |
| | 6.2 | 44 | 22.6 | 4.8 | 28.6 | 0 | -7.8 | 2% | |
| | 6.3 | 54.2 | 17 | 4.2 | 24.6 | 0 | -9.8 | 1% | |
| | 6.4 | 0.1 | 1.7 | 17 | 71.2 | 1 | -0.24 | 1% | |
| | | | | | | | | | |
| Cells 7 | 7.1 | 0.6 | 3.7 | 19.9 | 75.8 | 0 | -5 | 2% | |
| | 7.2 | 5.2 | 3 | 18.5 | 73.3 | 0 | -0.21 | 0% | |
| | 7.3 | 0.2 | 2 | 20.3 | 77.5 | 1 | -1.72 | 2% | |
| | 7.4 | 16 | 3 | 16.9 | 64.1 | 0 | -0.78 | 1% | |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | | | | | | | | |
| | 8.2 | | | | | | | | |
| | 8.3 | 31 | 27 | 2.4 | 39.6 | 0 | -0.27 | 1% | |
| | 8.4 | 0.1 | 0.1 | 20 | 79 | 0 | 0 | 0% | |
| | | | | | | | | | |
| Cells 9 | 9.1 | 62.3 | 24.8 | 0.4 | 12.5 | 1 | -18.2 | 25% | |
| | 9.2 | 55.8 | 31 | 0 | 13.2 | 1 | -19.9 | 45% | |
| | 9.3 | 22 | 8 | 12 | 58 | 0 | -2.9 | 2% | |
| | 9.4 | 37.5 | 20.6 | 0.3 | 41.6 | 0 | -2.98 | 5% | |
| | 9.6 | 0 | 0 | 21 | 79 | 0 | 0 | 0% | |
| | | | | | | | | | |
| Cells 10 | 10.2 | 16 | 8 | 12 | 64 | 0 | -0.3 | 0% | |
| | 10.3 | 65 | 35 | 0 | 0 | 0 | -15 | 30% | |
| | 10.4 | 37.8 | 21 | 0.3 | 40.9 | 1 | -1 | 3% | |
| | 10.5 | 64.8 | 19.6 | 2.2 | 13.4 | 1 | -15.7 | 40% | |
| | 10.6 | 64.3 | 20.4 | 1.2 | 14.1 | 0 | -18.76 | 40% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 72 | 31 | 1.3 | 0 | 1 | 0 | 20% | |
| | 2 | 11 | 6 | 16 | 66 | 4 | -16 | 5% | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 28 | 24 | 2.3 | 47 | 1 | -4.26 | 20% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 12 | 1 | 0 | 0 | 21 | 79 | 0 | -0.19 | 2% | |
| | 2 | 0.4 | 1.7 | 20.1 | 77.8 | 1 | -0.37 | 1% | |
| | 3 | 63 | 22.1 | 0.8 | 14.1 | 1 | -2.7 | 5% | |
| | 4 | 12.7 | 14.4 | 1.6 | 71.3 | 1 | -8.76 | 20% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 54.3 | 18.2 | 4.1 | 23.4 | 1 | -19.21 | 20% | |
| | 2 | 64.7 | 21 | 0.9 | 13.4 | 1 | -20.03 | 20% | |
| | 3 | 67.5 | 19.4 | 1.2 | 11.9 | 1 | -20.79 | 90% | |
| | 4 | 67.6 | 22.4 | 0.4 | 9.6 | 1 | -23.07 | 80% | |
| | 5 | 16.9 | 13.1 | 1.1 | 68.9 | 3 | -21.65 | 20% | |
| | 6 | 60.1 | 18 | 0.3 | 21.6 | 1 | -24.2 | 60% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 7.9 | 3.6 | 17.4 | 71.1 | 0 | -5.89 | 2% | |
| | 2 | 25.6 | 12.3 | 11.1 | 51 | 1 | -15.4 | 5% | |
| | 3 | 40.4 | 17.5 | 6.3 | 35.8 | 1 | -22.07 | 20% | |
| | 4 | 42.4 | 21.4 | 5.3 | 30.9 | 1 | -21.08 | 30% | |
| | 5 | 0 | 0 | 21.1 | 78.9 | 1 | -1.1 | 1% | |
| | 6 | 33.9 | 16.9 | 7.4 | 41.8 | 1 | -21 | 5% | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 64 | 38 | 0.7 | 0 | 1 | -28.74 | 60% | |
| | 2 | 23 | 12.1 | 12.5 | 52.4 | 1 | -25.76 | 60% | |
| | 3 | 55 | 34 | 2.6 | 9.8 | 0 | -26.3 | 60% | |
| | 4 | 64 | 35 | 0 | 1 | 2 | -5.82 | 60% | |
| | 5 | 66.2 | 26.8 | 1.2 | 5.8 | 0 | -27.42 | 60% | |
| | 6 | 34.1 | 14.6 | 9.4 | 41.9 | 0 | -19.87 | 60% | |
| | 7 | 56.8 | 27.1 | 1.1 | 15 | 4 | -7.26 | 60% | |
| | 8 | 56 | 33 | 2.5 | 5.9 | 1 | -24.79 | 60% | |
| | 9 | 64 | 35 | 0.3 | 0.7 | 2 | -7.25 | 60% | |
| | 10 | 52 | 25.2 | 3.4 | 19.4 | 1 | -26.78 | 60% | |
| | 11 | 64 | 28 | 0 | 8 | 0 | -27.02 | 60% | |
| | 12 | 62 | 35 | 0.6 | 0 | 0 | -26.9 | 60% | |
| | | | | | | | | | |
| Cells 17 | 1 | 57.2 | 36.1 | 1.1 | 5.6 | 1 | -21.2 | 30% | |
| | 2 | 56.8 | 33 | 1.5 | 8.7 | 1 | -20.4 | 30% | |
| | 3 | 58.3 | 34.5 | 1.4 | 5.8 | 1 | -20.89 | 30% | |
| | 4 | 57.9 | 35 | 1.2 | 5.9 | 2 | -23.4 | 30% | |
| | 5 | 56.9 | 36.2 | 1.1 | 5.8 | 1 | -21.55 | 30% | |
| | 6 | 56.3 | 35 | 1.2 | 5.2 | 3 | -22 | 30% | |
| | | | | | | | | | |
| Cells 18 | 1 | 58.3 | 35.3 | 1.2 | 5.2 | 0 | -15.38 | 20% | |
| | 2 | 55.9 | 36.1 | 0.9 | 7.1 | 1 | -20.45 | 20% | |
| | 3 | 57.8 | 36.4 | 1.2 | 4.6 | 5 | -20.22 | 20% | |
| | 4 | 54.1 | 34.2 | 1.9 | 9.8 | 1 | -10.99 | 20% | |
| | 5 | 57.9 | 34.7 | 1.3 | 6.1 | 0 | -21.03 | 20% | |
| | | | | | | | | | Total gas flow |
| Flare/Engine | Before | 47.6 | 30 | 1.9 | 20.5 | 0 | -29 | | 315m3/hr |
| Flare/Engine | After | 48.2 | 33 | 1.4 | 17.4 | 0 | -25 | | 310m3/hr |

**Comments:**

Gas flare and engine operating inconjunction with the increased suction applied is causing over extraction of the gas wells

# NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

B9 POWER
Generating Sustainable Energy

Model | Serial No GM09053
Date: 29/04/2015
Weather: Cold & Wintry 998mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 61.7 | 17.2 | 3.8 | 17.3 | 1 | -3.57 | 5 | |
| | 1.4 | 71.5 | 19.3 | 1.8 | 7.4 | 1 | -3.75 | 2 | |
| | | | | | | | | | |
| Cells 2 | 2.1 | 22.8 | 17.7 | 0.9 | 58.6 | 1 | -0.13 | 1 | |
| | 2.2 | 14.7 | 5.6 | 8.9 | 70.8 | 1 | -0.19 | 1 | |
| | 2.3 | 26.3 | 13.7 | 1.7 | 58.3 | 1 | -2.53 | 5 | |
| | | | | | | | | | |
| Cells 3 | 3.2 | 42.7 | 20 | 1.2 | 36.1 | 1 | -2.04 | 20 | |
| | 3.3 | | | | | | | | |
| | 3.4 | 20.1 | 13.3 | 1.2 | 65.4 | 1 | -2.52 | 20 | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 29 | 19.8 | 1.4 | 49.8 | 1 | -17.65 | 40 | |
| | 4.3 | 72.1 | 25.9 | 0.6 | 1.4 | 3 | -0.53 | 2 | |
| | 4.4 | 19.9 | 13.7 | 1.3 | 65.1 | 1 | -2.46 | 5 | |
| | | | | | | | | | |
| Cells 5 | 5.1 | 73.4 | 26.4 | 0.5 | 0 | 2 | -3.74 | 5 | |
| | 5.2 | 2.3 | 5.9 | 12.5 | 79.3 | 2 | -0.57 | 0 | |
| | 5.3 | 30.7 | 11.7 | 12.1 | 45.5 | 1 | -0.07 | 2 | |
| | 5.4 | 74.9 | 23.8 | 0.7 | 0.6 | 2 | -0.34 | 2 | |
| | | | | | | | | | |
| Cells 6 | 6.1 | 46.1 | 21.9 | 1 | 31 | 1 | -0.11 | 2 | |
| | 6.2 | 49.6 | 19.8 | 6.2 | 24.4 | 1 | -3.09 | 2 | |
| | 6.3 | 59.4 | 12.2 | 5.8 | 22.6 | 1 | -10.25 | 5 | |
| | 6.4 | 0.3 | 4.1 | 19.4 | 76.2 | 1 | -0.1 | 0 | |
| | | | | | | | | | |
| Cells 7 | 7.1 | 3.3 | 8.6 | 16.6 | 71.5 | 1 | 0.06 | 0 | |
| | 7.2 | 1.4 | 5.9 | 18.8 | 73.9 | 1 | 0.03 | 0 | |
| | 7.3 | 0.3 | 3.1 | 19.8 | 76.8 | 0 | -0.94 | 2 | |
| | 7.4 | 66.4 | 23.4 | 1.7 | 8.5 | 1 | -0.39 | 2 | |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | | | | | | | | |
| | 8.2 | | | | | | | | |
| | 8.3 | 64.2 | 27.8 | 0.6 | 7.4 | 2 | -0.31 | 5 | |
| | 8.4 | 0.2 | 2.1 | 20.1 | 77.6 | 1 | -0.47 | 0 | |
| | | | | | | | | | |
| Cells 9 | 9.1 | 13.4 | 8.6 | 3 | 75 | 1 | 0.29 | 0 | |
| | 9.2 | 54 | 22.3 | 1.9 | 21.8 | 1 | -14.64 | 200 | |
| | 9.3 | 76.1 | 14.5 | 1.3 | 8.1 | 1 | -2.21 | 2 | |
| | 9.4 | 51.6 | 22.1 | 2.4 | 23.9 | 1 | -14.75 | 25 | |
| | 9.6 | | | | | | | | |
| | | | | | | | | | |
| Cells 10 | 10.2 | 0.3 | 4.1 | 17.2 | 78.4 | 0 | -0.97 | 0 | |
| | 10.3 | 65.6 | 27.9 | 1.7 | 4.8 | 1 | -15.5 | 40 | |
| | 10.4 | 65 | 26.4 | 0.4 | 8.2 | 2 | -15.37 | 50 | |
| | 10.5 | 75.7 | 20.7 | 1.1 | 2.5 | 1 | -8.52 | 20 | |
| | 10.6 | 65.9 | 24 | 1.2 | 8.9 | 1 | -15.43 | 20 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 71.4 | 25 | 0.5 | 3.1 | 1 | 0.4 | 5 | |
| | 2 | 6.9 | 5 | 15.9 | 72.2 | 4 | 14.19 | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 30.2 | 18.5 | 1.7 | 49.6 | 1 | -16.72 | 20 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 12 | 1 | 0.3 | 4.5 | 19.9 | 75.3 | 1 | 0 | 0 | |
| | 2 | 0.2 | 3.3 | 20.1 | 76.4 | 1 | -0.16 | 0 | |
| | 3 | 72.4 | 22.4 | 2 | 3.2 | 1 | 0.16 | 0 | |
| | 4 | 31.5 | 17.9 | 1 | 49.6 | 1 | -7.53 | 20 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 62 | 20 | 0.6 | 17.4 | 1 | -17 | 5 | |
| | 2 | 1 | 3.7 | 19.8 | 75.5 | 1 | | | |
| | 3 | 56.5 | 20.1 | 0.6 | 22.8 | 2 | -17.48 | 80 | |
| | 4 | 58.4 | 20.5 | 1.9 | 19.2 | 2 | -17.39 | 60 | |
| | 5 | 47.4 | 18.9 | 1 | 32.7 | 1 | -17.32 | 20 | |
| | 6 | 52.9 | 20.7 | 3.6 | 22.8 | 1 | -17.56 | 60 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | | | | | | | | |
| | 2 | 30 | 13.1 | 9.2 | 47.7 | 1 | -7.57 | 2 | |
| | 3 | 72.4 | 20.3 | 1.6 | 5.7 | 2 | -18.89 | 60 | |
| | 4 | 60.9 | 27.2 | 1.2 | 10.7 | 2 | -18.23 | 20 | |
| | 5 | 13.5 | 8.1 | 14.9 | 63.5 | 1 | -1.38 | 1 | |
| | 6 | 42.7 | 18.8 | 6.9 | 31.6 | 1 | -19.3 | 5 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 62.3 | 23.9 | 3.3 | 10.5 | 1 | -17.94 | 60 | |
| | 2 | 29 | 10.9 | 13 | 47.1 | 1 | -11.49 | 60 | |
| | 3 | 62.7 | 26.9 | 2.1 | 8.3 | 2 | -19.02 | 60 | |
| | 4 | 64.3 | 27.5 | 0.7 | 7.5 | 2 | -16.39 | 60 | |
| | 5 | 69.5 | 27.9 | 0.8 | 1.8 | 2 | -18.69 | 60 | |
| | 6 | 36 | 17.6 | 8.5 | 37.9 | 1 | -14.79 | 60 | |
| | 7 | 72.9 | 25.8 | 0.6 | 0.7 | 2 | -11.49 | 60 | |
| | 8 | 67.5 | 32.2 | 0.5 | 0 | 1 | -18.24 | 60 | |
| | 9 | 70.2 | 30 | 0.4 | 0 | 3 | -16.3 | 60 | |
| | 10 | 53.8 | 25.8 | 4.5 | 15.9 | 1 | -17.9 | 60 | |
| | 11 | 74.1 | 24 | 1 | 0.9 | 1 | -17.68 | 60 | |
| | 12 | 68.9 | 22 | 2.2 | 6.9 | 1 | -17.06 | 60 | |
| | | | | | | | | | |
| Cells 17 | 1 | 66.5 | 33.8 | 0.8 | 0 | 2 | -6.97 | 50 | |
| | 2 | 61.9 | 37.5 | 0.5 | 0.1 | 2 | -12.28 | 20 | |
| | 3 | 64 | 35 | 1.5 | 0 | 2 | -11.84 | 20 | |
| | 4 | 64.3 | 35 | 0.9 | 0 | 2 | -11.51 | 20 | |
| | 5 | 63.4 | 35.8 | 1.5 | 0 | 3 | -11.61 | 20 | |
| | 6 | 63.5 | 34.9 | 1.1 | 0.5 | 4 | -12.33 | 20 | |
| | | | | | | | | | |
| Cells 18 | 1 | 62 | 37.3 | 0.8 | 0 | 0 | -10.72 | 40 | |
| | 2 | 57.6 | 35.4 | 1.7 | 5.3 | 1 | -6.26 | 20 | |
| | 3 | 62.4 | 35.2 | 1.3 | 1.1 | 8 | -10.73 | 20 | |
| | 4 | 61.9 | 34.8 | 1.6 | 1.7 | 2 | -11.26 | 20 | |
| | 5 | 59.6 | 36.1 | 1.5 | 2.8 | 0 | -9.52 | 20 | |
| | | | | | | | | | Total gas flow |
| Flare/Engine | Before | 49 | 29 | 1.6 | 18.7 | 0 | -23 | | 290m3/hr |
| Flare/Engine | After | 51 | 31 | 1.4 | 17.2 | 0 | -20 | | 275m3/hr |

**Comments:**

Gas flare and engine operating inconjunction with the increased suction applied is causing over extraction of the gas wells

## NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

B9 POWER Generating Sustainable Energy

Model Serial No GM09053
Date: 29/05/2015
Weather: Showers 978mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 70.3 | 19.3 | 2.8 | 7.6 | 0 | -4.92 | 5 | |
| | 1.4 | 23.3 | 16.8 | 3 | 56.9 | 0 | -4.62 | 5 | |
| | | | | | | | | | |
| Cells 2 | 2.1 | 32.6 | 15.6 | 1 | 50.5 | 0 | -0.58 | 1 | |
| | 2.2 | 15.5 | 7.8 | 10.2 | 66.5 | 0 | -0.71 | 2 | |
| | 2.3 | 23.5 | 13.8 | 4.2 | 58.5 | 0 | -3.14 | 2 | |
| | | | | | | | | | |
| Cells 3 | 3.2 | 52.8 | 22.8 | 0.6 | 23.8 | 0 | -2.77 | 5 | |
| | 3.3 | | | | | | | | |
| | 3.4 | 22.5 | 15.7 | 0.5 | 61.3 | 0 | -3.29 | 5 | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 51.2 | 23.6 | 0.4 | 24.8 | 0 | 0.07 | 60 | |
| | 4.3 | 66.7 | 28 | 0.4 | 4.9 | 2 | 0.16 | 0 | |
| | 4.4 | 53.7 | 21.2 | 0.6 | 24.5 | 0 | -2.77 | 8 | |
| | | | | | | | | | |
| Cells 5 | 5.1 | 68 | 25.5 | 0.7 | 5.8 | 1 | -4.54 | 5 | |
| | 5.2 | 7.6 | 17.2 | 0.2 | 75 | 2 | -0.7 | 1 | |
| | 5.3 | 29.3 | 20.6 | 0.3 | 49.8 | 1 | -0.75 | 1 | |
| | 5.4 | 15.1 | 16.2 | 3.7 | 65 | 0 | -0.79 | 1 | |
| | | | | | | | | | |
| Cells 6 | 6.1 | 49.1 | 22.8 | 0.8 | 27.3 | 0 | -0.47 | 2 | |
| | 6.2 | 71.3 | 26.5 | 1.3 | 0.7 | 0 | -3.99 | 5 | |
| | 6.3 | 70.5 | 11.5 | 4 | 14 | 0 | -6.57 | 3 | |
| | 6.4 | 5.5 | 10.7 | 16.4 | 67.4 | 0 | -0.22 | 0 | |
| | | | | | | | | | |
| Cells 7 | 7.1 | 20.9 | 16.4 | 14.2 | 48.5 | 0 | -6.98 | 2 | |
| | 7.2 | 1 | 4.9 | 19.9 | 74.2 | 0 | -0.2 | 0 | |
| | 7.3 | 65.4 | 24 | 1.6 | 9 | 0 | -3.83 | 5 | |
| | 7.4 | 19.2 | 8.1 | 5.6 | 67.1 | 0 | -0.08 | 0 | |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | | | | | | | | |
| | 8.2 | | | | | | | | |
| | 8.3 | 72.5 | 31.2 | 0.2 | 0 | 1 | -0.79 | 5 | |
| | 8.4 | 0.4 | 4.3 | 20.2 | 75.1 | 0 | -42.11 | 0 | |
| | | | | | | | | | |
| Cells 9 | 9.1 | 16.4 | 10.3 | 5.5 | 67.8 | 1 | 0.2 | 0 | |
| | 9.2 | 66.9 | 25.1 | 0.6 | 7.4 | 1 | -21.59 | 20 | |
| | 9.3 | 38.1 | 5.4 | 6.3 | 50.1 | 1 | 0.2 | 0 | |
| | 9.4 | 61.8 | 24.9 | 0.8 | 12.5 | 0 | -21.63 | 20 | |
| | 9.6 | | | | | | | | |
| | | | | | | | | | |
| Cells 10 | 10.2 | 15 | 4.4 | 10.6 | 70 | 0 | -1.43 | 1 | |
| | 10.3 | 52.5 | 19.4 | 5.8 | 22.3 | 1 | -22.44 | 40 | |
| | 10.4 | 14 | 6.1 | 8.3 | 71.6 | 1 | -1.39 | 2 | |
| | 10.5 | 77.3 | 26.3 | 0.2 | 0 | 0 | -15.36 | 30 | |
| | 10.6 | 74.4 | 23.8 | 1 | 0.8 | 1 | -22.63 | 30 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 15.8 | 15.9 | 6.2 | 62.1 | 0 | 0.27 | 0 | |
| | 2 | 9.1 | 6.3 | 15.6 | 69 | 3 | 19.59 | 0 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 3 | 60.1 | 23.2 | 0.3 | 16.4 | 0 | -0.38 | 2 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 12 | 1 | 0.3 | 2 | 21.7 | 76 | 1 | -0.09 | 0 | |
| | 2 | 0.2 | 1.8 | 21.9 | 76.1 | 1 | -0.15 | 0 | |
| | 3 | 67.3 | 26.2 | 0.7 | 5.8 | 0 | 0.3 | 0 | |
| | 4 | 51.2 | 23.1 | 0.3 | 25.4 | 0 | 0.03 | 40 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 68.9 | 22.3 | 1.6 | 7.2 | 1 | -24.69 | 5 | |
| | 2 | 63.4 | 20.3 | 1.6 | 14.7 | 0 | -24.81 | 5 | |
| | 3 | 70.9 | 20 | 0.7 | 8.4 | 1 | -24.69 | 80 | |
| | 4 | 71.7 | 21.8 | 0.9 | 5.6 | 0 | -24.9 | 60 | |
| | 5 | 43.9 | 15 | 0.4 | 40.7 | 0 | -24.14 | 20 | |
| | 6 | 65.5 | 24.8 | 2.1 | 7.6 | 0 | -24.75 | 60 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 19.3 | 9.7 | 13.9 | 57.1 | 2 | -0.39 | 2 | |
| | 2 | 75.8 | 24.5 | 0.3 | 0 | 1 | -6.26 | 5 | |
| | 3 | 77.3 | 18.9 | 1.2 | 2.6 | 0 | -25.06 | 60 | |
| | 4 | 71.8 | 28.3 | 0.3 | 0 | 1 | -24.6 | 20 | |
| | 5 | 8.7 | 10.5 | 17.9 | 62.9 | 0 | -0.19 | 2 | |
| | 6 | 55.4 | 23 | 4.5 | 17.1 | 1 | -25.02 | 10 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 67.1 | 23.1 | 2.6 | 7.2 | 0 | -22.62 | 60 | |
| | 2 | 24.1 | 9.5 | 13.7 | 52.7 | 0 | -21.19 | 60 | |
| | 3 | 58.5 | 26.6 | 3.5 | 11.4 | 0 | -24.06 | 60 | |
| | 4 | 72.9 | 29.5 | 0.5 | 0 | 0 | -23.64 | 60 | |
| | 5 | 72.6 | 31.3 | 0.1 | 0 | 0 | -23.24 | 60 | |
| | 6 | 36.6 | 17.8 | 8.9 | 36.7 | 0 | -14.51 | 60 | |
| | 7 | 60.3 | 27.3 | 0.5 | 11.9 | 2 | -14.11 | 60 | |
| | 8 | 68.1 | 32.4 | 0.2 | 0 | 1 | -22.63 | 60 | |
| | 9 | 67.2 | 29.2 | 0.2 | 3.4 | 1 | -11.77 | 60 | |
| | 10 | 55.1 | 22.4 | 5 | 17.5 | 0 | -22.54 | 60 | |
| | 11 | 67.1 | 24.9 | 1.4 | 6.6 | 0 | -19.96 | 60 | |
| | 12 | 60.8 | 25.6 | 0.6 | 13 | 2 | -14.46 | 60 | |
| | | | | | | | | | |
| Cells 17 | 1 | 65.1 | 38.2 | 0.1 | 0 | 1 | -8.55 | 20 | |
| | 2 | 63.2 | 40.1 | 0.1 | 0 | 0 | -12.96 | 20 | |
| | 3 | 61.1 | 36.6 | 1.1 | 1.2 | 1 | -10.61 | 20 | |
| | 4 | 60.4 | 37.8 | 1.1 | 0.7 | 1 | -12.52 | 20 | |
| | 5 | 63.8 | 39.5 | 0.1 | 0 | 2 | -12.99 | 20 | |
| | 6 | 64.3 | 39.1 | 0.1 | 0 | 2 | -13.39 | 20 | |
| | | | | | | | | | |
| Cells 18 | 1 | 52.7 | 35.1 | 0.9 | 11.3 | 1 | -12.35 | 20 | |
| | 2 | 59.5 | 36.3 | 1.5 | 2.7 | 1 | -7.72 | 20 | |
| | 3 | 57.4 | 37.6 | 0.5 | 4.5 | 12 | -12.08 | 20 | |
| | 4 | 59.9 | 32.5 | 2.3 | 5.3 | 0 | -11.73 | 20 | |
| | 5 | 60 | 35.8 | 1.5 | 2.7 | 0 | -11.3 | 20 | |
| | | | | | | | | | Total gas flow |
| Flare/Engine | After | 56.8 | 36 | 1.7 | 5.5 | 1 | -26.14 | | 265m3/hr |

**Comments:**

Gas flare and engine operating inconjunction with the increased suction applied is causing over extraction of the gas wells

# NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model Serial No GM09053
Date: 30/06/2015
Weather: Warm & sunny intervals 988mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 46.1 | 15.5 | 7.3 | 31.1 | 0 | -5.4 | 10 | Improved CH4 |
| | 1.4 | 62.5 | 24.8 | 0.9 | 11.8 | 0 | -5.2 | 5 | Improved CH4 |
| | | | | | | | | | |
| Cells 2 | 2.1 | 20.8 | 22.9 | 2.5 | 53.8 | 0 | -3.2 | 5 | CH4 deteriorated |
| | 2.2 | 27 | 20.2 | 3.4 | 49.4 | 0 | -1.4 | 5 | O2 Reduction |
| | 2.3 | 31.3 | 23.6 | 1.3 | 43.8 | 0 | -3.1 | 2 | Improved CH4 |
| | | | | | | | | | |
| Cells 3 | 3.2 | 41.2 | 27.7 | 0.2 | 30.9 | 0 | -2.79 | 5 | CH4 deteriorated |
| | 3.3 | | | | | | | | |
| | 3.4 | 27 | 23.6 | 0.6 | 48.8 | 0 | -3.42 | 5 | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 51.3 | 23.4 | 0.4 | 24.9 | 0 | 0.07 | 60 | |
| | 4.3 | 51.5 | 30.2 | 0 | 18.3 | 3 | -1.2 | 2 | Drawdown of CH4 |
| | 4.4 | 40.9 | 27.5 | 1.7 | 29.9 | 0 | -2.65 | 5 | Increase in O2 |
| | | | | | | | | | |
| Cells 5 | 5.1 | 59.8 | 28.2 | 2.9 | 9.1 | 2 | -5.3 | 5 | Drawdown of CH4 |
| | 5.2 | 29 | 5 | 0.6 | 75 | 2 | -1.2 | 2 | |
| | 5.3 | 13 | 6.6 | 16.4 | 64 | 0 | -1.8 | 5 | Increase in O2 |
| | 5.4 | 49 | 13.4 | 0.3 | 37.3 | 1 | -1.8 | 5 | Improved CH4 |
| | | | | | | | | | |
| Cells 6 | 6.1 | 31.5 | 23.9 | 1.4 | 43.2 | 0 | -0.89 | 2 | Drawdown of CH4 |
| | 6.2 | 52.3 | 25.9 | 4.6 | 17.2 | 1 | -4.2 | 5 | Drawdown of CH4 |
| | 6.3 | 54.8 | 16.8 | 5.5 | 22.9 | 0 | -7.8 | 5 | Increase in O2 |
| | 6.4 | 57.7 | 19 | 3.4 | 19.9 | 0 | -0.65 | 2 | Improved CH4 |
| | | | | | | | | | |
| Cells 7 | 7.1 | 40.4 | 15.1 | 8.8 | 35.7 | 0 | -0.8 | 0 | O2 ingress |
| | 7.2 | 48 | 27 | 5 | 20 | 0 | -0.5 | 1 | Improved CH4 |
| | 7.3 | 0.1 | 0.2 | 20.5 | 79.2 | 0 | -4.8 | 0 | CH4 & O2 deteriorated |
| | 7.4 | 58.8 | 18.5 | 1.7 | 21 | 0 | -1.4 | 5 | Improved CH4 |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | 45.7 | 24.3 | 5.6 | 24.4 | 0 | -0.1 | 0 | |
| | 8.2 | 34.2 | 25.1 | 0.9 | 39.8 | 1 | -3.7 | 10 | |
| | 8.3 | 45 | 31.4 | 2.6 | 21 | 0 | -0.84 | 5 | Drawdown of CH4 |
| | 8.4 | 0.2 | 0.2 | 20 | 79.6 | 0 | -2.1 | 0 | |
| | | | | | | | | | |
| Cells 9 | 9.1 | 56.8 | 23 | 0.7 | 19.5 | 0 | -1.3 | 2 | Improved CH4 |
| | 9.2 | 63.6 | 30.1 | 0.9 | 5.4 | 0 | -23.1 | 30 | |
| | 9.3 | 31.9 | 3.3 | 1.7 | 63.1 | 0 | 0.2 | 0 | Drawdown of CH4 |
| | 9.4 | 63.5 | 29.9 | 2.9 | 3.7 | 0 | -23.26 | 30 | |
| | 9.6 | | | | | | | | |
| | | | | | | | | | |
| Cells 10 | 10.2 | 25.5 | 11.8 | 11.8 | 50.9 | 0 | -1.68 | 2 | Increase in O2 |
| | 10.3 | 58.4 | 30.1 | 1 | 10.5 | 2 | -21.09 | 20 | |
| | 10.4 | 50.4 | 11 | 0.3 | 38.2 | 1 | -20.89 | 20 | Improved CH4 |
| | 10.5 | 71.9 | 32 | 0.3 | 0 | 0 | -22.7 | 40 | |
| | 10.6 | 67.5 | 28.9 | 0.2 | 3.4 | 0 | -22.49 | 30 | Slight drawdown of CH4 |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 52.2 | 32.2 | 0.3 | 15.3 | 1 | -1.6 | 10 | Improved CH4 |
| | 2 | 9.9 | 5.8 | 14.9 | 69.4 | 3 | 19.64 | 1 | |
| | 3 | 46.8 | 25.5 | 2.8 | 24.9 | 0 | -0.73 | 5 | Slight draw down |
| | | | | | | | | | |
| | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cells 12 | 1 | 0.1 | 0 | 20.8 | 79.1 | 0 | -0.05 | 0 | |
| | 2 | 0.4 | 0.4 | 20.7 | 78.5 | 0 | -0.1 | 0 | |
| | 3 | 29.8 | 13.5 | 12.5 | 44.2 | 0 | -2.3 | 10 | Increase in O2 |
| | 4 | 10.5 | 13.1 | 6.7 | 69.7 | 1 | -6.8 | 60 | Increase in O2 |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 58.4 | 24.6 | 2.6 | 14.4 | 0 | -29.2 | 20 | Slight drawdown of CH4 |
| | 2 | 60.6 | 25.5 | 0.5 | 13.4 | 1 | -28.3 | 20 | Slight drawdown of CH4 |
| | 3 | 22.8 | 18.3 | 0.1 | 58.8 | 0 | -30.4 | 60 | |
| | 4 | 66.4 | 23.3 | 0.8 | 9.5 | 2 | -32.8 | 80 | Slight drawdown of CH4 |
| | 5 | 12.8 | 17.6 | 1.4 | 68.2 | 0 | -27.6 | 20 | CH4 & O2 deteriorated |
| | 6 | 60.3 | 30 | 1.5 | 8.2 | 0 | -31.43 | 80 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 29.8 | 17.5 | 9.6 | 43.1 | 3 | -27.4 | 25 | |
| | 2 | 38 | 27.5 | 1.9 | 32.6 | 1 | -5.98 | 5 | Drawdown of CH4 |
| | 3 | 54.3 | 10.1 | 0.8 | 34.8 | 3 | -26.9 | 60 | Drawdown of CH4 |
| | 4 | 50.9 | 11.1 | 0.5 | 38.2 | 0 | -27.2 | 20 | Drawdown of CH4 |
| | 5 | 71.9 | 31.7 | 1.9 | 0 | 0 | -0.43 | 5 | |
| | 6 | 37.8 | 23.6 | 5.2 | 34.1 | 1 | -25.08 | 25 | Increase in O2 |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 64 | 30.7 | 1.7 | 3.6 | 1 | -24.65 | 60 | |
| | 2 | 27.6 | 14.1 | 11.4 | 46.9 | 1 | -22.38 | 60 | |
| | 3 | 50.7 | 32.6 | 0.4 | 16.3 | 3 | -24.32 | 60 | Drawdown of CH4 |
| | 4 | 61.9 | 31.2 | 2.1 | 4.8 | 2 | -24.97 | 60 | Drawdown of CH4 |
| | 5 | 46.2 | 24.5 | 6.1 | 23.2 | 1 | -25.67 | 60 | Drawdown of CH4 |
| | 6 | 37.7 | 20.8 | 7.8 | 33.7 | 1 | -16.73 | 60 | |
| | 7 | 62 | 32.4 | 0.6 | 5 | 3 | -16.98 | 60 | |
| | 8 | 53.9 | 29.5 | 3.7 | 12.9 | 2 | -24.89 | 60 | Drawdown of CH4 |
| | 9 | 50.3 | 31.3 | 0.5 | 17.9 | 4 | -23.67 | 60 | Drawdown of CH4 |
| | 10 | 58.8 | 30.5 | 2.6 | 8.1 | 1 | -24.1 | 60 | |
| | 11 | 74.8 | 29.4 | 0.4 | 0 | 1 | -23.53 | 60 | xx |
| | 12 | 53.5 | 11.7 | 1 | 33.8 | 1 | -25.21 | 60 | Drawdown of CH4 |
| | | | | | | | | | |
| Cells 17 | 1 | 64.3 | 39.9 | 0.4 | 0 | 3 | -15.2 | 40 | |
| | 2 | 61.4 | 40.5 | 0.5 | 0 | 3 | -14.98 | 40 | |
| | 3 | 59.6 | 40.5 | 0.8 | 0 | 4 | -15.19 | 40 | Drawdown of CH4 |
| | 4 | 56 | 37.9 | 1.9 | 4.2 | 3 | -14.78 | 60 | Drawdown of CH4 |
| | 5 | 62 | 40.3 | 0.5 | 0 | 5 | -15.71 | 60 | Drawdown of CH4 |
| | 6 | 58.7 | 38.9 | 1.3 | 1.1 | 8 | -14.78 | 60 | Drawdown of CH4 |
| | | | | | | | | | |
| Cells 18 | 1 | 58.9 | 39.3 | 1.7 | 0.1 | 4 | -15.71 | 60 | |
| | 2 | 59 | 38.6 | 1.6 | 0.8 | 4 | -15.12 | 60 | |
| | 3 | 58.6 | 38.7 | 1.4 | 1.3 | 4 | -15.68 | 60 | |
| | 4 | 58.5 | 38.7 | 1.5 | 1.3 | 3 | -15.17 | 60 | |
| | 5 | 54.1 | 35.7 | 2.6 | 7.6 | 3 | -14.79 | 60 | Drawdown of CH4 |
| | | | | | | | | | |
| Flare/Engine | Before | 46 | 29 | 1.8 | 23.2 | 1 | -34 | Total gas flow | 320m3/hr |
| Flare/Engine | After | 48 | 31 | 1.6 | 19.4 | 1 | -33 | | 310m3/hr |

**Comments:**
At site audit, no apparent air leaks attributing to the O2. Further investigations to be carried out

# NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model Serial No GM09053
Date: 24/07/2015
Weather: Rain 981mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 39.2 | 13.2 | 9.4 | 38.2 | 0 | -3 | 2 | CH4 deteriorated |
| | 1.4 | 40.3 | 19.9 | 4.5 | 35.3 | 0 | -2 | 5 | CH4 deteriorated |
| | | | | | | | | | |
| Cells 2 | 2.1 | 18.7 | 19.2 | 3 | 59.1 | 0 | 0 | 5 | |
| | 2.2 | | | | | | | | |
| | 2.3 | 19.7 | 20.2 | 1.8 | 58.3 | 0 | -2 | 2 | CH4 deteriorated |
| | | | | | | | | | |
| Cells 3 | 3.2 | 42.2 | 26.8 | 3 | 28 | 0 | -2.5 | 5 | Slight improvement In CH4 |
| | 3.3 | | | | | | | | |
| | 3.4 | 16.3 | 22.8 | 1.3 | 59.6 | 0 | -2.5 | 2 | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 30.6 | 24.6 | 0.7 | 44.1 | 1 | -5 | 20 | Increased suction |
| | 4.3 | 37.7 | 17.2 | 9 | 36.1 | 2 | -1.1 | 5 | Drawdown of CH4 |
| | 4.4 | 42 | 26.4 | 1.5 | 30.1 | 0 | -0.5 | 5 | Slight improvement In CH4 |
| | | | | | | | | | |
| Cells 5 | 5.1 | 47.8 | 12.4 | 1.3 | 38.5 | 3 | -3 | 5 | CH4 deteriorated |
| | 5.2 | 42.8 | 22.3 | 1.4 | 33.5 | 1 | 0 | 5 | CH4 deteriorated |
| | 5.3 | 24.2 | 12.3 | 12.2 | 51.3 | 0 | -0.5 | 2 | Suction Reduced |
| | 5.4 | 50.4 | 22.9 | 4.7 | 22 | 1 | -1.5 | 5 | Increase in O2 |
| | | | | | | | | | |
| Cells 6 | 6.1 | 45.3 | 24.6 | 1.7 | 28.4 | 1 | 0 | 5 | |
| | 6.2 | 63.9 | 30.1 | 2.1 | 3.9 | 2 | 0 | 5 | Overall gas improved |
| | 6.3 | 56.5 | 15.3 | 5 | 23.2 | 0 | -1.5 | 2 | |
| | 6.4 | 0 | 1.7 | 12 | 86.3 | 0 | 0 | 0 | Overall gas deteriorated |
| | | | | | | | | | |
| Cells 7 | 7.1 | 16.1 | 6.3 | 16.6 | 61 | 0 | -0.5 | 5 | Overall gas deteriorated |
| | 7.2 | 9.2 | 4.1 | 10.8 | 75.9 | 0 | -1.2 | 0 | Overall gas deteriorated |
| | 7.3 | 0.1 | 1.7 | 19.8 | 78.4 | 0 | 0 | 0 | CH4 & O2 deteriorated |
| | 7.4 | 50 | 22.8 | 5.4 | 21.8 | 0 | 0 | 5 | Draw down of CH4 |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | 45.7 | 24.3 | 5.6 | 24.4 | 0 | -0.1 | 0 | |
| | 8.2 | 34.2 | 25.1 | 0.9 | 39.8 | 1 | -3.7 | 10 | |
| | 8.3 | 60.4 | 32.1 | 1.9 | 5.6 | 1 | 0 | 5 | Overall gas improved |
| | 8.4 | 0 | 0.1 | 20.3 | 79.6 | 0 | -1.5 | 2 | |
| | | | | | | | | | |
| Cells 9 | 9.1 | 56.4 | 9.6 | 1.1 | 32.9 | 0 | -1.3 | 2 | |
| | 9.2 | 58.6 | 28.4 | 1.8 | 11.2 | 0 | -10 | 30 | |
| | 9.3 | 43.7 | 4.8 | 3.5 | 48 | 0 | 0 | 0 | Drawdown of CH4 |
| | 9.4 | 61 | 29.2 | 1.3 | 8.5 | 0 | -8 | 40 | |
| | 9.6 | | | | | | | | |
| | | | | | | | | | |
| Cells 10 | 10.2 | 0.8 | 1.3 | 19.7 | 78.2 | 0 | -1.68 | 5 | Deterioration of gas |
| | 10.3 | 60.3 | 31.5 | 2.1 | 6.1 | 24 | -9 | 5 | |
| | 10.4 | 50 | 12.2 | 1.4 | 36.4 | 0 | -9 | 25 | |
| | 10.5 | 57.6 | 27 | 3.4 | 12 | 0 | -6 | 30 | |
| | 10.6 | 65.7 | 27.1 | 0.9 | 6.3 | 0 | -8 | 30 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 69.5 | 32 | 1.3 | 0 | 1 | -4 | 5 | Improved CH4 |
| | 2 | 6.7 | 4.1 | 17.3 | 71.9 | 1 | -1 | 2 | |
| | 3 | 48.7 | 29.5 | 2 | 19.8 | 0 | -1.4 | 5 | Improved CH4 |
| | | | | | | | | | |
| | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cells 12 | 1 | 0.2 | 0 | 20.7 | 79.1 | 0 | 0 | 0 | |
| | 2 | 0.6 | 0.6 | 20.6 | 78.2 | 3 | 0 | 0 | |
| | 3 | 20 | 8.5 | 15.1 | 56.4 | 0 | -4 | 2 | |
| | 4 | 29.9 | 21.6 | 1.6 | 46.9 | 0 | -10 | 2 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 35.6 | 15.8 | 7.8 | 40.8 | 0 | -29.2 | 20 | Deterioration of gas |
| | 2 | 48 | 22.2 | 2.9 | 26.9 | 1 | -2 | 25 | Deterioration of gas |
| | 3 | 25.8 | 13.4 | 6.3 | 54.5 | 0 | -17 | 80 | |
| | 4 | 46.1 | 17.7 | 7.2 | 29 | 1 | -16 | 80 | Drawdown of CH4 |
| | 5 | 24 | 14.3 | 7.7 | 54 | 0 | -16 | 10 | Slight improvement in gas |
| | 6 | 50.4 | 26.5 | 5 | 18.1 | 1 | -15 | 60 | Slight drawdown of CH4 |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 57.4 | 33.8 | 2.6 | 6.2 | 2 | -3 | 5 | |
| | 2 | 54.2 | 29.3 | 3.6 | 12.9 | 2 | -16 | 5 | Improved CH4 |
| | 3 | 68.8 | 22.9 | 2.4 | 5.9 | 2 | -14 | 60 | Improved CH4 |
| | 4 | 48.8 | 10.9 | 0.7 | 39.6 | 4 | -2 | 5 | Deteioration of gas |
| | 5 | 22.4 | 9.8 | 14.1 | 53.7 | 1 | -2 | 2 | Deteioration of gas |
| | 6 | 12.2 | 5.6 | 17.1 | 65.1 | 0 | -13 | 5 | Deteioration of gas |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 62.2 | 30.2 | 2.1 | 5.5 | 0 | -18.2 | 60 | |
| | 2 | 23 | 11.9 | 12.7 | 52.4 | 0 | -17.4 | 60 | |
| | 3 | 56.3 | 26.6 | 3.7 | 13.4 | 4 | -19.1 | 60 | Improved CH4 |
| | 4 | 70.4 | 34.1 | 0.5 | 0 | 2 | -19 | 60 | |
| | 5 | 67.3 | 32.9 | 1.9 | 0 | 2 | -19 | 60 | Improved CH4 |
| | 6 | 31.4 | 18.9 | 8.6 | 41.1 | 1 | -13.2 | 20 | |
| | 7 | 46.1 | 28.7 | 1.6 | 23.6 | 3 | -13 | 20 | Drawdown of CH4 |
| | 8 | 50.7 | 28.2 | 4.4 | 16.7 | 1 | -19 | 60 | Drawdown of CH4 |
| | 9 | 33 | 20.5 | 6.6 | 39.9 | 3 | -18.4 | 60 | Drawdown of CH4 |
| | 10 | 43.2 | 23 | 7 | 26.8 | 2 | -18.9 | 60 | Drawdown of CH4 |
| | 11 | 71.3 | 27.4 | 1.2 | 0.1 | 0 | -17.6 | 60 | |
| | 12 | 61.3 | 33.2 | 1.2 | 4.3 | 0 | -18.2 | 60 | |
| | | | | | | | | | |
| Cells 17 | 1 | 58.7 | 36.5 | 2.8 | 2 | 14 | -17 | 40 | Increased suction |
| | 2 | 62.7 | 40.9 | 0.2 | 0 | 19 | -17 | 60 | Increased suction |
| | 3 | 58 | 38.7 | 2.3 | 1 | 0 | -16 | 40 | Increased suction |
| | 4 | 56 | 37.9 | 1.9 | 4.2 | 3 | -14.78 | 60 | Increased suction |
| | 5 | 56.7 | 37.8 | 1.8 | 3.7 | 0 | -16 | 60 | Increased suction |
| | 6 | 40.9 | 27.6 | 6.7 | 24.8 | 0 | -17 | 60 | Increased suction |
| | | | | | | | | | |
| Cells 18 | 1 | 60.4 | 39.3 | 3.2 | 0 | 4 | -16 | 60 | Increased suction |
| | 2 | 54.7 | 35.9 | 2.6 | 6.8 | 4 | -17 | 60 | Increased suction |
| | 3 | 56 | 37 | 2.5 | 4.5 | 0 | -17 | 60 | Increased suction |
| | 4 | 52.7 | 35.1 | 2.8 | 9.4 | 0 | -16 | 60 | Increased suction |
| | 5 | 56.5 | 36.4 | 2.3 | 4.8 | 0 | -16 | 60 | Increased suction |
| | | | | | | | | | |
| Flare/Engine | Before | 48 | 32 | 1.9 | 23.2 | 1 | -24 | Total gas flow | 360m3/hr |
| Flare/Engine | After | 49.5 | 34.3 | 1.6 | 19.4 | 1 | -23 | | 360m3/hr |

**Comments:**

At site audit, no apparent air leaks attributing to the O2. Further investigations to be carried out

O2 readings in red text will be checked on as a priority.

New pressure meter used to read suction as a fault with the gas analyser for suction readings

Gas Analyser suction readings for Cells 15/16

# NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model Serial No GM09053
Date: 20/08/2015
Weather: Sunny intervals 988mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 58.5 | 19.2 | 1.8 | 20.5 | 0 | -1 | 2 | |
| | 1.4 | 46.5 | 16.6 | 1 | 35.9 | 0 | -2 | 5 | |
| | | | | | | | | | |
| Cells 2 | 2.1 | 42 | 24 | 1.1 | 32.9 | 0 | -2 | 5 | |
| | 2.2 | 38.3 | 22.2 | 1.5 | 38 | 0 | -2 | 2 | |
| | 2.3 | 32.7 | 20.4 | 3.7 | 43.2 | 0 | -2 | 2 | |
| | | | | | | | | | |
| Cells 3 | 3.2 | 58.8 | 28.1 | 0 | 13.1 | 0 | -4 | 5 | |
| | 3.4 | 38.7 | 22.1 | 1.8 | 37.4 | 0 | -5 | 5 | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 58.1 | 29 | 0.1 | 12.8 | 0 | -12 | 60 | |
| | 4.3 | 46.3 | 23 | 0.5 | 30.2 | 0 | -2 | 2 | |
| | 4.4 | 42.6 | 24.8 | 0.5 | 32.1 | 0 | -4 | 5 | |
| | | | | | | | | | |
| Cells 5 | 5.1 | 61.6 | 32 | 1 | 5.4 | 0 | -2 | 2 | |
| | 5.2 | 27.1 | 20.1 | 1.3 | 51.5 | 0 | -3 | 2 | |
| | 5.3 | 23.5 | 11 | 13.1 | 52.4 | 0 | -1 | 2 | Faulty valve - possible air leak |
| | 5.4 | 48.9 | 22.2 | 0.7 | 28.2 | 0 | -2 | 2 | |
| | | | | | | | | | |
| Cells 6 | 6.1 | 52.5 | 23.4 | 0.9 | 23.2 | 0 | -2 | 5 | |
| | 6.2 | 44.6 | 22.3 | 0.5 | 32.6 | 0 | -3 | 2 | |
| | 6.3 | 64.7 | 16.9 | 3.3 | 15.1 | 0 | -1 | 0 | |
| | 6.4 | 0.2 | 2 | 19.8 | 77 | 0 | 0 | 0 | Broken pipe to be fixed |
| | | | | | | | | | |
| Cells 7 | 7.1 | 0.1 | 1.6 | 20.4 | 77.9 | 0 | 0 | 0 | KCC design - perforated pipe close to surface drawing in air ingress |
| | 7.2 | 0.2 | 3.2 | 19.8 | 76.8 | 0 | 0 | 0 | Excavation needs to be backfilled by KCC |
| | 7.3 | 0.1 | 1.3 | 20.5 | 78.1 | 0 | 0 | 0 | Excavation needs to be backfilled by KCC |
| | 7.4 | 53.7 | 25.5 | 1.2 | 19.6 | 0 | -2 | 2 | |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | 44 | 33 | 2.4 | 20.6 | 0 | -6 | 20 | |
| | 8.2 | 41 | 28 | 1.6 | 29.4 | 1 | -2 | 3 | |
| | 8.3 | 41.4 | 24 | 0.3 | 34.3 | 0 | -6 | 5 | |
| | 8.4 | 0.2 | 3.2 | 19.8 | 76.8 | 0 | 0 | 0 | Requires wellhead repair |
| | | | | | | | | | |
| Cells 9 | 9.1 | 64.8 | 20.2 | 0.6 | 14.4 | 0 | 0 | 0 | Damaged pipework to be repaired |
| | 9.2 | 50.6 | 25.8 | 0.4 | 23.2 | 0 | -7 | 30 | |
| | 9.3 | 67.5 | 8.7 | 0.9 | 22.9 | 0 | 0 | 0 | Well is flooded |
| | 9.4 | 46 | 20 | 2.1 | 21.9 | 0 | -5 | 15 | |
| | 9.6 | No reading as pipe disconnected from main line | | | | | | | Damaged pipework to be repaired |
| | | | | | | | | | |
| Cells 10 | 10.2 | 12.5 | 13.5 | 8.8 | 65.2 | 0 | 0 | 0 | KCC design - perforated pipe close to surface drawing in air ingress |
| | 10.3 | 51.6 | 26.1 | 0.4 | 21.9 | 0 | -9 | 40 | |
| | 10.4 | 54.4 | 22 | 0.5 | 23.1 | 0 | -9 | 10 | |
| | 10.5 | 43.3 | 21.8 | 0.6 | 34.3 | 0 | -8 | 30 | |
| | 10.6 | 48.7 | 20.1 | 1.4 | 29.8 | 0 | -8 | 30 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 52.9 | 27.3 | 0.6 | 19.2 | 0 | -10 | 20 | |
| | 2 | 9.9 | 6 | 14.5 | 69.6 | 0 | -2 | 2 | Visual checks carried out for O2 ingress. Well to be excavated |
| | 3 | 58.4 | 29.4 | 0.1 | 12.1 | 0 | -8 | 5 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 12 | 1 | 0.2 | 2.4 | 20.2 | 77.2 | 0 | 0 | 0 | Visual checks carried out for O2 ingress. Well to be excavated |
| | 2 | 0.5 | 1.6 | 20.5 | 77.4 | 0 | 0 | 0 | Visual checks carried out for O2 ingress. Well to be excavated |
| | 3 | 53.2 | 26.9 | 0.8 | 19.1 | 0 | -3 | 2 | |
| | 4 | 27.4 | 20.1 | 0.1 | 52.4 | 0 | -12 | 40 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 40.1 | 17 | 8.3 | 34.6 | 0 | -1 | 20 | Visual checks carried out for O2 ingress. Possible damage from lagoons works |
| | 2 | 67.8 | 26.8 | 0 | 5.4 | 0 | -3 | 20 | Any more suction and gas will deteriorate |
| | 3 | 40.2 | 19.2 | 1.1 | 39.5 | 0 | -14 | 80 | |
| | 4 | 44.8 | 17.4 | 1 | 36.8 | 0 | -12 | 80 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 5 | 20.1 | 16.8 | 0.8 | 62.3 | 0 | -4 | 2 | |
| | 6 | 60.7 | 30.7 | 0.7 | 7.9 | 0 | -9 | 60 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 50 | 27.2 | 2.9 | 19.9 | 0 | -2 | 2 | Any more suction and gas will deteriorate |
| | 2 | 58 | 30.3 | 2.1 | 9.6 | 0 | -10 | 50 | |
| | 3 | 67.5 | 21.7 | 2.5 | 8.3 | 0 | -16 | 80 | |
| | 4 | 55 | 30.2 | 2.4 | 12.4 | 0 | -9 | 5 | |
| | 5 | 64.7 | 28.1 | 1.8 | 5.4 | 0 | -2 | 3 | Any more suction and gas will deteriorate |
| | 6 | 52.6 | 25.7 | 4.2 | 17.5 | 3 | -4 | 5 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 58.5 | 31.5 | 0.7 | 9.3 | 0 | -15 | 60 | |
| | 2 | 26.8 | 12.9 | 12.1 | 48.2 | 0 | -16 | 60 | Wellhead to be cut to ground level due to settlement - integrity of cap maybe damaged or perforations close to surface |
| | 3 | 45.7 | 21.9 | 0.6 | 31.8 | 0 | -17 | 60 | |
| | 4 | 51.9 | 24.7 | 2.6 | 20.8 | 0 | -17 | 60 | |
| | 5 | 53.2 | 29.4 | 0.8 | 16.6 | 0 | -17 | 60 | |
| | 6 | 34.8 | 21.2 | 8.6 | 35.4 | 0 | -14.6 | 60 | Wellhead to be cut to ground level due to settlement - integrity of cap maybe damaged or perforations close to surface |
| | 7 | 55 | 27.8 | 0.4 | 16.8 | 0 | -11 | 60 | |
| | 8 | 53.6 | 28 | 1.3 | 17.1 | 0 | -16 | 60 | |
| | 9 | 54.5 | 27.9 | 0.8 | 16.8 | 4 | -15.5 | 60 | |
| | 10 | 52.5 | 26.8 | 2.4 | 18.3 | 0 | -15 | 60 | |
| | 11 | 56.7 | 23.8 | 0.3 | 19.2 | 0 | -16 | 60 | |
| | 12 | 48.9 | 27.9 | 1 | 22.2 | 0 | -18 | 60 | |
| | | | | | | | | | |
| Cells 17 | 1 | 42.9 | 28.6 | 6.1 | 22.4 | 0 | -13 | 50 | Over extraction - very shallow pin well possibly drawing in air through cap |
| | 2 | 48.5 | 34.1 | 0.5 | 16.9 | 0 | -13 | 60 | |
| | 3 | 57.8 | 39.6 | 1.2 | 1.4 | 3 | -12 | 80 | |
| | 4 | 56.6 | 37.4 | 1.8 | 4.2 | 0 | -12 | 80 | |
| | 5 | 58.8 | 39.3 | 0.2 | 1.7 | 0 | -11 | 60 | |
| | 6 | 55.3 | 35.9 | 0.3 | 8.5 | 0 | -13 | 90 | |
| | | | | | | | | | |
| Cells 18 | 1 | 55.8 | 40.4 | 0.4 | 3.4 | 0 | -11 | 50 | |
| | 2 | 56.3 | 37.1 | 1.6 | 5 | 0 | -12 | 40 | Increased suction |
| | 3 | 40.1 | 29.6 | 0.9 | 29.4 | 24 | -11 | 60 | Over extraction |
| | 4 | 55.3 | 37.1 | 1.6 | 6 | 0 | -10 | 60 | Increased suction |
| | 5 | 59.3 | 38.8 | 0.8 | 1.1 | 10 | -11 | 60 | Increased suction |
| | | | | | | | | | |
| Flare/Engine | | | | | | | | Total gas flow | |
| Flare/Engine | After | 47.2 | 31.6 | 2.3 | 18.9 | 1 | -22 | | 360m3/hr |

**Comments:**

Remedial works identified to be agreed with KCC.  Further investigations will be carried out to add to the scope of remedial works anticipated to be

New pressure meter used to read suction as a fault with the gas analyser for suction readings

Gas Analyser suction readings for Cells 15/16

## NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model Serial No GM09053
Date: 30/09/2015
Weather: Sunny intervals 1011mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 46.5 | 16 | 6 | 16 | 0 | -4 | 2 | Well over pulled too much suction applied to well |
| | 1.4 | 55 | 21 | 1 | 23 | 0 | -2 | 5 | |
| | | | | | | | | | |
| Cells 2 | 2.1 | 45 | 22 | 1.5 | 32 | 0 | -3 | 5 | |
| | 2.2 | 45 | 19 | 1.5 | 34 | 0 | -4 | 2 | |
| | 2.3 | 33 | 17 | 4 | 45 | 0 | -2 | 2 | |
| | | | | | | | | | |
| Cells 3 | 3.2 | 49 | 23 | 2.2 | 25 | 0 | -6 | 5 | |
| | 3.4 | 47 | 20 | 2.7 | 31 | 0 | -4 | 5 | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 48 | 24 | 2 | 25 | 0 | -12 | 60 | |
| | 4.3 | 55 | 25 | 0.5 | 18 | 0 | -2 | 2 | Exposed and checked pipework |
| | 4.4 | 36 | 23 | 1.5 | 40 | 0 | -2 | 5 | |
| | | | | | | | | | |
| Cells 5 | 5.1 | 57 | 27 | 1 | 14 | 0 | -3 | 2 | |
| | 5.2 | 56 | 21 | 0.3 | 22 | 0 | -5 | 2 | |
| | 5.3 | 54 | 25 | 1.9 | 18 | 0 | -1 | 2 | Valve replaced & f/l exposed to check for any dips |
| | 5.4 | 55 | 25 | 1.9 | 19 | 0 | -2 | 2 | |
| | | | | | | | | | |
| Cells 6 | 6.1 | 5 | 7 | 11 | 77 | 0 | -9 | 5 | Well over pulled needs new valve |
| | 6.2 | 47 | 23 | 0.8 | 30 | 0 | -8 | 2 | Realigned pipework |
| | 6.3 | 69 | 15 | 2 | 12 | 0 | -1 | 0 | Needs new valve |
| | 6.4 | 43 | 23 | 1.9 | 32 | 0 | 0 | 0 | Exposed f/l, realigned. No condensate blockage |
| | | | | | | | | | |
| Cells 7 | 7.1 | 0.1 | 4 | 19 | 76 | 0 | 0 | 0 | KCC design - perforated pipe close to surface drawing in air ingress |
| | 7.2 | 0.2 | 3.2 | 19.8 | 76.8 | 0 | 0 | 0 | Excavation needs to be backfilled by KCC |
| | 7.3 | 0.2 | 0.9 | 20 | 78 | 0 | 0 | 0 | Excavation needs to be backfilled by KCC |
| | 7.4 | 48 | 25.5 | 2 | 15 | 0 | -1 | 2 | |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | 45 | 29 | 1.8 | 24 | 0 | -6 | 15 | |
| | 8.2 | 45 | 27 | 2 | 26 | 1 | -5 | 5 | |
| | 8.3 | 62 | 31 | 0.3 | 6 | 0 | -1 | 5 | Needs new valve fitted |
| | 8.4 | 0.2 | 3.2 | 19.8 | 76.8 | 0 | 0 | 0 | Well capped- leachate at 2m bgl |
| | | | | | | | | | |
| Cells 9 | 9.1 | 62 | 23 | 0.6 | 5 | 0 | -1 | 1 | Pipe work fixed well on line |
| | 9.2 | 60 | 27 | 0.4 | 11 | 0 | -3 | 30 | |
| | 9.3 | 62 | 14 | 0.9 | 13 | 0 | 0 | 0 | Well is flooded |
| | 9.4 | 48 | 24 | 0.6 | 27 | 0 | -3 | 15 | |
| | 9.6 | 21 | 15 | 2 | 62 | 0 | 0 | 0% | Well fixed however still poor methane |
| | | | | | | | | | |
| Cells 10 | 10.2 | 49 | 17 | 1.6 | 32 | 0 | 0 | 0 | KCC design - perforated pipe close to surface drawing in air ingress |
| | 10.3 | 56 | 27 | 0.7 | 16 | 0 | -6 | 40 | |
| | 10.4 | 51 | 21 | 1.7 | 26 | 0 | -7 | 10 | |
| | 10.5 | 49 | 22 | 0.5 | 29 | 0 | -5 | 30 | |
| | 10.6 | 41 | 19 | 2 | 37 | 0 | -6 | 30 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 47 | 34 | 0.2 | 18 | 0 | -7 | 20 | |
| | 2 | 15 | 7 | 14 | 64 | 0 | -1 | 2 | To find well head would require road been excavated |
| | 3 | 56 | 33 | 2 | 8 | 0 | -8 | 20 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 12 | 1 | 0.6 | 3 | 19 | 77 | 0 | 0 | 0 | No pipe damage visual all pipe work intact |
| | 2 | 48 | 20 | 2 | 29 | 0 | -2 | 2 | Gas pipe work all fixed up to standard well producing methane now |
| | 3 | 39 | 22 | 1.6 | 37 | 0 | -8 | 2 | New test point fitted |
| | 4 | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 48 | 23 | 0.7 | 29 | 0 | -9 | 15 | Pipe work buried important not to over pull this well |
| | 2 | 67 | 29 | 1 | 3 | 0 | -6 | 25 | Any more suction and gas will deteriorate |
| | 3 | 55 | 27 | 0.8 | 18 | 0 | -12 | 90 | |
| | 4 | 45 | 23 | 1 | 32 | 0 | -6 | 50 | |
| | 5 | 43 | 27 | 0.8 | 30 | 0 | -4 | 2 | Important not to over pressurise well |
| | 6 | 50 | 27 | 0.7 | 23 | 0 | -8 | 50 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 26 | 14 | 12 | 47 | 0 | -2 | 2 | Well over pulled will have to reduce suction |
| | 2 | 58 | 27 | 1.5 | 13 | 0 | -12 | 60 | |
| | 3 | 63 | 26 | 1.9 | 8 | 0 | -13 | 80 | |
| | 4 | 54 | 30 | 2.4 | 14 | 0 | -10 | 15 | |
| | 5 | 64 | 29 | 1.7 | 4 | 0 | -4 | 3 | Any more suction and gas will deteriorate |
| | 6 | 54 | 29 | 2.7 | 14 | 6 | -6 | 10 | |
| | | | | | | | | | |
| | | | | | | | | | All wellheads lowered to ground level to allow condensate to drain freely |
| Cells 15/16 | 1 | 56 | 24 | 2 | 15 | 0 | -16 | 60 | & realigned trunk main to KOP |
| | 2 | 55 | 26 | 0.9 | 17 | 0 | -16 | 60 | Wellhead fixed |
| | 3 | 58 | 32 | 0.4 | 10 | 0 | -14 | 60 | |
| | 4 | 54 | 27 | 1.4 | 18 | 0 | -15 | 60 | |
| | 5 | 56 | 30 | 0.2 | 13 | 0 | -14 | 60 | |
| | 6 | 56 | 28 | 0.5 | 15 | 0 | -14.6 | 60 | Well head fixed |
| | 7 | 51 | 29 | 1.7 | 19 | 0 | -15 | 60 | |
| | 8 | 55 | 28 | 3 | 13 | 0 | -14 | 60 | |
| | 9 | 55 | 28 | 1.7 | 15 | 4 | -14 | 60 | |
| | 10 | 57 | 29 | 3 | 10 | 0 | -13 | 60 | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 11 | 44 | 19 | 1.8 | 36 | 0 | -15 | 60 | |
| | 12 | 60 | 32 | 0.2 | 9 | 0 | -15 | 60 | |
| | | | | | | | | | |
| Cells 17 | 1 | 45 | 28 | 4 | 21 | 0 | -12 | 50 | Over extraction - very shallow pin well possibly drawing in air through cap |
| | 2 | 54 | 35 | 0.6 | 10 | 0 | -12 | 60 | |
| | 3 | 51 | 35 | 1.2 | 12 | 3 | -12 | 80 | |
| | 4 | 52 | 32 | 0.7 | 16 | 0 | -12 | 80 | |
| | 5 | 54 | 40 | 0.2 | 6 | 0 | -11 | 60 | |
| | 6 | 57 | 37 | 1.6 | 4 | 0 | -12 | 90 | |
| | | | | | | | | | |
| Cells 18 | 1 | 57 | 35 | 1.3 | 6 | 0 | -12 | 50 | |
| | 2 | 57 | 39 | 0.8 | 3 | 0 | -12 | 40 | Increased suction |
| | 3 | 49 | 33 | 1.4 | 17 | 6 | -11 | 60 | |
| | 4 | 49 | 40 | 0.5 | 11 | 0 | -12 | 60 | Increased suction |
| | 5 | 58 | 37 | 1.2 | 2.6 | 4 | -11 | 60 | Increased suction |
| | | | | | | | | | |
| Flare/Engine | Before | 52 | 35 | 1.4 | 12 | 1 | -24 | Total gas flow | 320m3hr |
| Flare/Engine | After | 49 | 30 | 2 | 19 | 2 | -21 | | 330m3hr |

**Comments:**

Refer to N.Kerry Ops 15_Remedial Works Log

Pressure test carried out by third party contractor to check for blockages on pipeworks in Cells 1-12. Full suction can be applied to the whole gasfield network when valves fully open. Refer to Condensate Management Checklist for North Kerry.During pressure test exercise, methane quality reduced by 8% in 2hours at the gas plant with valves open suggesting 1) no condensate in lines 2) the gas is poor on a number of wells so with full suction, the gas is not sustainable 3) the gasfield is balanced to control gas, prevent underground fires in the waste mass by restricting oxygen ingress and optimise for gas utilisation.

**Outstanding Remedial Works inc:-**

1) New Valves for 5.2, 6.3, 6.4, 4.3 & 8.3
2) Connect main trunk to side riser on Cell 9/10
3) KCC to fill in excavations around 7.1, 7.2, 7.3 & 8.4
4) Pin wellheads to be lowered on 18/19 to improve condensate and pipe aligned to ensure condensate falls to PKOP
5) Connect main trunk to side riser on Cell 9/10

# NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model | Serial No GM09053
Date: 29/10/2015
Weather: Mild Dry 0973mb

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Comments |
|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 56 | 17 | 0.3 | 26 | 0 | -3 | 2 | Well over pulled too much suction applied to well |
| | 1.4 | 47 | 17 | 1.1 | 35 | 0 | -2 | 5 | |
| | | | | | | | | | |
| Cells 2 | 2.1 | 41 | 22 | 0.5 | 37 | 0 | -1 | 5 | |
| | 2.2 | 57 | 21 | 0.6 | 27 | 0 | -2 | 2 | |
| | 2.3 | 47 | 26 | 0.6 | 27 | 0 | -2 | 2 | |
| | | | | | | | | | |
| Cells 3 | 3.2 | 48 | 19 | 0.4 | 32 | 0 | -3 | 5 | |
| | 3.4 | 49 | 20 | 0.4 | 31 | 0 | -3 | 5 | |
| | | | | | | | | | |
| Cells 4 | 4.2 | 57 | 29 | 1.3 | 12.4 | 0 | -6 | 60 | |
| | 4.3 | 45 | 23 | 0.6 | 31 | 0 | -2 | 2 | |
| | 4.4 | 56 | 29 | 0.5 | 15 | 0 | -2 | 5 | |
| | | | | | | | | | |
| Cells 5 | 5.1 | 55 | 28 | 0.4 | 16 | 0 | -2 | 2 | |
| | 5.2 | 24 | 22 | 2 | 52 | 0 | -3 | 2 | |
| | 5.3 | 46 | 28 | 0.4 | 26 | 0 | -1 | 2 | Scheduled remedial works - Valve replaced. Full suction apparent when the valve is fully open. |
| | 5.4 | 38 | 21 | 0.5 | 40 | 0 | -2 | 2 | |
| | | | | | | | | | |
| Cells 6 | 6.1 | 45 | 23 | 0.8 | 32 | 0 | -2 | 5 | Well over pulled needs new valve. Valve is ordered |
| | 6.2 | 50 | 27 | 0.5 | 22 | 0 | -2 | 2 | Scheduled remedial works with pipe realigned. Full suction now apparent when then the valve is fully open |
| | 6.3 | 30 | 9 | 5 | 56 | 0 | -1 | 0 | Needs new valve.Valve is ordered |
| | 6.4 | 0.1 | 4 | 19 | 77 | 0 | 0 | 0 | Well needs excavated for further investigation. Possible cap defect - liase with KCC |
| | | | | | | | | | |
| Cells 7 | 7.1 | 0 | 2.1 | 21 | 77 | 0 | 0 | 0 | KCC design - perforated pipe close to surface drawing in air ingress |
| | 7.2 | 0 | 3.3 | 20 | 76 | 0 | 0 | 0 | Excavation needs to be backfilled by KCC |
| | 7.3 | 0.1 | 2.6 | 20 | 76 | 0 | 0 | 0 | Excavation needs to be backfilled by KCC |
| | 7.4 | 41 | 21 | 0.7 | 38 | 0 | -1 | 2 | |
| | 7.5 | | | | | | | | |
| | | | | | | | | | |
| Cells 8 | 8.1 | 45 | 29 | 1.8 | 24 | 0 | -6 | 15 | |
| | 8.2 | 45 | 27 | 2 | 26 | 1 | -5 | 5 | |
| | 8.3 | 47 | 25 | 0.7 | 27 | 0 | -1 | 5 | Needs new valve fitted.Valve is orederd |
| | 8.4 | 0 | 1.6 | 21 | 77 | 0 | 0 | 0 | Requires wellhead repair. Liase with KCC as the well is in a deep excavation |
| | | | | | | | | | |
| Cells 9 | 9.1 | 50 | 18 | 5 | 26 | 0 | -1 | 1 | Pipe work fixed well on line |
| | 9.2 | 44 | 23 | 0.5 | 32 | 0 | -11 | 30 | |
| | 9.3 | 73 | 15 | 2 | 10 | 0 | 0 | 0 | Well is flooded |
| | 9.4 | 54 | 27 | 0.3 | 19 | 0 | -9 | 15 | |
| | 9.6 | 46 | 24 | 1 | 29 | 0 | -1 | 2% | Gas quality has improved |
| | | | | | | | | | |
| Cells 10 | 10.2 | 70 | 11 | 1.1 | 18 | 0 | 0 | 0 | KCC design - perforated pipe close to surface drawing in air ingress. To liase with KCC |
| | 10.3 | 55 | 27 | 3 | 15 | 0 | -8 | 40 | |
| | 10.4 | 52 | 25 | 0.3 | 22 | 0 | -9 | 10 | |
| | 10.5 | 32 | 18 | 0.5 | 50 | 0 | -5 | 30 | |
| | 10.6 | 44 | 21 | 0.4 | 35 | 0 | -9 | 30 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 11 | 1 | 46 | 22 | 0.3 | 31 | 0 | -3 | 20 | |
| | 2 | 9 | 5 | 15 | 70 | 0 | -1 | 2 | To find well head would require road being excavated |
| | 3 | 55 | 30 | 14 | 14 | 0 | -7 | 20 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 12 | 1 | 0.2 | 2.5 | 20 | 76 | 0 | 0 | 0 | Scheduled remedial works. No pipe damage visual all pipe work intact. Liase with KCC on integrity of cap seal around the well |
| | 2 | 44 | 24 | 1.4 | 32 | 0 | -2 | 2 | Scheduled remedial works. Gas pipe work all fixed to standard. Well showing signs of producing CH4 |
| | 3 | 48 | 26 | 0.2 | 25 | 0 | -6 | 30 | |
| | 4 | | | | | | | | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 13 | 1 | 57 | 25 | 2.7 | 15 | 0 | -10 | 20 | Schedual remedial works. Pipe work buried important not to over pull this well. O2 ingress reduced |
| | 2 | 60 | 28 | 0.6 | 12 | 0 | -8 | 25 | Any more suction and gas will deteriorate |
| | 3 | 48 | 22 | 0.8 | 29.5 | 0 | -9 | 60 | Any more suction and gas will deteriorate |
| | 4 | 68 | 27 | 1.7 | 15 | 0 | -9 | 50 | Any more suction and gas will deteriorate |
| | 5 | 38 | 21 | 0.7 | 41 | 0 | -7 | 40 | Any more suction and gas will deteriorate |
| | 6 | 56 | 25 | 0.7 | 18 | 0 | -9 | 50 | Any more suction and gas will deteriorate |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 14 | 1 | 45 | 24 | 0.3 | 31 | 0 | -4 | 4 | |
| | 2 | 59 | 29 | 2.8 | 9 | 0 | -11 | 70 | |
| | 3 | 46 | 22 | 6 | 25 | 0 | -3 | 15 | Scheduled remedial works. No pipe damage visual all pipe work intact. Liase with KCC on integrity of cap seal around the well |
| | 4 | 53 | 28 | 2 | 17 | 0 | -11 | 15 | |
| | 5 | 57 | 31 | 1.5 | 10 | 0 | -8 | 10 | |
| | 6 | 52 | 28 | 1.2 | 18 | 3 | -8 | 10 | |
| | | | | | | | | | |
| | | | | | | | | | |
| Cells 15/16 | 1 | 56 | 27 | 3 | 13 | 0 | -13 | 60 | |
| | 2 | 59 | 28 | 0.4 | 13 | 0 | -13 | 60 | Scheduled remedial works. Wellhead fixed . O2 ingress reduced |
| | 3 | 49 | 28 | 0.6 | 22 | 0 | -13 | 60 | |
| | 4 | 50 | 28 | 0.6 | 22 | 0 | -12 | 60 | |
| | 5 | 50 | 22 | 0.3 | 28 | 0 | -12 | 60 | |
| | 6 | 46 | 24 | 0.7 | 29 | 0 | -3 | 5 | Scheduled remedial works. Wellhead fixed . O2 ingress reduced |
| | 7 | 52 | 31 | 1.6 | 16.6 | 0 | -3 | 5 | |
| | 8 | 57 | 35 | 0.4 | 7 | 0 | -12 | 60 | |
| | 9 | 61 | 29 | 0.2 | 10 | 4 | -11 | 60 | |
| | 10 | 58 | 31 | 2.7 | 8 | 0 | -13 | 60 | |
| | 11 | 52 | 25 | 0.1 | 23 | 0 | -10 | 60 | |
| | 12 | 68 | 35 | 0.3 | 0 | 0 | -13 | 60 | |
| | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cells 17 | 1 | 43 | 30 | 5 | 21 | 0 | -9 | 50 | Over extraction - very shallow pin well possibly drawing in air through cap associated pipe work all ok |
| | 2 | 47.4 | 35 | 0.6 | 16 | 0 | -10 | 60 | |
| | 3 | 57 | 41 | 0.9 | 0 | 3 | -10 | 80 | |
| | 4 | 58 | 39 | 0.9 | 1.7 | 0 | -10 | 80 | |
| | 5 | 51 | 36 | 0.2 | 12.6 | 0 | -9 | 60 | |
| | 6 | 55 | 38 | 2.2 | 4 | 0 | -10 | 90 | |
| | | | | | | | | | |
| Cells 18 | 1 | 51 | 36 | 0.4 | 13 | 0 | -10 | 50 | |
| | 2 | 51 | 37 | 0 | 12 | 0 | -10 | 40 | |
| | 3 | 57 | 40 | 1.1 | 0.8 | 6 | -10 | 60 | |
| | 4 | 49 | 37 | 0 | 13.4 | 0 | -10 | 60 | |
| | 5 | 57 | 40 | 1.2 | 1.1 | 4 | -11 | 60 | |
| | | | | | | | | | |
| Flare/Engine | Before | 45 | 30 | 2.8 | 22 | 1 | -17 | Total gas flow | 320m3hr |
| Flare/Engine | After | 50 | 32 | 1.4 | 16.4 | 3 | -18 | | 300m3hr |

**Comments:**

Remedial works carried out has seen an improvement with gas quality. Meeting with KCC 12/11/2015 to discuss combined KCC works with filling in excavations around wells identified above.

New pressure meter used to read suction as a fault with the gas analyser for suction readings

Gas Analyser suction readings for Cells 15/16

## NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model | Serial No GM09053

Date: 27/11/2015

Weather: Wind/Rain 1002

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Monitor at wellhead/flowline/manifold (w/f/m) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 53 | 22 | 4 | 21 | 0 | -2 | 2% | w | Well over pulled if too much suction applied to well |
| | 1.4 | 71 | 24 | 1.8 | 4 | 0 | -1 | 5% | w | |
| | | | | | | | | | | |
| Cells 2 | 2.1 | 48 | 25 | 0.7 | 26 | 0 | -2 | 5% | W | |
| | 2.2 | 6 | 14 | 6 | 74 | 0 | -1 | 2% | w | Well over pulled if too much suction applied to well. New valve fitted |
| | 2.3 | 41 | 25 | 0.9 | 33 | 0 | -1 | 2% | w | |
| | | | | | | | | | | |
| Cells 3 | 3.2 | 59 | 27 | 0.2 | 13 | 0 | -1 | 5% | w | |
| | 3.4 | 66 | 27 | 0.6 | 6 | 0 | -1 | 5% | w | |
| | | | | | | | | | | |
| Cells 4 | 4.2 | 54 | 27 | 3 | 14 | 0 | -2 | 60% | w | KCC to address issues |
| | 4.3 | 61 | 31 | 0.6 | 7 | 0 | -1 | 2% | w | |
| | 4.4 | 56 | 29 | 0.5 | 15 | 0 | -1 | 5% | W | |
| | | | | | | | | | | |
| Cells 5 | 5.1 | 41 | 28 | 0.5 | 31 | 0 | -1 | 2% | w | Excavated gas well all surface pipe work ok |
| | 5.2 | 38 | 22 | 1.7 | 39 | 0 | -1 | 2% | W | |
| | 5.3 | 3 | 3 | 19 | 74 | 0 | -2 | 2% | W | KCC design perforated pipe close to surface drawing in air ingress |
| | 5.4 | 56 | 27 | 0.6 | 16 | 0 | -2 | 2% | W | Excavation needs to be back filled by KCC |
| | | | | | | | | | | |
| Cells 6 | 6.1 | 14 | 14 | 6 | 66 | 0 | -1 | 5% | W | New valve fitted |
| | 6.2 | 49 | 24 | 0.6 | 26 | 0 | -2 | 2% | w | |
| | 6.3 | 10 | 3 | 18 | 69 | 0 | -1 | 2% | W | New valve fitted |
| | 6.4 | 0.2 | 3.8 | 18 | 78 | 0 | -1 | 1% | W | Well needs excavated for further investigation. Possible cap defect - KCC contractor to repair |
| | | | | | | | | | | Traced & exposed pipework and no condensate issues. |
| Cells 7 | 7.1 | 2 | 3 | 20 | 75 | 0 | 0 | 0 | W | KCC design perforated pipe close to surface drawing in air ingress |
| | 7.2 | 28 | 8 | 12 | 51 | 0 | 0 | 0 | W | Excavation needs to be backfilled by KCC |
| | 7.3 | 0.1 | 2.6 | 20 | 76 | 0 | 0 | 0 | W | Excavation needs to be backfilled by KCC |
| | 7.4 | 5 | 5 | 16 | 74 | 0 | -1 | 2 | W | |
| | 7.5 | | | | | | | | | |
| | | | | | | | | | | |
| Cells 8 | 8.1 | 42 | 28 | 1 | 29 | 0 | -1 | 15% | W | |
| | 8.2 | 47 | 28 | 2 | 26 | 1 | -5 | 5% | M | |
| | 8.3 | 55 | 30 | 0.7 | 14 | 0 | -1 | 5% | W | New valve fitted |
| | 8.4 | 0 | 1.6 | 21 | 77 | 0 | 0 | 0 | W | Requires wellhead repair. KCC contractor to repair as the well is in a deep excavation |
| | | | | | | | | | | |
| Cells 9 | 9.1 | 62 | 18 | 2.5 | 17 | 0 | -1 | 1% | W | |
| | 9.2 | 60 | 27 | 0.5 | 12 | 0 | -9 | 30% | w | |
| | 9.3 | 44 | 7 | 2 | 46 | 0 | -1 | 1% | w | |
| | 9.4 | 74 | 30 | 1.8 | 0 | 0 | -10 | 15% | W | |
| | 9.6 | 43 | 22 | 1 | 31 | 0 | -2 | 2% | W | |
| | | | | | | | | | | |
| Cells 10 | 10.2 | 41 | 5 | 16 | 53 | 0 | -1 | 1% | w | KCC design perforated pipe close to surface drawing in air ingress |
| | 10.3 | 62 | 18 | 1.8 | 18 | 0 | -9 | 40% | w | |
| | 10.4 | 44 | 20 | 0.5 | 36 | 0 | -8 | 10% | w | |
| | 10.5 | 42 | 22 | 1 | 35 | 0 | -8 | 30% | w | |
| | 10.6 | 53 | 22 | 5 | 20 | 0 | -9 | 30% | w | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 11 | 1 | 43 | 21 | 0.5 | 36 | 0 | -5 | 20 | W | |
| | 2 | 11 | 6 | 14 | 70 | 0 | -1 | 2% | w | To excavate well would require digging up road |
| | 3 | 55 | 28 | 1.8 | 14 | 0 | -6 | 20% | w | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 12 | 1 | 2 | 2 | 8 | 87 | 0 | 0 | 0 | M | Scheduled remedial works. No pipe damage visual all pipe work intact. Liase with KCC on integrity of cap seal around the well |
| | 2 | 33 | 23 | 0.6 | 44 | 0 | -2 | 2 | M | |
| | 3 | 35 | 25 | 0.8 | 39 | 0 | -7 | 30 | M | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 13 | 1 | 47 | 22 | 1.5 | 30 | 0 | -8 | 20 | M | |
| | 2 | 65 | 24 | 0.6 | 10 | | -7 | 25 | M | Any more suction and gas will deteriorate |
| | 3 | 51 | 18 | 0.6 | 30 | 0 | -7 | 60 | M | Any more suction and gas will deteriorate |
| | 4 | 45 | 18 | 0.6 | 36 | 0 | -7 | 50 | M | Any more suction and gas will deteriorate |
| | 5 | 51 | 17 | 0.3 | 32 | 0 | -3 | 4 | M | Any more suction and gas will deteriorate |
| | 6 | 61 | 26 | 0.6 | 11 | 0 | -7 | 50 | M | Any more suction and gas will deteriorate |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 14 | 1 | 26 | 17 | 11 | 45 | 0 | -2 | 4 | M | Well over pulled |
| | 2 | 65 | 24 | 0.6 | 10 | 0 | -10 | 70 | M | |
| | 3 | 51 | 18 | 0.6 | 36 | 0 | -3 | 15 | M | Important not to over pull gas well |
| | 4 | 45 | 18 | 0.6 | 36 | 0 | -10 | 15 | M | |
| | 5 | 51 | 17 | 0.3 | 32 | 0 | -9 | 10 | M | |
| | 6 | 61 | 26 | 0.6 | 11 | 2 | -3 | 3 | M | Over extraction will reduce gas quality |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 15/16 | 1 | 68 | 24 | 0.4 | 6 | 0 | -16 | 60 | W | KCC to carry out remedial works on the liner cap around the wells on Cells 15/16 |
| | 2 | 64 | 32 | 0.5 | 3 | 0 | -17 | 60 | W | |
| | 3 | 69 | 36 | 0.2 | 0 | 0 | -17 | 60 | W | |
| | 4 | 59 | 28 | 0.3 | 11 | 0 | -16 | 60 | W | |
| | 5 | 64 | 27 | 0.3 | 8 | 0 | -16 | 60 | W | |
| | 6 | 42 | 22 | 4 | 32 | 0 | -6 | 10 | W | Well needs further investigation |
| | 7 | 65 | 33 | 0.4 | 1 | 0 | -6 | 10 | W | |
| | 8 | 55 | 34 | 0.4 | 9 | 0 | -17 | 60 | W | |
| | 9 | 59 | 27 | 0.4 | 13 | 0 | -16 | 60 | W | |
| | 10 | 60 | 31 | 2.6 | 6 | 0 | -17 | 60 | W | |
| | 11 | 66 | 27 | 0.2 | 0 | 0 | -17 | 60 | W | |
| | 12 | 68 | 34 | 0.8 | 0 | 0 | -17 | 60 | W | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | |
| Cells 17 | 1 | 62 | 42 | 0.5 | 0 | 0 | -13 | 50 | W | New valve fitted |
| | 2 | 62 | 42 | 0.6 | 0 | 0 | -14 | 60 | W | |
| | 3 | 51 | 39 | 2.1 | 0 | 1 | -14 | 80 | W | |
| | 4 | 63 | 44 | 0.1 | 0 | 0 | -14 | 80 | W | |
| | 5 | 53 | 39 | 1.7 | 5 | 0 | -13 | 60 | W | |
| | 6 | 53 | 40 | 1.8 | 4 | 0 | -14 | 90 | W | |
| | | | | | | | | | | |
| Cells 18 | 1 | 59 | 40 | 0.7 | 0 | 0 | -16 | 50 | M | |
| | 2 | 59 | 43 | 0.2 | 0 | 0 | -15 | 40 | M | |
| | 3 | 53 | 39 | 2 | 5 | 0 | -15 | 60 | M | |
| | 4 | 63 | 44 | 0 | 0 | 0 | -15 | 60 | M | |
| | 5 | 54 | 40 | 1.2 | 4 | 0 | -15 | 60 | M | |
| | | | | | | | | | | |
| Valves | 1 | 28 | 18 | 3.2 | 51 | 1 | -1.5 | 1% | | Line 1 |
| | 2 | 26 | 16 | 2.8 | 58 | 0 | -1 | 1% | | Line 2 |
| | 3 | 52 | 34 | 1.6 | 12.4 | 1 | -18 | 40% | | Line 3 |
| | 4 | | | | | | | | | |
| | 5 | 41 | 23 | 2.4 | 33 | 1 | -12 | 30% | | Manifold 11/12 |
| | 6 | 46 | 26 | 1.4 | 27 | 0 | -10 | 60% | | Manifold 13 |
| | 7 | 42 | 21 | 3 | 34 | 1 | -13 | 80% | | Manifold 14 |
| | 8 | 48 | 30 | 2.8 | 19.2 | 0 | -12 | 30% | | Mainline cell 15 |
| | 9 | 49 | 32 | 1.6 | 17.3 | 0 | -14 | 80% | | Cell 9&10 |
| | 10 | 58 | 40 | 1 | 1 | 2 | -14 | 60% | | Mainline 17 |
| | 11 | 55 | 38 | 0.5 | 3.5 | 0 | -16 | 100% | | Manifold 18 |
| | | | | | | | | | | |
| Flare/Engine | Before | 47 | 32 | 2.6 | 18 | 2 | -25 | 300m3hr | | |
| Flare/Engine | After | 53 | 34 | 1 | 12 | 3 | -21 | 285m3hr | | |

**Comments:**

## NORTH KERRY LANDFILL GAS EXTRACTION WELL MONITORING

Model Serial No GM09053
Date: 30/12/2015
Weather: Wind/Rain 986

| Cell | Well | CH4 (%) | CO2 (%) | O2 (%) | Balance (%) | CO (ppm) | Static Pressure (mb) | Valve Pos (%) | Monitor at wellhead/flowline/manifold (w/f/m) | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| Cells 1 | 1.3 | 51 | 18 | 0.4 | 30 | 0 | -1 | 2% | w | Well over pulled |
| | 1.4 | 50 | 17 | 1.8 | 31 | 0 | -1 | 5% | w | |
| | | | | | | | | | | |
| Cells 2 | 2.1 | 58 | 23 | 1.3 | 17 | 0 | -1 | 5% | W | |
| | 2.2 | 69 | 27 | 1.4 | 2.9 | 0 | -1 | 2% | w | |
| | 2.3 | 38 | 17 | 0.9 | 44 | 0 | -1 | 2% | w | |
| | | | | | | | | | | |
| Cells 3 | 3.2 | 48 | 19 | 0.6 | 33 | 0 | -1 | 5% | w | |
| | 3.4 | 46 | 19 | 0.5 | 34 | 0 | -1 | 5% | w | |
| | | | | | | | | | | |
| Cells 4 | 4.2 | 38 | 20 | 8 | 33 | 0 | -6 | 60% | w | KCC to address issues |
| | 4.3 | 44 | 24 | 1.4 | 31 | 0 | -1 | 2% | w | |
| | 4.4 | 47 | 20 | 0.8 | 33 | 0 | -1 | 5% | w | |
| | | | | | | | | | | |
| Cells 5 | 5.1 | 41 | 20 | 0.5 | 38 | 0 | -1 | 2% | w | Excavated gas well all surface pipe work ok |
| | 5.2 | 13 | 15 | 7 | 65 | 0 | -1 | 2% | W | |
| | 5.3 | 9 | 5 | 19 | 68 | 0 | -1 | 2% | W | KCC design perforated pipe close to surface drawing in air ingress |
| | 5.4 | 38 | 19 | 0.5 | 43 | 0 | -1 | 2% | W | Excavation needs to be backfilled by KCC |
| | | | | | | | | | | |
| Cells 6 | 6.1 | 9 | 14 | 1.7 | 75 | 0 | -1 | 5% | W | |
| | 6.2 | 36 | 19 | 0.4 | 45 | 0 | -1 | 2% | w | |
| | 6.3 | 29 | 9 | 3 | 58 | 0 | -1 | 2% | W | |
| | 6.4 | 2 | 3.8 | 20 | 74 | 0 | -1 | 1% | W | Well needs excavated for further investigation. Possible cap defect - KCC contractor to repair |
| | | | | | | | | | | Traced & exposed pipework and no condensate issues. |
| Cells 7 | 7.1 | 1 | 5 | 20 | 78 | 0 | 0 | 0 | W | KCC design perforated pipe close to surface drawing in air ingress |
| | 7.2 | 19 | 5 | 13 | 61 | 0 | 0 | 0 | W | Excavation needs to be backfilled by KCC |
| | 7.3 | 21 | 6 | 7 | 65 | 0 | 0 | 0 | W | Excavation needs to be backfilled by KCC |
| | 7.4 | 21 | 6 | 7 | 66 | 0 | -1 | 2 | W | |
| | 7.5 | | | | | | | | | |
| | | | | | | | | | | |
| Cells 8 | 8.1 | 44 | 29 | 1 | 26 | 0 | -1 | 15% | W | |
| | 8.2 | 42 | 26 | 2 | 30 | 1 | -6 | 5% | M | |
| | 8.3 | 40 | 26 | 0.7 | 33 | 0 | -1 | 5% | W | |
| | 8.4 | 0 | 1.6 | 21 | 77 | 0 | 0 | 0 | W | Requires wellhead repair. KCC contractor to repair as the well is in a deep excavation |
| | | | | | | | | | | |
| Cells 9 | 9.1 | 60 | 19 | 0.7 | 21 | 0 | -1 | 1% | W | |
| | 9.2 | 61 | 26 | 0.5 | 12 | 0 | -10 | 30% | w | |
| | 9.3 | 38 | 6 | 2.6 | 53 | 0 | 0 | 0% | w | |
| | 9.4 | 53 | 18 | 5 | 0 | 0 | -10 | 15% | W | |
| | 9.6 | 46 | 25 | 1 | 27 | 0 | -2 | 2% | W | |
| | | | | | | | | | | |
| Cells 10 | 10.2 | 58 | 28 | 2 | 12 | 0 | -1 | 1% | w | KCC design perforated pipe close to surface drawing in air ingress |
| | 10.3 | 55 | 18 | 2 | 24 | 0 | -6 | 40% | w | |
| | 10.4 | 71 | 26 | 2 | 2 | 0 | -4 | 10% | w | |
| | 10.5 | 51 | 23 | 2 | 24 | 0 | -6 | 30% | w | |
| | 10.6 | 54 | 21 | 0.2 | 25 | 0 | -5 | 30% | w | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 11 | 1 | 63 | 30 | 2 | 6 | 0 | -7 | 20 | W | |
| | 2 | 17 | 9 | 12 | 62 | 0 | -1 | 1% | w | To excavate well would require digging up road |
| | 3 | 61 | 31 | 1.8 | 6 | 0 | -8 | 20% | w | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 12 | 1 | 2 | 1.4 | 19 | 78 | 0 | 0 | 0 | M | KCC design perforated pipe close to surface drawing in air ingress |
| | 2 | 20 | 12 | 9 | 59 | 0 | -2 | 2 | M | Over pulled gas well |
| | 3 | 23 | 18 | 5 | 54 | 0 | -7 | 30 | M | Flooded gas field |
| | 4 | | | | | | | | | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 13 | 1 | 58 | 24 | 1 | 17 | 0 | -10 | 20 | M | |
| | 2 | 61 | 28 | 1 | 9 | | -9 | 25 | M | |
| | 3 | 60 | 22 | 0.8 | 17 | 0 | -9 | 60 | M | |
| | 4 | 56 | 26 | 0.2 | 18 | 0 | -9 | 50 | M | |
| | 5 | 62 | 22 | 0.2 | 15.5 | 0 | -2 | 4 | M | |
| | 6 | 61 | 25 | 0.9 | 12 | 0 | -8 | 50 | M | |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 14 | 1 | 23 | 12 | 13 | 51 | 0 | -1 | 4 | M | Well over pulled |
| | 2 | 45.5 | 22 | 0.4 | 32 | 0 | -6 | 70 | M | |
| | 3 | 61 | 22 | 0.2 | 16.2 | 0 | -5 | 15 | M | Important not to over pull gas well |
| | 4 | 58 | 28 | 0.7 | 13 | 0 | -7 | 15 | M | |
| | 5 | 62 | 26 | 0.5 | 11 | 0 | -8 | 10 | M | |
| | 6 | 68 | 33 | 0.7 | 0 | 2 | -4 | 6 | M | Over extraction will reduce gas quality |
| | | | | | | | | | | |
| | | | | | | | | | | |
| Cells 15/16 | 1 | 61 | 28 | 2 | 8 | 0 | -14 | 60 | W | KCC to carry out remedial works on the liner cap around the wells on Cells 15/16 |
| | 2 | 68 | 30 | 1.7 | 0 | 0 | -13 | 60 | W | |
| | 3 | 57 | 35 | 0.6 | 7 | 0 | -13 | 60 | W | |
| | 4 | 72 | 33 | 0.4 | 0 | 0 | -14 | 60 | W | |
| | 5 | 63 | 25 | 0.4 | 10.8 | 0 | -14 | 60 | W | |
| | 6 | 64 | 30 | 0.3 | 5 | 0 | -5 | 10 | W | Well needs further investigation |
| | 7 | 52 | 24 | 2.2 | 22 | 0 | -5 | 10 | W | |
| | 8 | 57 | 28 | 0.3 | 13.8 | 0 | -14 | 60 | W | |
| | 9 | 58 | 25 | 0.5 | 16 | 0 | -13 | 60 | W | |
| | 10 | 53 | 29 | 3 | 14 | 0 | -13 | 60 | W | |
| | 11 | 58 | 23 | 0.3 | 17 | 0 | -14 | 60 | W | |
| | 12 | 61 | 33 | 0.5 | 0 | 0 | -13 | 60 | W | |
| | | | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Cells 17 | 1 | 53 | 39 | 0.4 | 0 | 0 | -10 | 50 | W | |
| | 2 | 60 | 39 | 0.6 | 0 | 0 | -11 | 60 | W | |
| | 3 | 37 | 31 | 5 | 0 | 1 | -9 | 80 | W | Gas well over pulled |
| | 4 | 62 | 42 | 0.4 | 0 | 0 | -10 | 80 | W | |
| | 5 | 43 | 35 | 1.7 | 5 | 0 | -11 | 60 | W | |
| | 6 | 40 | 35 | 1.8 | 23 | 0 | -11 | 90 | W | |
| | | | | | | | | | | |
| Cells 18 | 1 | 52 | 37 | 1.4 | 9 | 0 | -12 | 50 | M | |
| | 2 | 52 | 39 | 1 | 7 | 0 | -10 | 40 | M | |
| | 3 | 49 | 36 | 2 | 12 | 0 | -10 | 60 | M | |
| | 4 | 53 | 38 | 0.1 | 0 | 0 | -9 | 60 | M | |
| | 5 | 44 | 34 | 3 | 18 | 0 | -10 | 60 | M | |
| | | | | | | | | | | |
| Valves | 1 | 44 | 23 | 2.5 | 31 | 1 | -0.7 | 1% | | Line 1 |
| | 2 | 46 | 22 | 2.3 | 28 | 0 | -0.8 | 1% | | Line 2 |
| | 3 | 48 | 30 | 1 | 21 | 1 | -16 | 40% | | Line 3 |
| | 4 | 36 | 21 | 4.1 | 38 | 1 | -9 | 30% | | Manifold 11/12 |
| | 5 | 52 | 31 | 1 | 16 | 0 | -12 | 60% | | Manifold 13 |
| | 6 | 43 | 23 | 3 | 31 | 1 | -9 | 80% | | Manifold 14 |
| | 7 | 52 | 33 | 2.4 | 13 | 0 | -15 | 30% | | Mainline cell 15 |
| | 8 | 44 | 29 | 1 | 26 | 0 | -15 | 80% | | Cell 9&10 |
| | 9 | 46 | 33 | 2 | 19 | 2 | -13 | 60% | | Mainline 17 |
| | 10 | 56 | 38 | 1 | 5 | 0 | -13 | 100% | | Manifold 18 |
| | | | | | | | | | | |
| Flare/Engine | Before | 45 | 30 | 3 | 22 | 3 | -27 | 270m3hr | | Gasfield flooded reduction in gas flow and quality - therefore gas flare output reduced |
| Flare/Engine | After | 53 | 34 | 1 | 12 | 3 | -21 | 260m3hr | | |

**Comments:**

# *Appendix F: Dust Monitoring*

southern scientific services ltd.



## ANALYSIS REPORT

| | | | |
|---|---|---|---|
| **CUSTOMER:** | **KERRY COUNTY COUNCIL** | **SAMPLE TYPE:** | **BERGERHOFF DUST GAUGE** |
| **ADDRESS:** | Environment Section, Maine Street, Tralee, County Kerry | **CONDITION OF SAMPLE ON RECEIPT:** | Satisfactory |
| | | **DATE SAMPLED:** | 30 December 2015 – 30 January 2016 |
| **REPORT TO:** | **PAUL O CONNELL** | **DATE RECEIVED:** | 02 February 2016 |
| **SAMPLED BY:** | John Paul Mannix | **DATE ANALYSED:** | 03 – 15 February 2016 |
| **SAMPLING PT:** | **NORTH KERRY LANDFILL** | **DATE REPORTED:** | 15 February 2016 |
| **ORDER NO:** | **-** | **WORK NO.:** | **34541 C** |

## TABLE OF RESULTS

| Method: | Lab Ref: | Your Ref: | **TOTAL PARTICULATES mg /m$^2$ / day** | **INORGANIC PARTICULATES mg /m$^2$ / day** |
|---|---|---|---|---|
| SCP 039 | C16-Feb 038 | D1 | 432 | 133 |
| SCP 039 | C16-Feb 039 | D2 | 133 | 98 |
| SCP 039 | C16-Feb 040 | D3 | 148 | 95 |
| SCP 039 | C16-Feb 041 | D4 | 100 | 100 |

Jennifer Keane

Jennifer Keane
**Chemistry Laboratory Manager**

- **The results relate only to the items tested.**
- **The analysis report shall not be reproduced except in full without written approval of the laboratory.**

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registered in ireland no 323196 | vat reg no IE 6343196 M

**COMMENT:**

**D1 – C16-Feb 038**

There is a possibility that this collector gauge was contaminated on-site prior to collection. The collector gauge contained clear water and a large amount of black organic matter and brown particulates.
The dried dish contained a large amount of brown residue. The ashed dish contained a large amount of brown particulates. The ashed residue underwent no effervescence on addition of acid indicting the absence of carbonate in the residue.

**In accordance to standard laboratory practice a blank sample and a QC standard were analysed with the batch of samples.**

# Appendix G: Noise Monitoring

# 4. Results

## 4.1 Environmental Conditions on the 25th February 2016

| Cloud Cover | Precipitation | Wind Direction | Av. wind speed @2m | Av. temperature |
|---|---|---|---|---|
| 60% | 0mm | South Westerly | Variable <0.5 – 1.7/s | 3ºC |

## 4.2 Noise Survey Results on the 25th February 2016

| I.D. | Start Time | $L_{Aeq\ (30\ mins)}$ dB | $L_{AF10\ (30\ mins)}$ dB | $L_{AF90\ (30\ mins)}$ dB |
|---|---|---|---|---|
| N1 | 11:44 | 35.3 | 32.9 | 25.2 |
| **Noise Sources:** Background noise included water flow from lagoon, this was most dominant noise source. Birdsong and rustling vegetation, traffic faintly audible from main road, occasional traffic on adjacent local road were also detected in background. An airplane was noted passing overhead at 12:00. Noise associated with the adjacent windfarm turbines was continuous but very faint in the background. No site activity was noted. | | | | |
| N2 | 12:19 | 32.6 | 32.9 | 28.9 |
| **Noise Sources:** Noise associated with turbines on adjacent windfarm was continuous and most dominant noise source at this location. Background noise included birdsong. No site activity was noted at this location. | | | | |
| N3 | 12:55 | 36.8 | 39.2 | 33.2 |
| **Noise Sources:** Internal site traffic was noted at this monitoring location. Leachate was being pumped for 10minutes into tankard and then truck engine started up and truck exited vicinity. Noise associated with the adjacent windfarm turbines was continuous in the background. Other background noise included birdsong. External road traffic in the distance to the west of site could be heard. | | | | |
| E1 | 09:47 | 33.1 | 34.1 | 31.0 |
| **Noise Sources:** Main noise source at this monitoring location was flowing water in adjacent stream. Main road traffic was faintly audible. Local road traffic included 1 No. van. Background noise included birdsong and rustling vegetation in breeze. Noise associated with the adjacent windfarm turbines was faint but continuous in the background. | | | | |
| E2 | 10:23 | 54.2 | 39.8 | 29.8 |
| **Noise Sources:** Passing traffic on the public road included 6No. Cars, 2 No. vans and 1 No. jeep. Background noise included, rustling vegetation in breeze, flowing water in nearby ditch and birdsong. Intermittently a chainsaw was noted in the background at a distance. | | | | |
| E3 | 10:58 | 53.0 | 48.0 | 31.9 |
| **Noise Sources:** Passing traffic on the public road included 11No. Cars, 4No. Vans. and 1No. Jeep. No traffic entered or exited the landfill during this monitoring event. Background noise included wind-derived noise from adjacent forestry trees, other rustling vegetation and birdsong. Noise associated with the adjacent windfarm turbines was faint but continuous and louder than at point E1. | | | | |

## *Appendix H: Landfill Gas Survey 2015*

# A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2015

| | | |
|---|---|---|
| Please choose from the drop down menu the license number for your site | W0004 | |
| Please choose from the drop down menu the name of the landfill site | North Kerry | |
| Please enter the number of flares operational at your site in 2015 | 1 | |
| Please enter the number of engines operational at your site in 2015 | 1 | |
| Total methane flared | 340,683 | kg/year |
| Total methane utilised in engines | 436,612 | kg/year |

**Please note that the closing date for reciept of completed surveys is 31/03/2016**

**Introduction**

The Office of Environmental Sustainability (OES) of the Environmental Protection Agency acts as the inventory agency in Ireland with responsibility for compiling and reporting national greenhouse gas inventories to the European Commission and the United Nations Framework Convention on Climate Change. In addition to meeting international commitments Ireland's national greenhouse gas inventory informs national agencies and Government departments as they face the challenge to curb emissions and meet Ireland's emission reduction targets under the Effort Sharing Decision (No. 406/2009/EC). The national inventory also informs data suppliers, making them aware of the importance of their contributions to the inventory process and a means of identifying areas where input data may be improved.

It is on this basis that the Environmental Protection Agency is asking landfill operators to partake in this survey so that the most uptodate information on methane flaring and recovery in utilisation plants at landfills sites is used in calculating the contribution of the landfill sector to national greenhouse gas emissions

The Environmental Protection Agency wishes to thank you for partaking in this survey. If you have any questions about the survey and how to complete it please view the "Help sheet" worksheet. If however, your query is not answered by viewing the "Help sheet" worksheet please contact:
LFGProject@epa.ie

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2015) to:
LFGProject@epa.ie

| | to be filled in by licensee | | calculated by spreadsheet |
|---|---|---|---|

**Flare No. 1**

| | | | |
|---|---|---|---|
| **Flare type ?** | Other | **Biogas 500m3/hr Modular Ground Flare** | |
| **Is the flare an open or enclosed flare ?** | Enclosed | **Rated flare capacity ?** Select | **m3/hr** |
| **Month /year comissioned ?** | January | 2012 | |
| **Month decomissioned if decomissioned in 2015 ?** | Select | | |
| **What is the function of the flare ?** | Back-up to engines | **If "other" enter flare function here** | |

| **Monthly** | Method M/C/E | Runtime days/month | Runtime hrs/day | Downtime hrs | Total runtime hrs/month | Average Inlet Pressure (mbg) | Average Flow Rate ($m^3$/hr) | Average $CH_4$ %v/v | Average $CO_2$ %v/v | Average $O_2$ %v/v | Combustion efficiency (%) | Total $CH_4$ $m^3$ | Total $CH_4$ kgs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | C | 31 | 24.0 | 257.0 | 487 | -26 | 120 | 48.00 | 30.00 | 2.00 | 98.0 | 27,490 | 18,494 |
| February | C | 28 | 24.0 | 270.0 | 402 | -22 | 100 | 50.00 | 31.00 | 2.40 | 98.0 | 19,698 | 13,305 |
| March | C | 31 | 24.0 | 150.0 | 594 | -22 | 120 | 47.00 | 29.00 | 1.80 | 98.0 | 32,832 | 22,176 |
| April | C | 30 | 24.0 | 8.0 | 712 | -27 | 140 | 48.00 | 31.00 | 2.10 | 98.0 | 46,889 | 31,512 |
| May | C | 31 | 24.0 | 12.0 | 732 | -24 | 140 | 52.00 | 36.00 | 1.00 | 98.0 | 52,224 | 35,204 |
| June | C | 30 | 24.0 | 55.0 | 665 | -21 | 110 | 44.00 | 28.00 | 2.50 | 98.0 | 31,542 | 21,327 |
| July | C | 31 | 24.0 | 19.0 | 725 | -23 | 140 | 48.00 | 30.00 | 2.00 | 98.0 | 47,746 | 32,218 |
| August | C | 31 | 24.0 | 20.0 | 724 | -21 | 150 | 50.00 | 31.00 | 2.00 | 98.0 | 53,214 | 35,980 |
| September | C | 30 | 24.0 | 13.0 | 707 | -18 | 140 | 52.00 | 34.00 | 1.40 | 98.0 | 50,440 | 34,208 |
| October | C | 31 | 24.0 | 7.0 | 737 | -26 | 150 | 51.00 | 33.00 | 1.20 | 98.0 | 55,253 | 37,170 |
| November | C | 30 | 24.0 | 34.0 | 686 | -28 | 135 | 49.00 | 34.00 | 1.40 | 98.0 | 44,471 | 29,857 |
| December | C | 31 | 24.0 | 44.0 | 700 | -30 | 120 | 53.00 | 35.00 | 1.10 | 98.0 | 43,630 | 29,232 |
| Total | | | | | 7,871 | | | | | | | 505,429 | 340,683 |

**Please note: Only fill the "Yearly" table if data is not availabe or cannot be calculated nor estimated on a monthly basis**

| **Yearly** | Method M/C/E | Runtime days/year | Runtime hrs/day | Downtime hrs | Total runtime hrs/year | Average Inlet Pressure (mbg) | Average Flow Rate $m^3$/hr | Average $CH_4$ %v/v | Average $CO_2$ %v/v | Average $O_2$ %v/v | Combustion efficiency (%) | Total $CH_4$ $m^3$ | Total $CH_4$ kgs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2015** | | | | | 0 | | | | | | | 0 | 0 |

| | to be filled in by licensee | | calculated by spreadsheet | |
|---|---|---|---|---|

**Engine No. 1**

| | | |
|---|---|---|
| **Engine type ?** | Other | **Jenbacher J208 GS** |
| **Month /year comissioned ?** | November | 2011 |
| **Month decomissioned if decomissioned in 2015 ?** | Select | |

| **Monthly** | Method M/C/E | Runtime days/month | Runtime hrs/day | Downtime hrs | Total runtime hrs/month | Average Inlet Pressure (mbg) | Average Flow Rate ($m^3$/hr) | Average $CH_4$ %v/v | Average $CO_2$ %v/v | Average $O_2$ %v/v | Combustion efficiency (%) | Total $CH_4$ $m^3$ | Total $CH_4$ kgs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| January | M | 31 | 24 | 33 | 711 | -26 | 160 | 48.00 | 30.00 | 2.00 | 98.0 | 53,513 | 36,000 |
| February | M | 28 | 24 | 29 | 643 | -22 | 155 | 50.00 | 31.00 | 2.40 | 98.0 | 48,836 | 32,987 |
| March | M | 31 | 24 | 12 | 732 | -22 | 165 | 47.00 | 29.00 | 1.80 | 98.0 | 55,631 | 37,577 |
| April | M | 30 | 24 | 0 | 720 | -27 | 160 | 48.60 | 31.50 | 2.10 | 98.0 | 54,867 | 36,874 |
| May | M | 31 | 24 | 19 | 725 | -24 | 150 | 52.00 | 36.00 | 1.00 | 98.0 | 55,419 | 37,358 |
| June | M | 30 | 24 | 2 | 718 | -21 | 180 | 44.00 | 28.00 | 2.50 | 98.0 | 55,728 | 37,680 |
| July | M | 31 | 24 | 26 | 718 | -23 | 165 | 48.00 | 30.00 | 2.00 | 98.0 | 55,728 | 37,604 |
| August | M | 31 | 24 | 110 | 634 | -21 | 160 | 50.00 | 31.00 | 2.00 | 98.0 | 49,706 | 33,608 |
| September | M | 30 | 24 | 9 | 711 | -18 | 155 | 52.00 | 34.00 | 1.40 | 98.0 | 56,160 | 38,087 |
| October | M | 31 | 24 | 0 | 744 | -32 | 150 | 51.00 | 33.00 | 1.20 | 98.0 | 55,778 | 37,295 |
| November | M | 30 | 24 | 2 | 718 | -38 | 155 | 49.00 | 34.00 | 1.40 | 98.0 | 53,441 | 35,515 |
| December | M | 31 | 24 | 30 | 714 | -30 | 145 | 53.00 | 35.00 | 1.10 | 98.0 | 53,773 | 36,029 |
| Total | | | | | 8,488 | | | | | | | 648,582 | 436,612 |

**Please note: Only fill the "Yearly" table if data is not availabe or cannot be calculated nor estimated on a monthly basis**

| **Yearly** | Method M/C/E | Runtime days/year | Runtime hrs/day | Downtime hrs | Total runtime hrs/year | Average Inlet Pressure (mbg) | Average Flow Rate $m^3$/hr | Average $CH_4$ %v/v | Average $CO_2$ %v/v | Average $O_2$ %v/v | Combustion efficiency (%) | Total $CH_4$ $m^3$ | Total $CH_4$ kgs |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **2015** | | | | | 0 | | | | | | 98.0 | 0 | 0 |

# *Appendix I: PRTR Report 2015*

| PRTR# : W0001 | Facility Name : North Kerry Landfill Site | Filename : W0001_2015.xls | Return Year : 2015 |

Guidance to completing the PRTR workbook

# PRTR Returns Workbook

Version 1.1.19

| | |
|---|---|
| **REFERENCE YEAR** | 2015 |

### 1. FACILITY IDENTIFICATION

| | |
|---|---|
| Parent Company Name | Kerry County Council |
| Facility Name | North Kerry Landfill Site |
| PRTR Identification Number | W0001 |
| Licence Number | W0001-04 |

Classes of Activity

| **No.** | **class_name** |
|---|---|
| - | Refer to PRTR class activities below |

| | |
|---|---|
| Address 1 | Muingnaminnane |
| Address 2 | Tralee |
| Address 3 | |
| Address 4 | |
| | |
| | Kerry |
| Country | Ireland |
| Coordinates of Location | -6.85099 54.1736 |
| River Basin District | IEGBNISH |
| NACE Code | 3821 |
| Main Economic Activity | Treatment and disposal of non-hazardous waste |
| **AER Returns Contact Name** | David Donegan |
| **AER Returns Contact Email Address** | david.donegan@kerrycoco.ie |
| **AER Returns Contact Position** | Assistant Engineer |
| **AER Returns Contact Telephone Number** | 0667162000 |
| **AER Returns Contact Mobile Phone Number** | 0879218946 |
| **AER Returns Contact Fax Number** | |
| **Production Volume** | 0.0 |
| **Production Volume Units** | |
| **Number of Installations** | 0 |
| **Number of Operating Hours in Year** | 0 |
| **Number of Employees** | 1 |
| **User Feedback/Comments** | |
| **Web Address** | |

### 2. PRTR CLASS ACTIVITIES

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

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

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

### 4. WASTE IMPORTED/ACCEPTED ONTO SITE

Guidance on waste imported/accepted onto site

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

**4.1 RELEASES TO AIR** Link to previous years emissions data | PRTR# : W0001 | Facility Name : North Kerry Landfill Site | Filename : W0001_2015.xls | Return Year : 2015 | 31/03/2016 11:43

**SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS**

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

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

**SECTION B : REMAINING PRTR POLLUTANTS**

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

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

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

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

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

## Additional Data Requested from Landfill operators

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

**Landfill:** North Kerry Landfill Site

| **Please enter summary data on the quantities of methane flared and / or utilised** | **T (Total) kg/Year** | **M/C/E** | **Method Used** – **Method Code** | **Method Used** – **Designation or Description** | **Facility Total Capacity m3 per hour** | |
|---|---|---|---|---|---|---|
| Total estimated methane generation (as per site model) | 1080023.0 | E | oth | Gassim 2.5 | N/A | |
| Methane flared | 340683.0 | C | oth | Calculated | 500.0 | (Total Flaring Capacity) |
| Methane utilised in engine/s | 436612.0 | M | oth | Calculated | 200.0 | (Total Utilising Capacity) |
| Net methane emission (as reported in Section A above) | 302728.0 | E | oth | Calculated | N/A | |

**5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE** | PRTR# : W0001 | Facility Name : North Kerry Landfill Site | Filename : W0001_2015.xls | Return Year : 2015 | 31/03/2016 11:44

**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: Name and Licence/Permit No of Recover/Disposer | Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer | Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY) | Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | M/C/E | Method Used | | | | | |
| **Within the Country** | **19 07 03** | **No** | 44029.28 | Landfill leachate other than those mentioned in 19 07 02 | D8 | M | Weighed | Offsite in Ireland | Finucane Burke Haulage,WCP-CK-09-0691-01 | Tralee Wastewater Treatment Plant,The Kerries,Tralee ,Co Kerry,Ireland | | |

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

## *Appendix J: Hydrological Review/Technical Assessment Report*


# HYDROLOGICAL REVIEW/TECHNICAL ASSESSMENT REPORT ON THE NORTH KERRY LANDFILL FOR THE ENVIRONMENTAL PROTECTION AGENCY

## W0001-04 (IED)

## KERRY COUNTY COUNCIL

## January 2016

FEHILY TIMONEY & COMPANY

| | |
|---|---|
| **Project Title:** | **Hydrological Review/Technical Assessment Report for the North Kerry Landfill** |
| **License No.:** | **W0001-04 (IED)** |
| **Project No:** | **LW15-017-04** |
| **Status:** | **For approval** |
| **Client:** | **Kerry County Council** |
| **Client Details:** | **Mr. David Donegan, Kerry County Council** |
| **Issued by:** | **Fehily Timoney & Company** |

**User is Responsible for Checking the Revision Status of This Document**

| Rev. Nr. | Description of Changes | Prepared by: | Checked by: | Approved by: | Date: |
|---|---|---|---|---|---|
| 0 | Issue to Client | SG/MG | BG | BG | 18.01.2016 |

**Client:** Kerry County Council

**Keywords:** North Kerry Landfill, Groundwater, Risk Assessment

**Abstract:** This report assesses the risk to groundwater from the North Kerry Landfill and makes recommendations in accordance with the EPA Guidance on the Authorisation of Discharges to Groundwater.

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# 1 INTRODUCTION

Fehily Timoney and Company was retained by Kerry County Council (KCC) to carry out a Groundwater Risk Assessment for the North Kerry Landfill, Muingnaminnane, Tralee, Co. Kerry, IED license no. W0001-04, in response to condition 8.16 of technical amendment A of the license which states:

> *"Within 18 months of the date of this technical amendment, the licensee shall carry out a risk screening and where necessary a technical assessment in accordance with the Guidance on the Authorisation of Discharges to Groundwater, published by the Environmental Protection Agency. A report on the outcome of the screening and where relevant the recommendations of the technical assessment in relation to the setting of groundwater compliance points and values, shall be included in the next AER. Any actions required to demonstrate compliance with the European Communities Environmental Objectives (Groundwater) Regulations 2010, as amended shall be agreed by the Agency and implemented before 22$^{nd}$ December 2015. Groundwater monitoring results shall be submitted annually or as required in the Schedule to this license."*

The location of the North Kerry Landfill is shown in Figure 1.1. The National Grid Reference at the centre of the landfill site is E495007, N617238.

## 1.1 Objectives and Background Information

To assist licensees comply with this Technical Amendment the Environmental Protection Agency (EPA) developed Guidance on the Authorisation of Discharges to Groundwater (EPA, 2011) to determine site compliance with the Environmental Objective (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010).

The Groundwater Regulations aim to give effect to the measures needed to achieve the environmental objectives established for groundwater by the Water Framework Directive (WFD) and the Groundwater Directive. Regulation 2 of the Groundwater Regulations sets out the purpose and scope of the regulations, which include the following requirements:

- *prevent [in the case of hazardous substances] or limit [in the case of non-hazardous substances] the input of pollutants into groundwater and to prevent the deterioration of the status of all bodies of groundwater*
- *protect, enhance and restore all bodies of groundwater and to ensure a balance between abstraction and recharge of groundwater, with the aim of achieving good groundwater status by not later than 22 December 2015*
- *the reversal of any significant and sustained upward trend in the concentration of any pollutant resulting from the impact of human activity in order to progressively reduce pollution of groundwater.*

Regulation 56 refers to plumes from point sources and contaminated land, and says that:

> *"Where necessary to assess the impact of existing plumes of pollution in bodies of groundwater that may threaten the achievement of the objectives in Article 4 of Directive 2000/60/EC, and in particular, those plumes resulting from point sources and contaminated land, the Agency shall carry out, or shall cause to have carried out, additional trend assessments for identified pollutants in order to verify that plumes from contaminated sites do not expand, do not cause the chemical status of the body or group of bodies of groundwater to deteriorate, and do not present a risk for human health and the environment."*

### 1.1.1 Site Development and Licensing History

KCC have been operating the North Kerry Landfill since 1994. The landfill was the first landfill in the country to be licensed by the EPA. The original EPA license (W0001-01) was issued in June 1998 and allowed for an annual waste intake of up to 40,000 tonnes. An environmental impact statement (EIS) was prepared in 1991 for the site, which preceded the EPA Act of 1992, the Waste Management Act of 1996, and the associated waste management licensing regulations.

A revised waste license (W0001-02) was issued in November 2000 in response to increasing levels of waste production in County Kerry and a higher quantity of waste being deposited at the landfill. This license allowed for an increased annual waste intake of up to 75,000 tonnes, while it also allowed for the acceptance of up to 2,000 tonnes per annum of biodegradable waste for composting at the landfill.

A second EIS for the site was produced in 2003 by Tobin/TES Consulting Engineers. This EIS focussed on the proposed extension of the landfill site into an area of commercial forestry owned by Coillte at its northern boundary. A further revision of the waste license was subsequently conducted with a new license (W001-03) issued in November 2004. This revision primarily addressed the extension of the landfill site. The maximum acceptable waste intake was increased to 77,000 tonnes per annum, while the license also allowed for a civic amenity waste facility to be operated on site.

The waste license W0001-03 was replaced by W0001-04 in March 2010 and is now deemed to be an Industrial Emissions license in accordance with the European Union (Industrial Emissions) Regulations 2013, S.I. No. 138 of 2013.

It is estimated that approximately 888,400 tonnes of waste has been placed in the North Kerry landfill during its working life between 1994 and 2014. Nineteen waste cells have been have been developed at the site over nine separate phases. All nineteen cells have now been fully capped, with the capping of the last cell completed in early 2015.

A decision was taken not to progress with the development of further waste cells at the landfill in September 2013. The available built capacity on site became exhausted in July 2014. The acceptance of waste for both landfilling and recycling at the civic amenity site subsequently ceased at this time. Both the landfill and the civic amenity site are now closed to all customers.

There are no authorised discharges to groundwater from the site at the North Kerry Landfill.


**Figure 1.1: Site location map (extract from GSI maps)**


**Figure 1.2: Aerial view of the North Kerry Landfill**

Source: www.bingmaps.com

## 1.2 Recent Site Assessments

Two environmental impact statements (EIS), a planning application and a waste license application have been prepared for this site in the past. Hydrogeological site assessments have been conducted in order to produce some of these reports. The planning application and waste license application were prepared in 1998 by KCC. An initial EIS was prepared for the site in 1991, with a subsequent EIS prepared in 2003 by Tobin/TES Consulting Engineers. The above reports provided the necessary baseline information for describing the environmental site setting, geology/soils, regional hydrogeology, site hydrogeology and hydrology/surface water features.

In compliance with the conditions of W0001-04 (IED), the most recent Annual Environmental Report (AER) submitted to the Agency in 2014 was used to assess the quality of surface and groundwater on and adjacent to the landfill site. This AER was compiled by KCC. Leachate, groundwater and surface water monitoring results obtained by KCC from regular monitoring carried out between 2001 and 2015 were also assessed.

# 2 ENVIRONMENTAL SITE SETTING

The North Kerry Landfill site is located at Muingnaminnane in the Stack Mountains, approximately 12 kms to the northeast of Tralee. The location of the landfill is shown in Figure 1.1. The entrance to the site is off the Tralee to Knocknagoshel road; a third class road which runs in a south west to north east direction past the northern boundary of the site. A county road also runs adjacent to the eastern boundary of the site. The main Tralee to Castleisland road (N21) is approximately 5 km to the south of the landfill.

The Stacks Mountains, commercial forestry plantations and undulating mountain bog dominate the landscape of the surrounding area. The majority of the land is used for commercial forestry. An area of cut over bog is also located adjacent to the eastern boundary of the landfill, as shown in Figure 1.2. The landfill site and surrounding lands are generally of poor agricultural quality and therefore local holdings of sheep and cattle are generally small. An extract from the CORINE[1] Land Cover mapping in the vicinity of the North Kerry Landfill is shown overleaf in
Figure 2.1. Further detail of the land use and habitat types surrounding the site is shown in
Figure 2.2. This figure was created by Tobin/TES Consulting Engineers for the EIS which was produced in 2003.

The North Kerry Landfill is located within a Special Protection Area (SPA), namely the Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. This SPA has been designated primarily for the protection of the hen harrier. The Lower River Shannon Special Area of Conservation (SAC) and the Knockatarriv/Knockariddera Bogs Natural Heritage Area (NHA) are also located nearby the site. A summary of the designated conservation areas within 5 kms of the site is presented in Table 2.1. The locations of these areas with respect to the site are shown in Figure 2.3.

### Table 2.1: Designated nature conservation areas within 5 kms of the North Kerry Landfill

| Site name | Site code | Designation | Distance to site | Orientation |
|---|---|---|---|---|
| Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle | 004161 | SPA | - | - |
| Lower River Shannon | 002165 | SAC | 2 km | North and west |
| Knockatarriv Bog | 002448 | NHA | 1.25 km | South east |
| Knockariddera Bog | 002448 | NHA | 4 km | South east |

No streams flow through the North Kerry Landfill. Surface water from the site discharges into the Glashoreag River, which is a tributary of the Smearlagh River. The Smearlagh River drains into the mouth of the Shannon via the River Feale.

The landfill is located within a rural area with a relatively low density and dispersed population. There are relatively few dwelling houses nearby the site due to its upland location, poor agricultural land and lack of proximity to any settlement development. Residential development in the immediate vicinity of the site is confined to a number of 'one off' dwelling houses, with information gathered for the EIS in 2003 indicating that the nearest of these houses is located approximately 1,030 metres east of the site.

There are no known groundwater sensitive receptors in the vicinity of the landfill.

[1] Source: http://gis.epa.ie/Envision depicting land cover

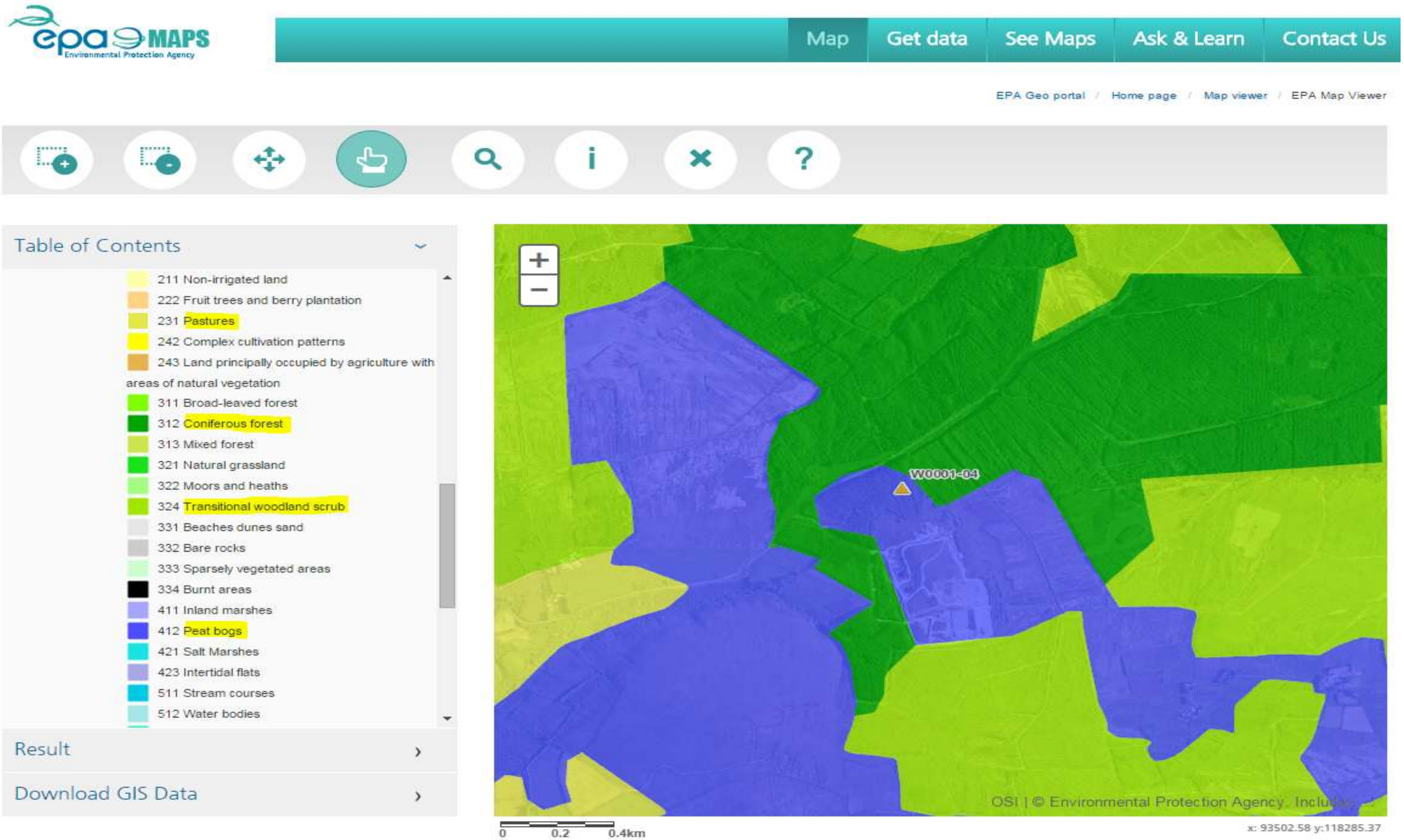



**Figure 2.1: CORINE land cover (extract from EPA maps)**

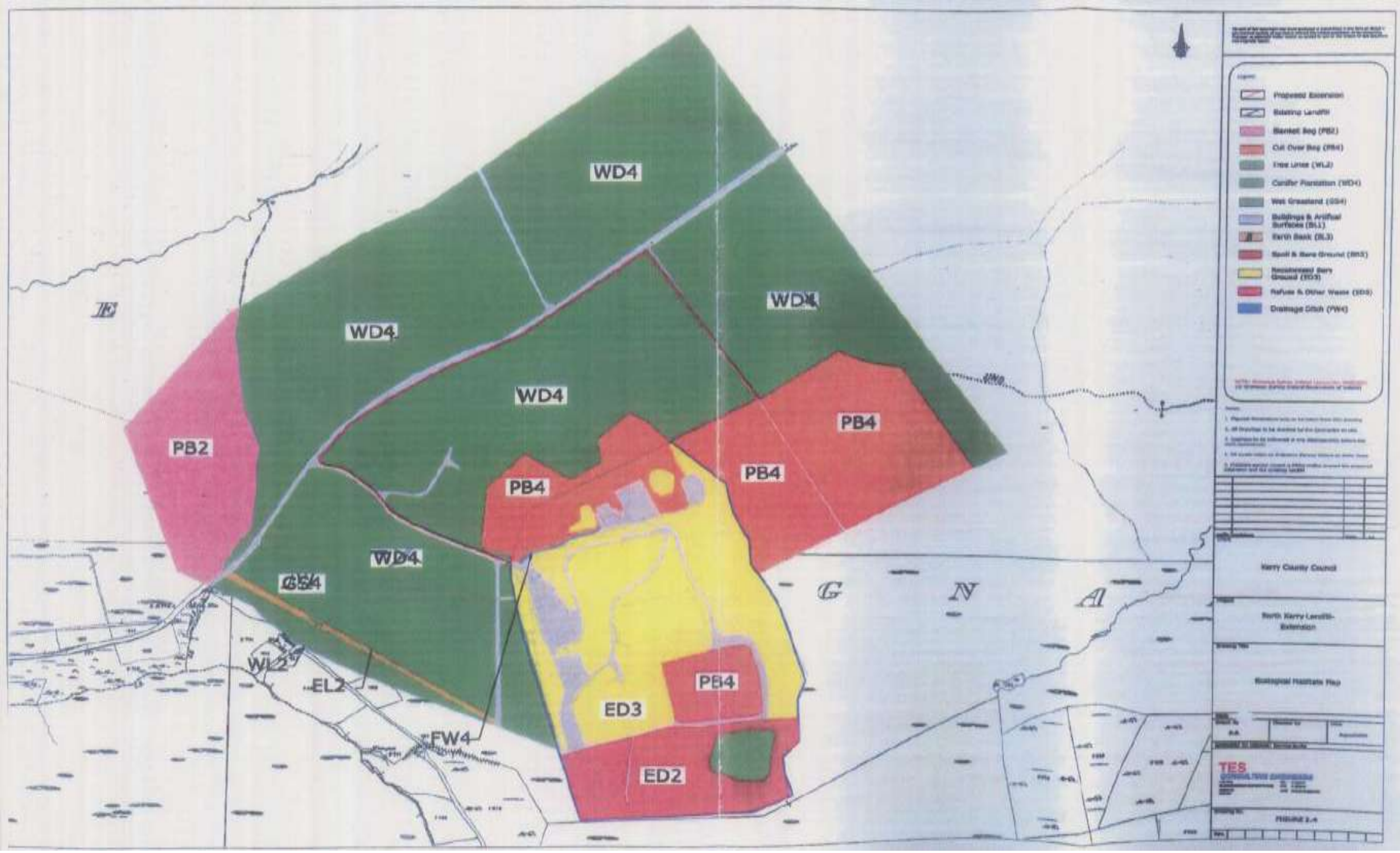



**Figure 2.2: Land use and habitat types surrounding the North Kerry landfill (extract from EIS, 2003)**

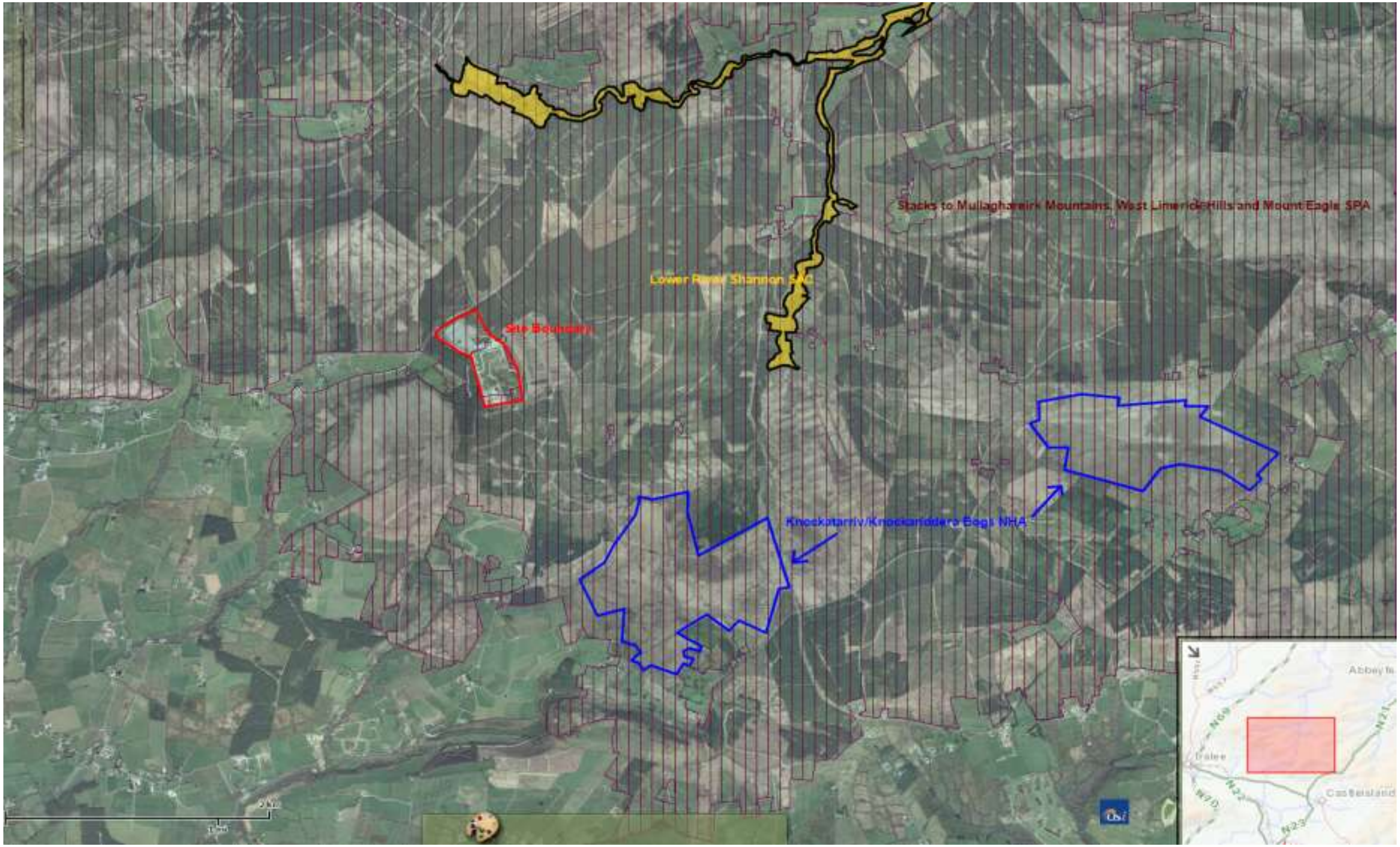



**Figure 2.3: Designated nature conservation areas surrounding the North Kerry Landfill (extract from NPWS maps)**

## 2.1 Geology

### 2.1.1 Regional Geology

**Bedrock Geology**

The most recently published geological map from the Geological Survey of Ireland (GSI) indicates that the region in which the site is located is underlain by Upper Carboniferous aged (355 to 290 million years ago) bedrock.

The site itself is underlain by the Feale Sandstone Formation. A gradational contact between this Formation and the Glenoween Shale Formation occurs to the west of the site. The Feale Sandstone Formation consists of a rhythmic repetition of sandstone, siltsone and shale, with occasional coal seams. The Glenoween Formation comprises dark grey silty mudstones, sandy shales and fine grained sandstone. The Feale Sandstone Formation and the Glenoween Shale Formation form part of the Clare Group of Namurian rocks which were deposited in a delta type environment.

The bedrock geology of the region surrounding the site is shown in Figure 2.4.

**Quaternary Geology**

The bedrock in the region is overlain by varying types of overburden including blanket peat, peaty and acidic gleys, acid brown earths/brown podzolics, peaty podzols and lithosols/regosols.

The origin of the unconsolidated materials in this area is associated with the movement and deposition from the Irish ice sheet during the last ice age. The last ice age occurred during the Quaternary Period (1.6 million to 10,000 years ago).

The soils of the region surrounding the site are shown in Figure 2.5.

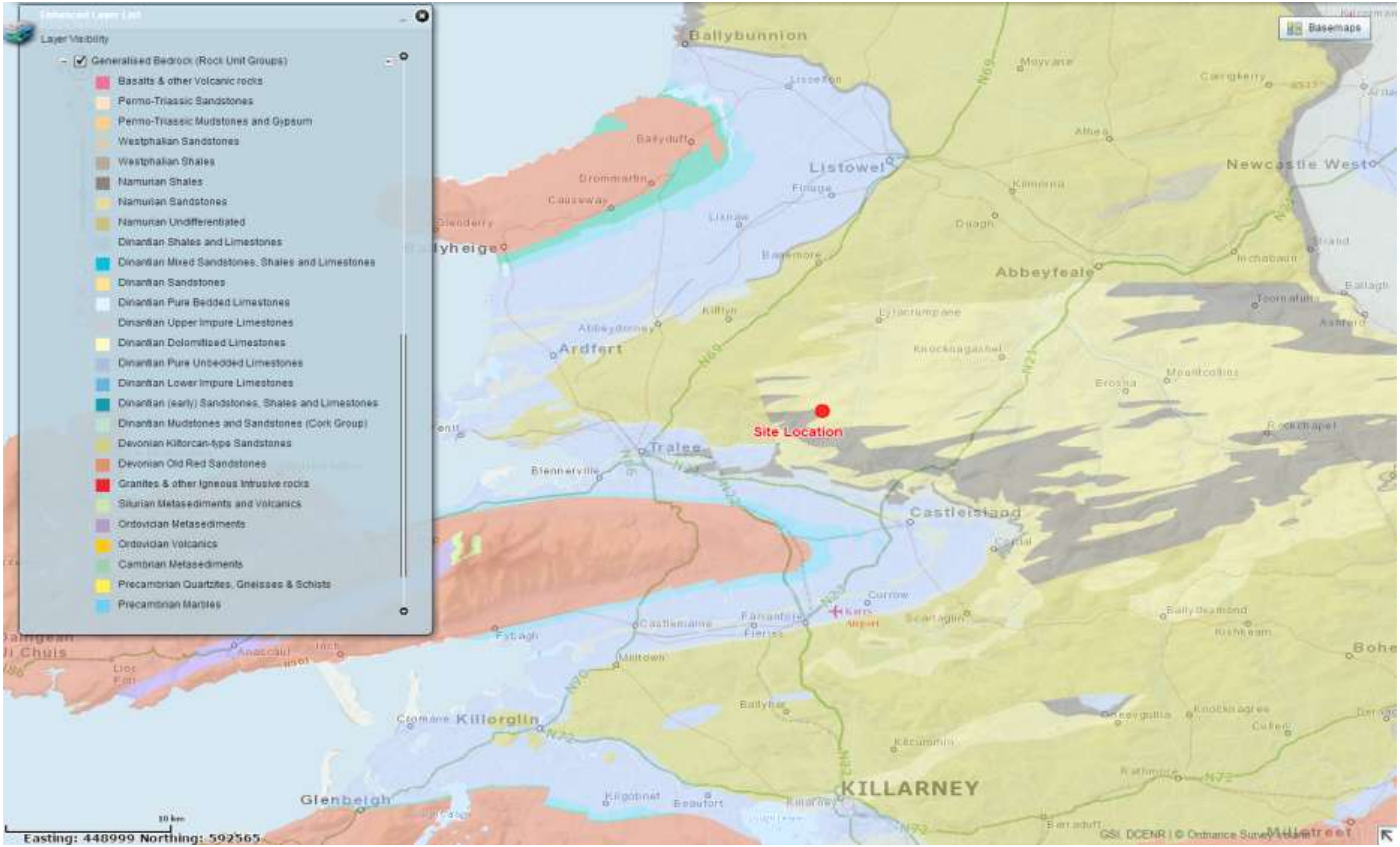



Figure 2.4: Regional geological setting of the North Kerry Landfill (extract from GSI maps)

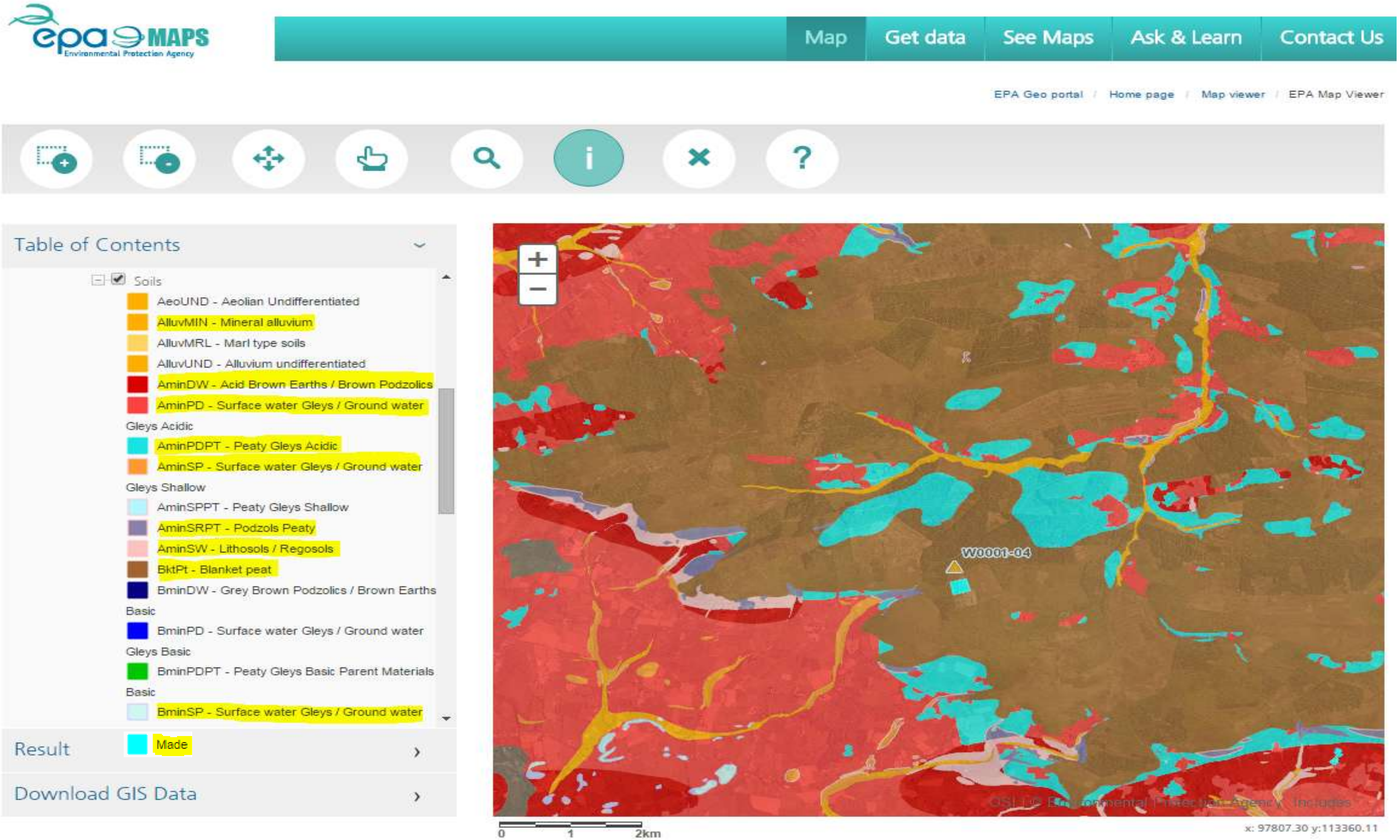



**Figure 2.5: Soil types surrounding the North Kerry Landfill (extract from EPA maps)**

### 2.1.2 Site Geology

**Bedrock Geology**

Previous site investigations conducted in 1991 as part of the original EIS and in 2003 as part of the most recent EIS indicate that the bedrock beneath the site comprises a sequence of shales and sandstones. The rock is weathered to a depth of approximately 36 m below ground level and is fractured in places. The lithological succession recorded from the borehole records is ascribed to either the Glenoween Shale Formation or the Feale Sandstone Formation.

Figure 2.6 shows the bedrock geology of the site and its immediate surrounding area.

There are no major faults or folds in the area.

**Quaternary Geology**

Site investigations conducted in the past indicate that the bedrock at the North Kerry Landfill is overlain by peat and compact clays. Gravelly clay has been observed at deep levels in the overburden, while yellow to grey clay has been observed at shallow levels.

The thickness of unconsolidated materials is not very extensive at the site. The logs of the trial pits undertaken for the EIS in 2003 indicated that the depth to bedrock across the site varied in thickness from 1 m to 1.9 m. Bedrock was encountered in all bar one of the twelve trial pits completed across the site in 2003.


**Figure 2.6: Geological setting of the North Kerry Landfill (extract from GSI maps)**

## 2.2 Regional Hydrogeology

The available GSI information for the region indicates that the bedrock underlying the site is classified as a locally important aquifer, i.e. moderately productive only in local zones. The aquifer types in the surrounding region of the site are shown overleaf in Figure 2.7.

Hydraulic testing was undertaken in the bedrock aquifer of the site during the preparation of the 1998 EIS. This testing indicated that the permeability was low, varying between $10^{-5}$ m/sec and $10^{-6}$ m/sec. A pump test was also undertaken in 2002 as part of a separate study. The hydraulic characteristics calculated from this test indicated that the aquifer had a very low transmissivity (1.7 – 4.2 $m^2$/day) and a low specific capacity (0.16 – 0.23 $m^3$/day/m). The low transmissivity values recorded during this study indicate that the rate of groundwater flow through the bedrock is very slow.

Site investigations conducted in the past have noted that similar to the bedrock, the permeability of the overburden beneath the site is also low.

The GSI vulnerability rating system indicates that the bedrock aquifer at the North Kerry Landfill should be assigned a ‘high’ vulnerability rating due to the relatively shallow overburden cover and the infiltration capacity of the overburden.

Data gathered as part of the 2003 EIS indicated that there were no domestic wells within the immediate vicinity of the site at this time. Two groundwater wells, used to meet the daily requirement of domestic dwellings, were recorded within 3 km of the site. The closest well was approximately 1.5 km to the southeast of the site, while the second well was recorded approximately 3 km to the southwest of the site. Both of these wells are located outside the sub-catchment of the landfill and are not considered to be at risk of impact from subsurface contamination at the site.

According to the EPA’s Envision database the local groundwater body can be summarised as follows:

- Having poorly productive bedrock belonging to the Abbyfeale Group (as shown in Figure 2.8)
- Having a good WFD Status according to 2007-2012 data (as shown in Figure 2.9)
- Expected to achieve good WFD Status (as shown in Figure 2.10).

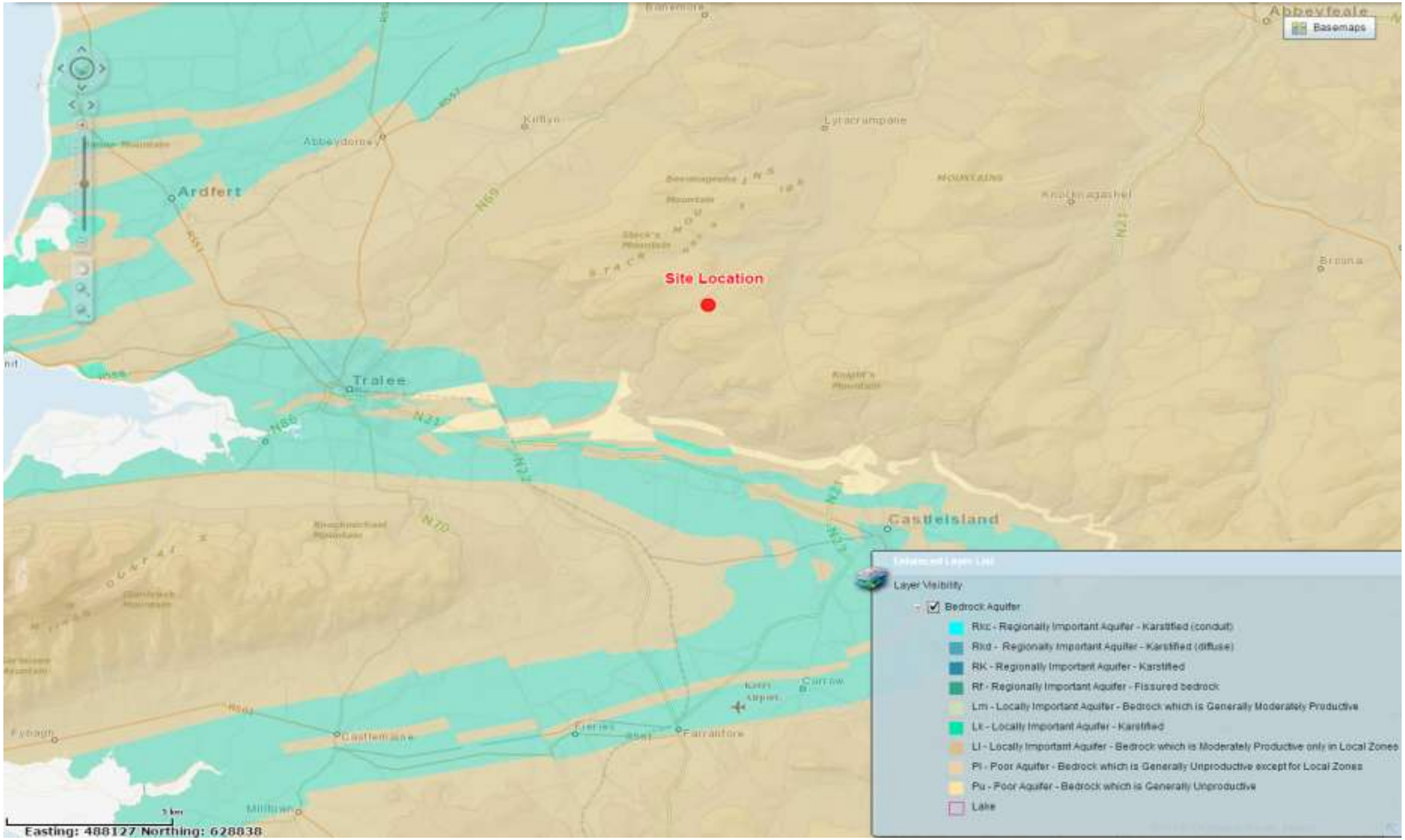



**Figure 2.7: Aquifer types surrounding the North Kerry Landfill (extract from GSI maps)**

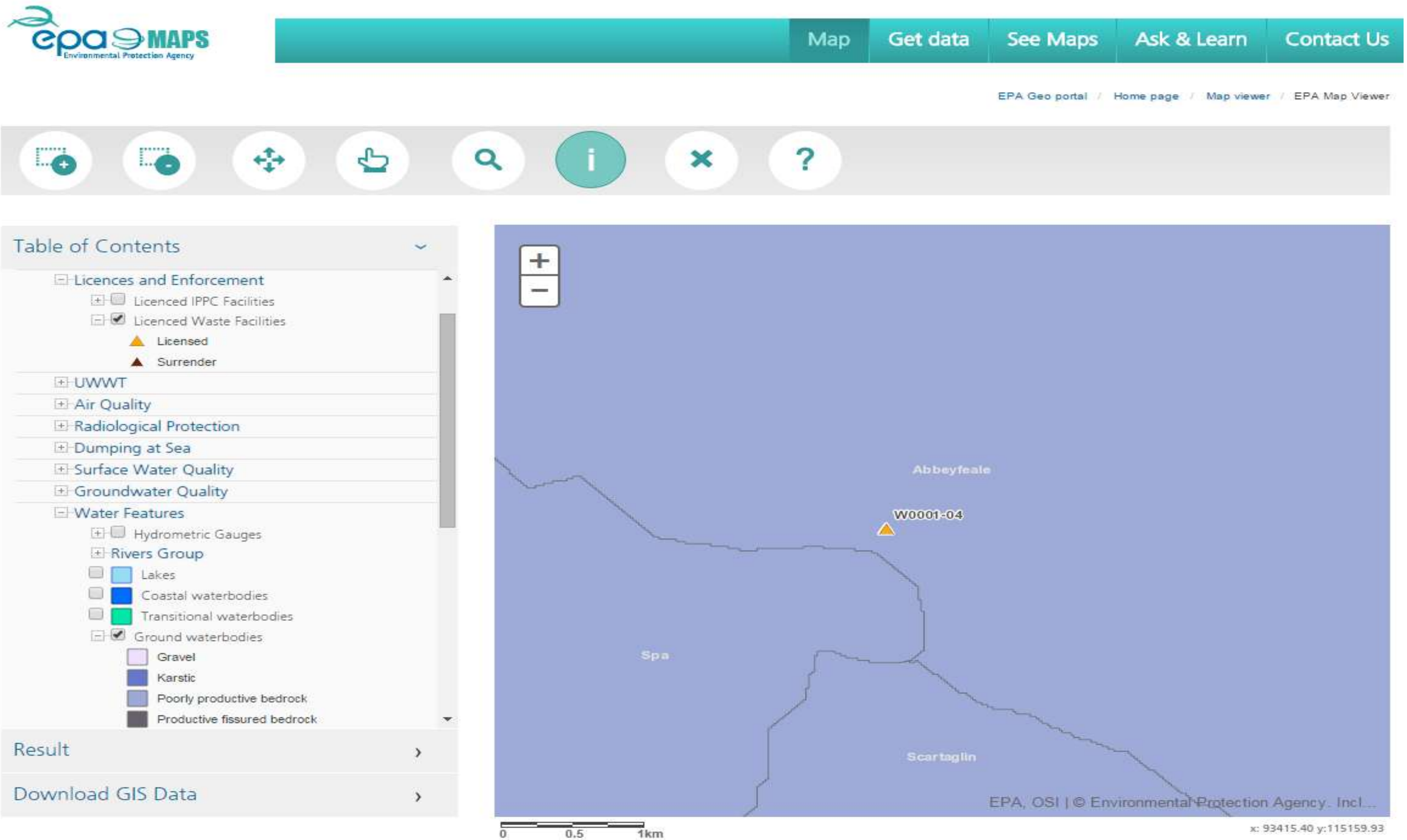



**Figure 2.8: Ground Waterbodies (extract from EPA maps)**

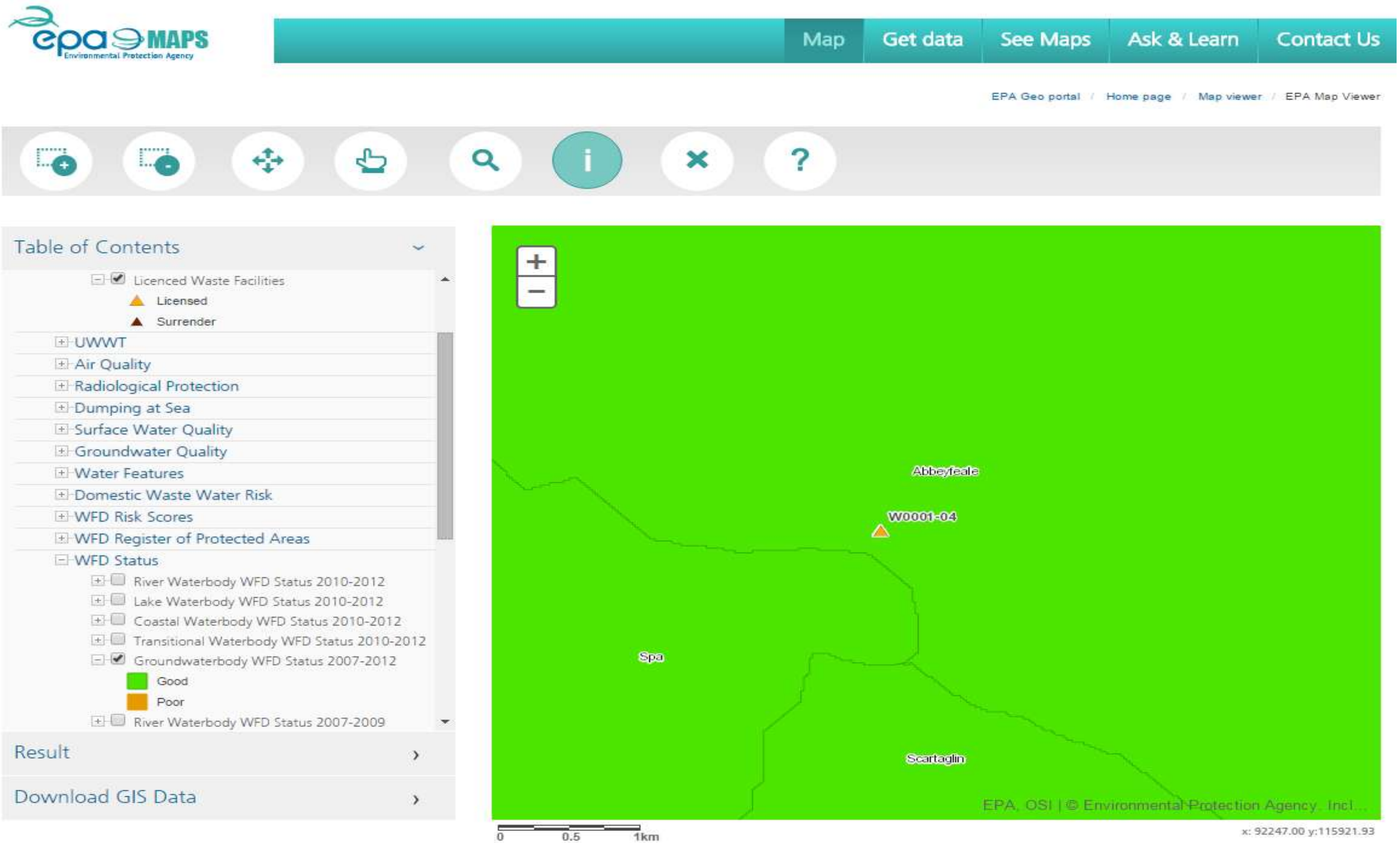



**Figure 2.9: Ground Waterbody WFD Status 2007-2012 (extract from EPA maps)**

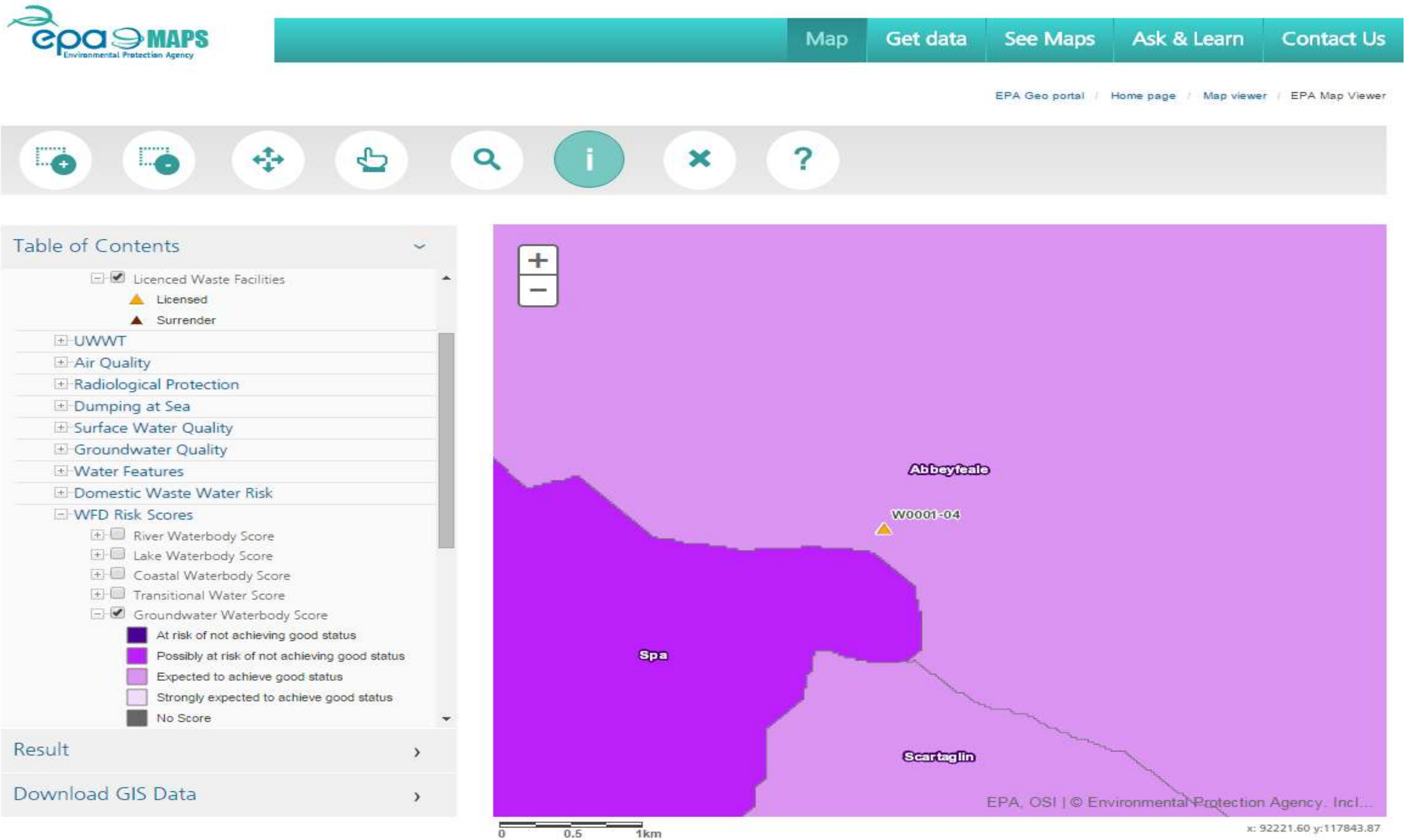



**Figure 2.10: Groundwater Waterbody Score (extract from EPA maps)**

## 2.3 Site Hydrogeology

Groundwater level data was collected as part of the site investigation conducted for the EIS in 2003. The elevation at the top of casing at each of the boreholes was measured relative to Ordance Datum. The data recorded indicated that groundwater levels beneath the site range from 243 mOD in the southern part of the site to 231 mOD in the northern part of the site.

Available information indicates the presence of a gradually falling water table from the south to the north of the landfill. Groundwater at the site flows in a northerly direction, moving towards the small streams and land drains located to the north of the site.

Groundwater gradients at the site were recorded as high during the site investigation conducted as part of the EIS in 2003. Results from this study indicated that gradients were in the order of 0.06 – 0.07, suggesting that the groundwater flow through the bedrock is retarded in localised, poorly connected fissures and fractures, due to the low permeability of the rock mass.

The nature of the overburden at the North Kerry Landfill provides a semi-protective layer underneath the waste. A large amount of the land underlying and surrounding the site is composed of peat and compact clays. These deposits are generally considered low permeability units. Peat has an average permeability of $1*10^{-3}$ m/day. While the composition of the overburden ensures that it is somewhat protective of the bedrock beneath it, the thickness of this layer is not extensive, thus limiting its protective capabilities. Permeability in the bedrock aquifer is generally orders of magnitude higher than the peats or clays.

Groundwater flow in the overburden is by porous flow, while groundwater flow in the bedrock is by fissure flow and is largely dependent on the degree and intensity of fracturing in the bedrock. There is no evidence from the borehole or trial pit records obtained from the EIS in 2003 of any appreciable thickness of low permeability clays in the overburden sequence. Therefore, groundwater in both the overburden and underlying bedrock is hydraulically connected.

## 2.4 Surface Water Features

No streams flow through the North Kerry Landfill. A number of surface water drains and small streams surround the landfill, particularly to the east, west and north of the site. The surface water from these features flows to the north and discharges into the Glashoreag River approximately 1.5 kms to the northeast of the landfill.

The Glashoreag River is a tributary of the Smearlagh River and is located within its catchment area. Tributary streams and rivers of the Smearlagh River rise in the Stacks Mountains and drain in a general northerly to north-easterly direction. The Smearlagh River converges with the larger River Feale approximately 3 km east of Listowel. The River Feale discharges to the mouth of the Shannon approximately 2 kms south of Ballybunnion.

The surface water catchment of the North Kerry Landfill and the streams and rivers in its immediate vicinity are presented in Figure 2.11.

The River Feale is classified as a Salmonid water body under the EC (Quality of Salmonid Waters) Regulations 1988. Ultimately, any tributaries of the River Feale, such as the Glashoreag River and the Smearlagh River would be classified as Salmonid water bodies also.

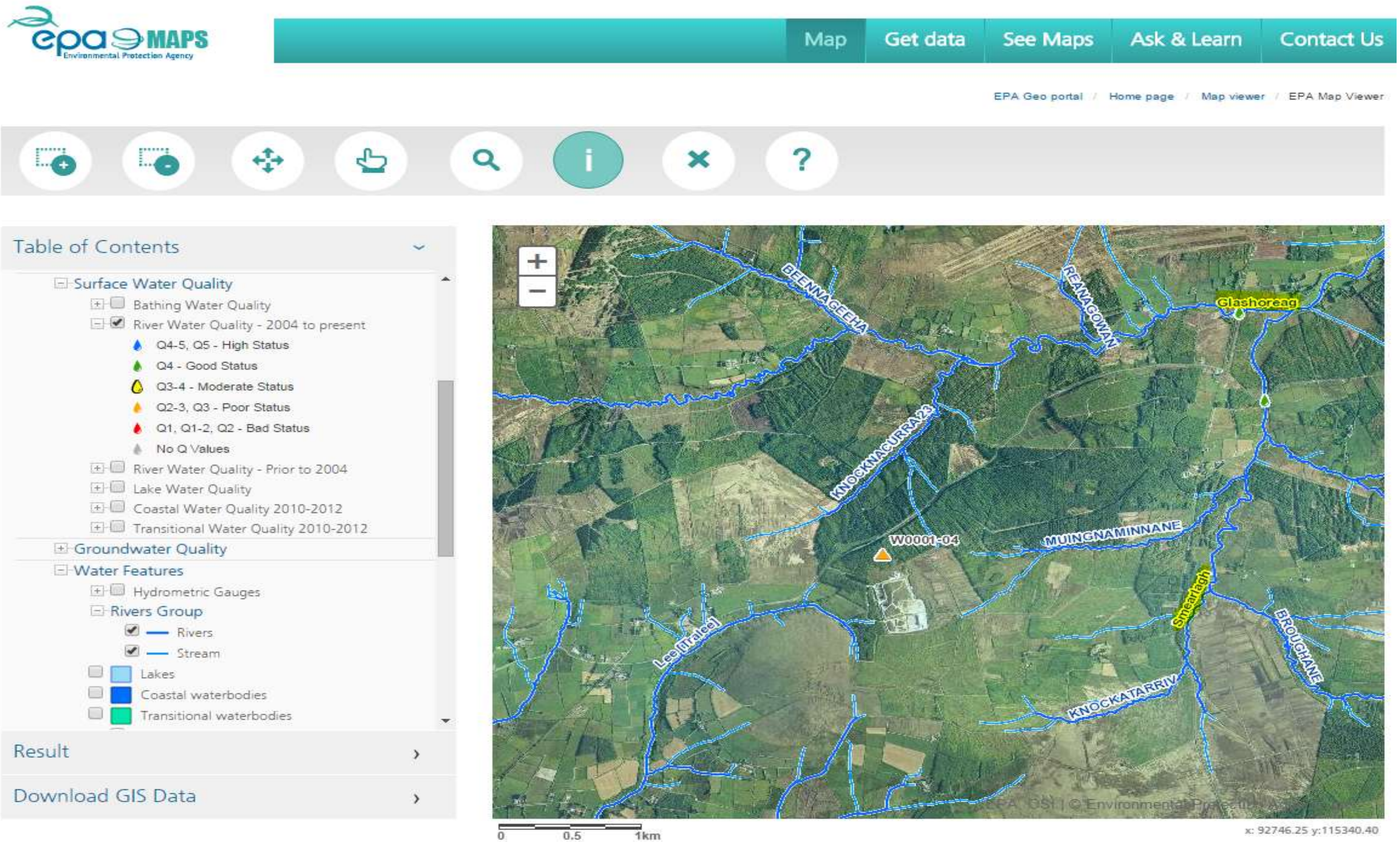



**Figure 2.11: Surface water catchment of the North Kerry Landfill (extract from EPA maps)**

# 3 CONCEPTUAL SITE MODEL (CSM)

The SPR assessment methodology is discussed in the EPA Guidance Document (2011) whereby a source and a receptor are linked by one or more pathways.

The methodology primarily aimed at:

1. Demonstrating that the landfill in question has adequate infiltration or run off capacity to avoid problems with surface settlement of leachate;

2. Estimating the chemical loading and attenuation that can be expected in the subsurface environment; and

3. Where necessary, verifying the impacts on groundwater quality by looking at trends in data for operational sites against license conditions and with relevant groundwater quality objectives and standards.

The assessment of a discharge to groundwater is risk-based and receptor focused. As such, pollution does not occur unless a pollutant causes harm to human health, the quality of aquatic ecosystems, or terrestrial ecosystems which are directly depending on aquatic ecosystems. Accordingly, this assessment involves a determination of 'risk of impact' to receptors.


**Figure 3.1: S-P-R Risk Factors (EPA, 2011)**

The following sections assess the hazard **source**, the likely **pathways** and the **receptors** for the North Kerry Landfill site.

## 3.1 Source

The waste material deposited historically at the North Kerry Landfill site presents the primary source of pollution. Leachate is produced from the waste material as water passes through it, bringing with it the soluble components of the material. The components may dissolve out of the material (e.g. heavy metals) and those that are created through naturally occurring microbiological processes (e.g. ammonia).

As the North Kerry Landfill accepted approximately 888,400 tonnes of waste over its lifetime (1994 to 2014), the leachate generating potential of the waste combined with rainfall inputs over an extended period is relatively high.

In the case of the North Kerry Landfill, leachate volumes are primarily a function of the original moisture content within the waste and rainfall inputs falling on sections of the landfill prior to their capping. At the North Kerry Landfill, the primary source of leachate generation is rainfall. Post capping secondary consolidation (settlement and waste breakdown) will "squeeze out" and discharge leachate until such time as the field capacity (i.e. the amount of moisture or water content held in the waste after excess leachate has drained away) is reached.

All nineteen constructed waste cells have now been fully capped, with the capping of the ninth phase, containing cells 17, 18 and 19 completed during 2014 and 2015. Cells 18 and 19 were permanently capped in June 2014, while cell 17 was permanently capped in March 2015. Post capping rainfall inputs will have negligible impacts on leachate volumes across the site due to the design of the engineered cap.

The North Kerry Landfill basal lining system consists of a 2 mm thick HDPE liner which is protected by a geotextile liner, a gravel drainage layer and a layer consisting of compacted clay.

In the unlikely event of the liner system failing and subsequent remedial works being unsuccessful, the consequences of any potential impact to groundwater or surface water are unlikely to be significant. This is due to the attenuation and dilution processes that the leachate would undergo as it passes through the unsaturated zone composed of peat and clays and migrates northwards in the direction of groundwater flow.

In addition to the protection that the landfill liner and capping system provides from leachate contaminants, the strength of the leachate, as impacted by the degradation of the waste, will decline over time as the waste breakdown rates reduce due to reducing amounts of organic matter and moisture.

### 3.1.1 Leachate Management

The control of leachate is paramount in the design and operation of any landfill to mitigate against potential groundwater contamination. A number of measures are necessary to minimise the generation of leachate and to collect and remove it in an environmentally safe manner.

KCC has prepared and implemented a leachate management plan for the North Kerry Landfill. This plan has helped to minimise the generation of leachate at the site and reduced the associated impacts on surface water and groundwater. The capping of the landfill has been important in the management of leachate at the site. The final capping of the last section of the landfill was completed in March 2015.

The North Kerry Landfill has been engineered so that the entire site is now fully contained. The primary liner in place is a 2mm thick HDPE liner. This type of liner was chosen so as to ensure that it could withstand any potential corrosion due to leachate. A geotextile protective liner of >750 g/m$^2$ with a high puncture resistance overlays the primary liner. A drainage layer which consists of gravel material and has a thickness of approximately 500 mm is in place above the geotextile layer. HDPE drains are present in this layer.

The entire area of the landfill is overlain by a compacted clay layer which has a minimum thickness of 1000 mm. This layer has a low permeability and is comprised of an average of 850 mm of subsoil and 150 mm of topsoil. The clay soil used supports vegetative growth.

Alongside the lining and capping of the landfill, general design procedures have also been implemented at the site to minimise leachate production. It has been ensured that all landfill cells do not exceed a gradient of 1:3 so as to enhance the runoff precipitation from the landfill. Additionally, alterations to the contouring of the top of the cells has taken place when necessary to allow runoff from the top of the landfill, thereby preventing ponding and minimising the risk of infiltration into the waste body.

The lining and capping system in place and the implementation of the above design procedures at the North Kerry Landfill have helped to ensure that rainfall inputs are having negligible impacts on leachate volumes across the site.

Leachate at the North Kerry Landfill is controlled by a leachate collection and removal system. Leachate collection and transport pipes drain to a number of leachate collection sumps from which leachate is pumped to the covered leachate holding lagoons located onsite.

### 3.1.2 Leachate Quantity and Quality

The volume and quality of the leachate produced at the North Kerry Landfill determines its potential to impact environmental receptors on and adjacent to the site.

Leachate levels are monitored at the site on a continuous basis by an onsite supervisor who checks the pumps and lagoon. Kerry Co Co hopes to install a SCADA system for cells 1 to 16 in 2016. A SCADE system is in place for cells 17 to 19.. The quality of the leachate is also monitored regularly. In accordance with the IED license, temperature measurements and visual and odour inspections of the leachate are carried out quarterly, while the leachate is analysed for specific parameters on an annual basis. A summary of the frequency that all leachate parameters are monitored at is presented in Appendix A.

This assessment uses the chemical analyses leachate results from the three leachate holding lagoons (LL1-LL3) at the landfill. The locations of these lagoons are shown in Figure 3.2. LL3 is the composting leachate lagoon. The locations of the different leachate monitoring points in each waste cell are also shown in Figure 3.2.

Figure 3.3 to Figure 3.8 show the annual leachate quality analysis results recorded for a number of parameters during the sampling period 2001 through 2015. No data was available for LL2 for the year 2001 or LL1 for the year 2011 as no monitoring of these lagoons was carried out during these years. Tables of annual leachate quality analysis results for LL1, LL2 and LL3 between 2001 and 2015 are presented in Appendix B.


**Figure 3.2: Leachate lagoons and leachate monitoring points**

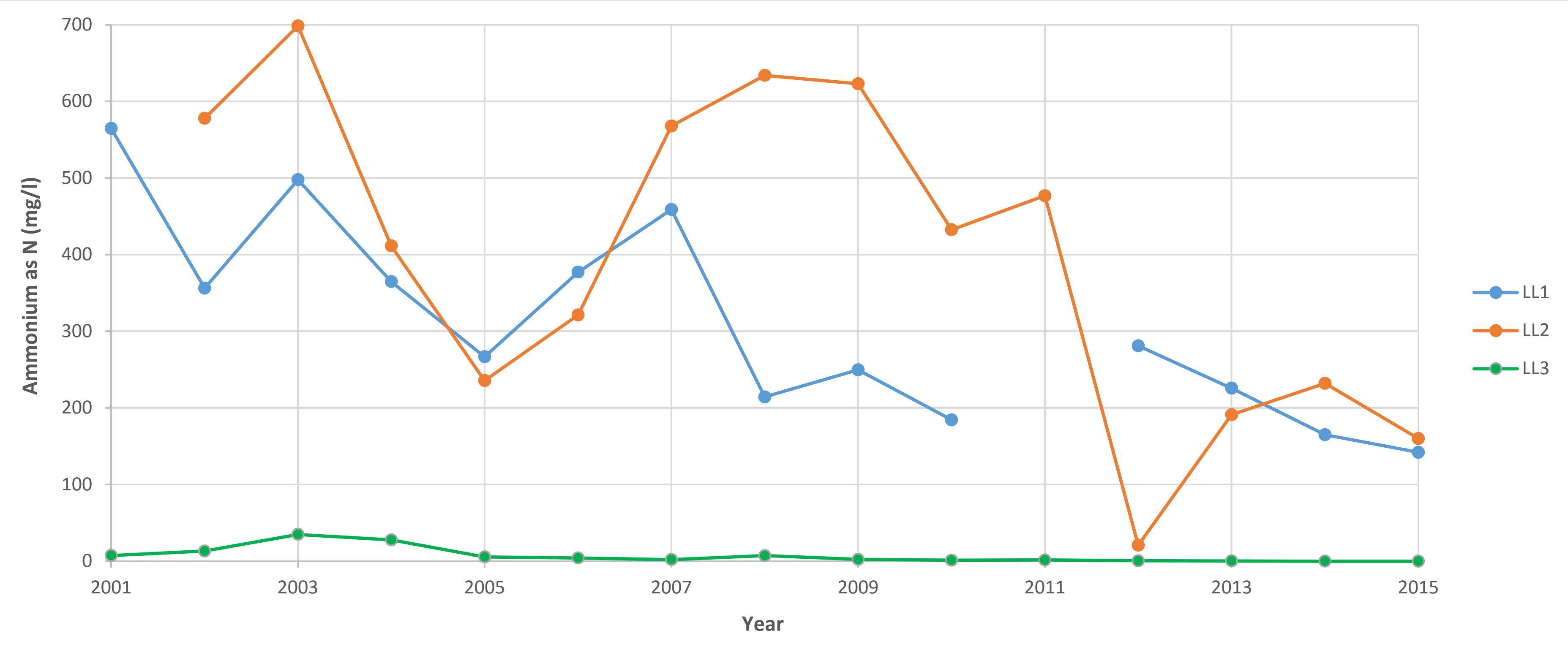



**Figure 3.3: LL1-LL3 Leachate Monitoring: Ammonium as N 2001-2015**

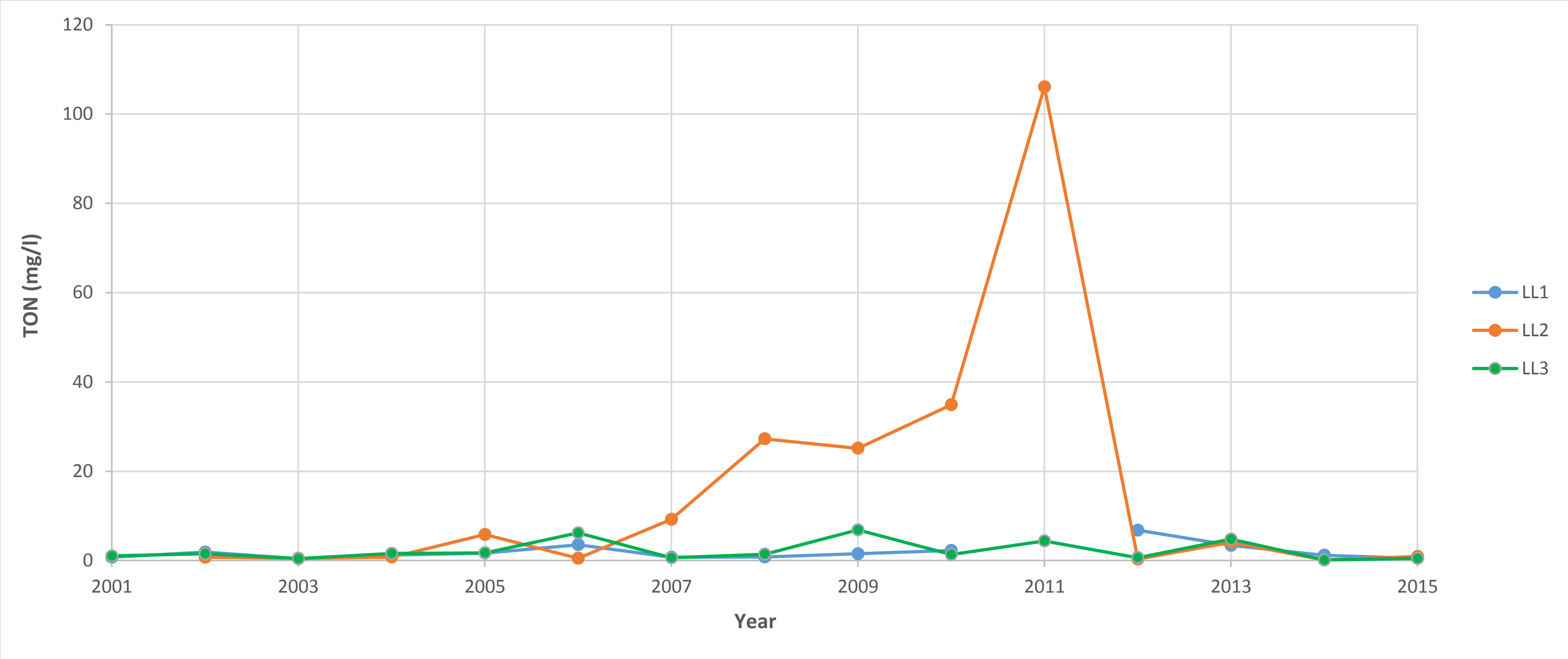



**Figure 3.4: LL1-LL3 Leachate Monitoring: TON 2001-2015**

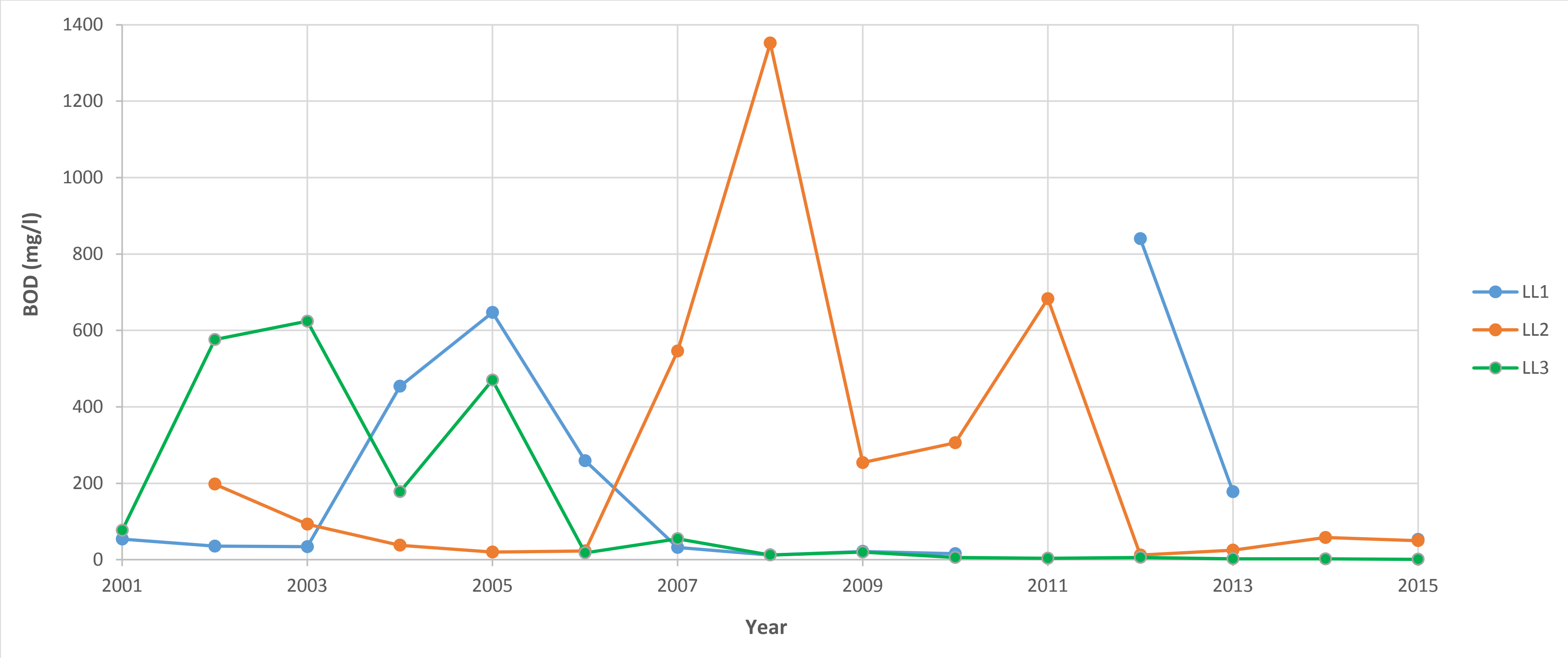



**Figure 3.5: LL1-LL3 Leachate Monitoring: BOD 2001-2015**

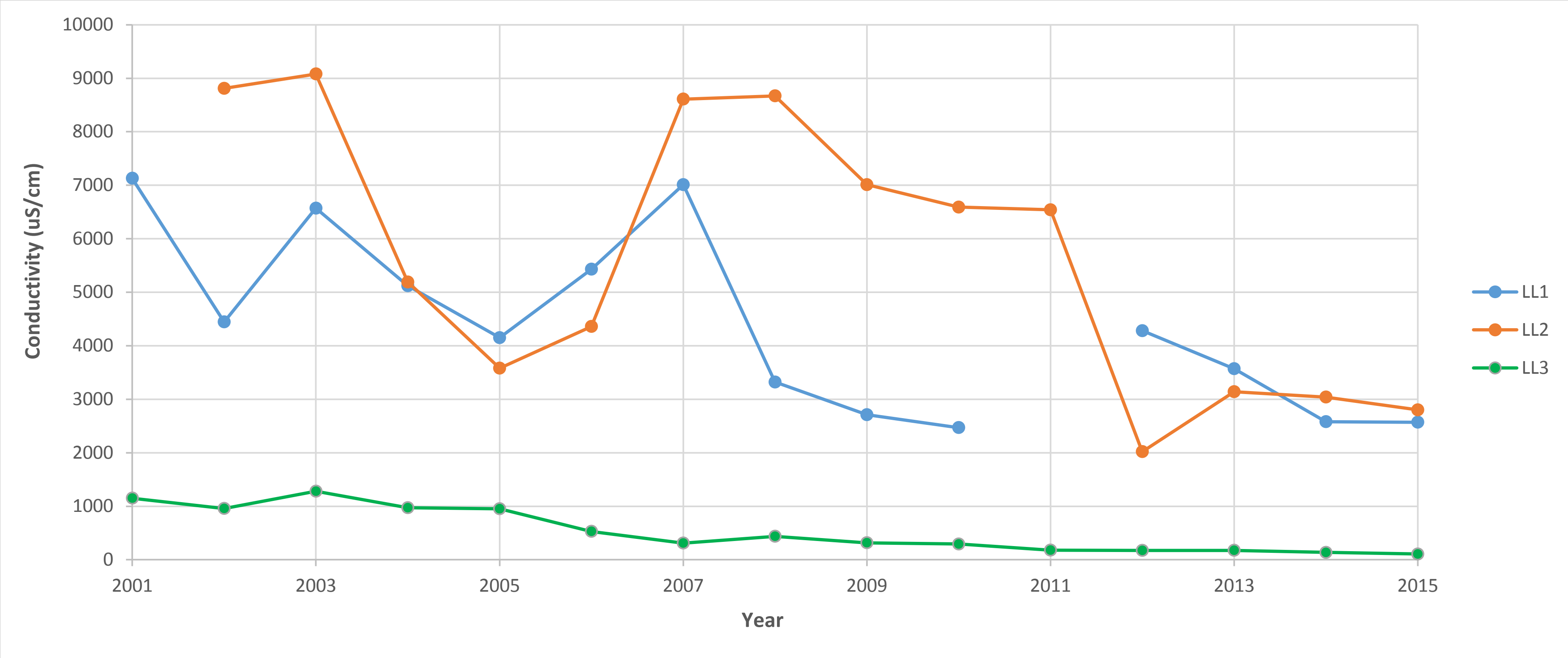



**Figure 3.6: LL1-LL3 Leachate Monitoring: Conductivity 2001-2015**

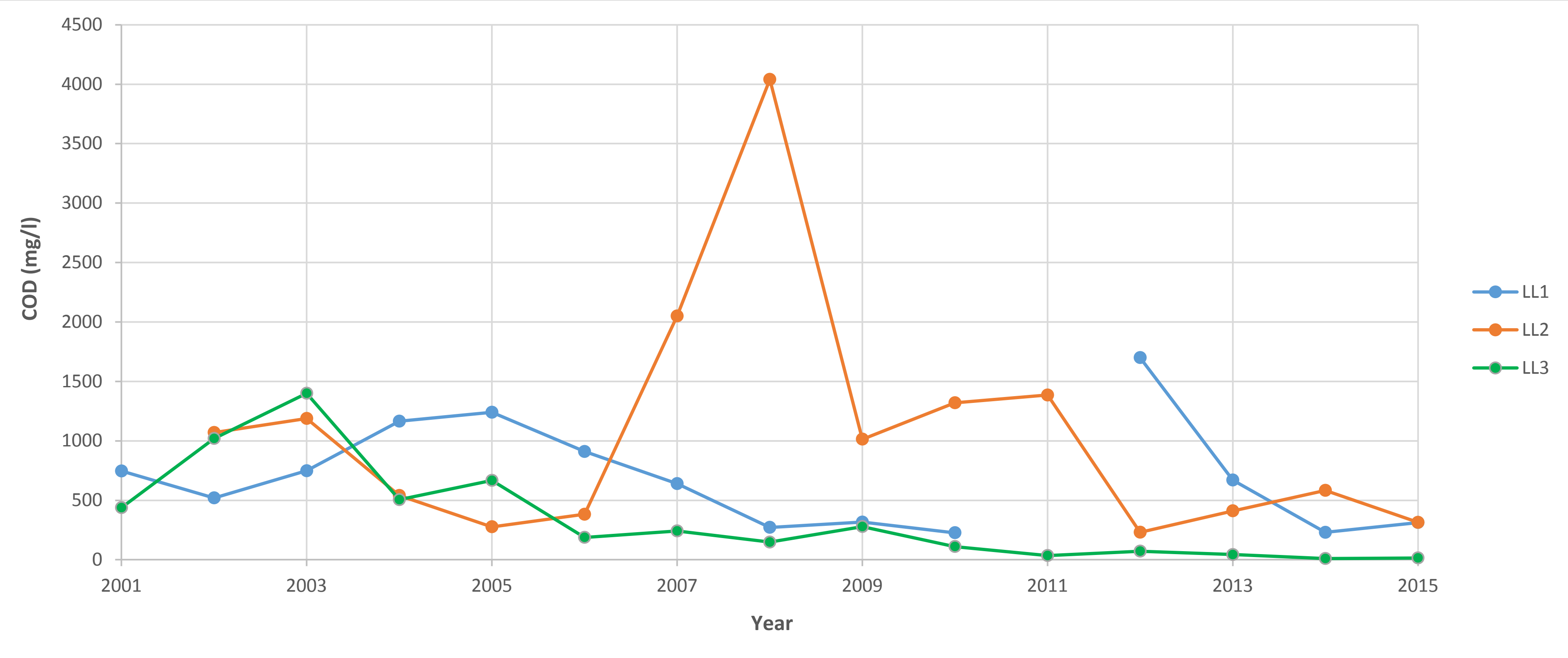



**Figure 3.7: LL1-LL3 Leachate Monitoring: COD 2001-2015**

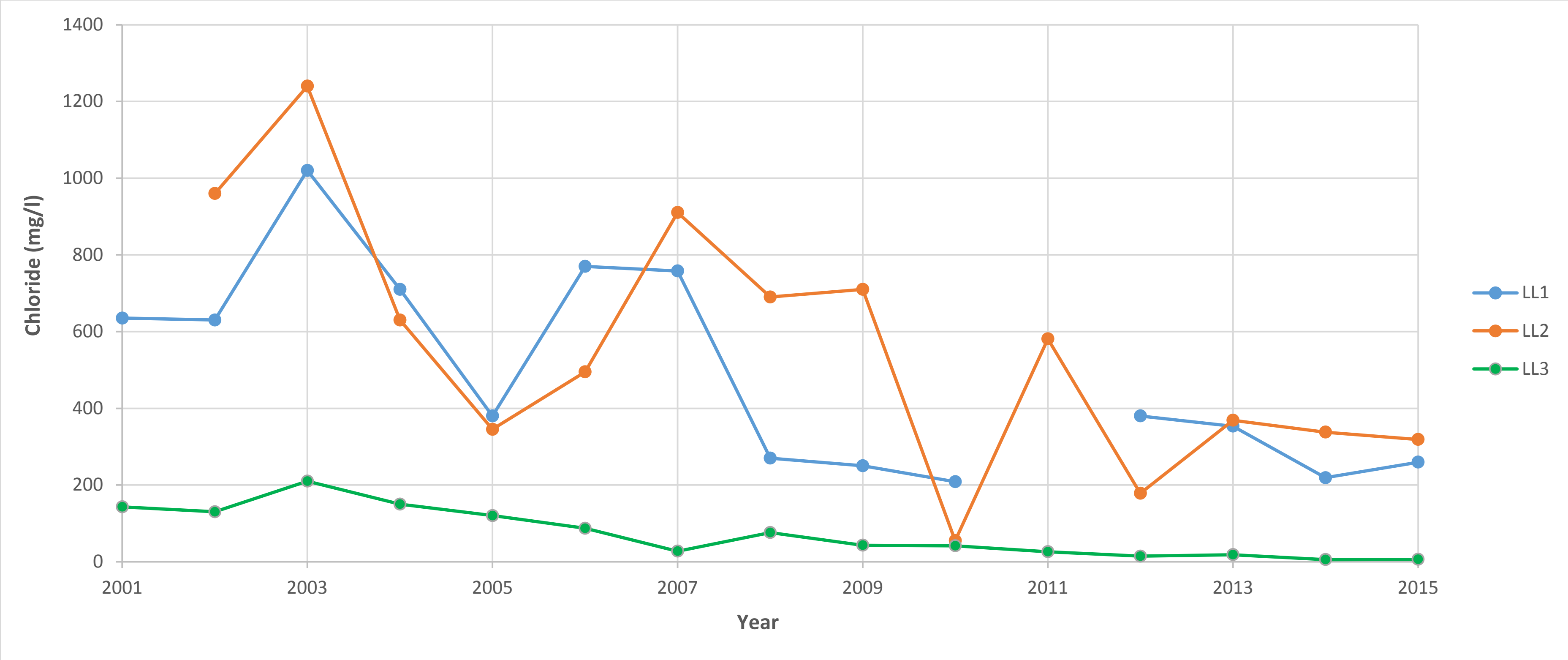



**Figure 3.8: LL1-LL3 Leachate Monitoring: Chloride 2001-2015**

Table 3.1 summarises the leachate quality situation for the sampling period 2001 through 2015 and shows that the North Kerry Landfill leachate is typical of leachate when compared to the "*Typical Leachate Composition of 30 Samples from UK/Irish Landfills accepting mainly domestic waste*" published in Landfill Operational Practices by the EPA, 1997.

These results show that leachate is weak and the potential to pollute groundwater is low.

### Table 3.1: Leachate Quality Monitoring North Kerry Landfill 2001 to 2015

| Parameter | North Kerry Leachate Analysis (LL1-LL3: 2001-2015) | | | Typical Leachate UK & Ireland[2] | | |
|---|---|---|---|---|---|---|
| | Max | Min | Mean | Max | Min | Mean |
| Ammoniacal Nitrogen (mg/l) | 698 | 0.05 | 241 | 1700 | <0.2 | 491 |
| BOD (mg/l) | 1352 | 1 | 198 | >4800 | 4.5 | 798 |
| Boron (ug/l) | 3320 | 0 | 1010 | 116000 | <2 | 7000 |
| Cadmium (ug/l) | 56 | 0 | 3 | 30 | <10 | <10 |
| Calcium (mg/l) | 482 | 18 | 94 | 1440 | 43 | 250 |
| Chloride (mg/l) | 1240 | 6 | 380 | 3410 | 27 | 1256 |
| Chromium (ug/l) | 107 | 4 | 41 | 560 | <40 | 70 |
| COD (mg/l) | 4040 | 35 | 739 | 33700 | <10 | 3078 |
| Conductivity (uS/cm) | 9080 | 106 | 3575 | 19200 | 503 | 7789 |
| Copper (ug/l) | 70 | 30 | 40 | 160 | 20 | 40 |
| Cyanide (total) (mg/l) | 0.16 | 0.01 | 0.05 | 0.16 | <0.05 | <0.05 |
| Fluoride (mg/l) | 0.2 | 0.1 | 0.2 | - | - | - |
| Iron (mg/l) | 15.2 | 0.2 | 6.2 | 664 | 0.4 | 54.5 |
| Lead (ug/l) | 30 | 1 | 9 | 280 | 40 | 100 |
| Magnesium (mg/l) | 154 | 1 | 46 | 470 | 18 | 151 |
| Manganese (ug/l) | 8107 | 40 | 1860 | 23200 | 100 | 1990 |
| Mercury (ug/l) | 5.1 | 0 | 0.8 | 1.0 | <0.1 | 0.1 |
| Potassium (mg/l) | 595 | 8 | 206 | 1480 | 2.7 | 491 |
| Sodium (mg/l) | 900 | 5 | 313 | 3000 | 12 | 904 |
| Sulphate (mg/l) | 117 | 2 | 37 | 739 | <5 | 136 |
| Total Oxidised Nitrogen (mg/l) | 106 | 0.3 | 7 | - | - | - |
| Total Phosphorus (mg/l) | 7 | 0.1 | 2 | - | - | - |
| Zinc (ug/l) | 1730 | 10 | 223 | 6700 | <10 | 580 |

[2] Typical Leachate Composition of 30 Samples from UK/Irish Landfills accepting mainly domestic Waste, Landfill Operational Practices, Environmental Protection Agency, 1997

The volumes of leachate removed from the North Kerry Landfill and disposed of off-site at a waste water treatment facility since the opening of the landfill are presented in Table 3.2.

**Table 3.2: Summary of leachate tankered off site (extract from 2014 AER)**

| Year | Leachate tankered off site ($m^3$)* |
|---|---|
| 1994 | 1,494.00 |
| 1995 | 6,475.00 |
| 1996 | 8,496.37 |
| 1997 | 12,175.49 |
| 1998 | 20,318.09 |
| 1999 | 22,822.95 |
| 2000 | 36,780.71 |
| 2001 | 18,953.85 |
| 2002 | 34,218.23 |
| 2003 | 30,721.59 |
| 2004 | 45,130.40 |
| 2005 | 54,784.59 |
| 2006 | 60,922.61 |
| 2007 | 55,436.15 |
| 2008 | 78,558.53 |
| 2009 | 73,727.85 |
| 2010 | 42,442.73 |
| 2011 | 50,108.58 |
| 2012 | 69,063.01 |
| 2013 | 67,830.01 |
| 2014 | 61,164.43 |
| | |
| **Total** | **851,625.44** |

Note: *Leachate volume disposed of off-site at a licensed WWTP in accordance with Waste License

### 3.1.3 Leachate Treatment

Leachate discharges into one of the on-site leachate holding tanks prior to being tankered off site for treatment at Tralee Waste Water Treatment Plant.

## 3.2 Other Potential Sources

A review was conducted to identify any waste licensed, industrial emissions licensed (IED) and/or integrated pollution prevention and control (IPPC) licensed facilities issued by the EPA in the immediate area of the North Kerry Landfill.
Figure 3.9 shows the location of licensed IPPC facilities within approximately 10 km of the North Kerry Landfill. As these facilities are not within the immediate vicinity of the landfill, they are unlikely to be significant sources of pollution. No waste licensed or IED licensed facilities are located within 10 km of the landfill.

### Table 3.3: IPPC licensed facilities within ~10 km of the North Kerry Landfill

| Facility type | Facility license number | Facility name | Main activity |
|---|---|---|---|
| IPPC | P0598-03 | Parknageragh Pig Breeders Company Limited | Raising of swine/pigs |
| IPPC | P0536-01 | Sports Socks Co. (Ireland) Limited | Dyeing of fibres or textiles |
| IPPC | P0161-01 | Henry Denny & Sons Limited | Food and drink processing |

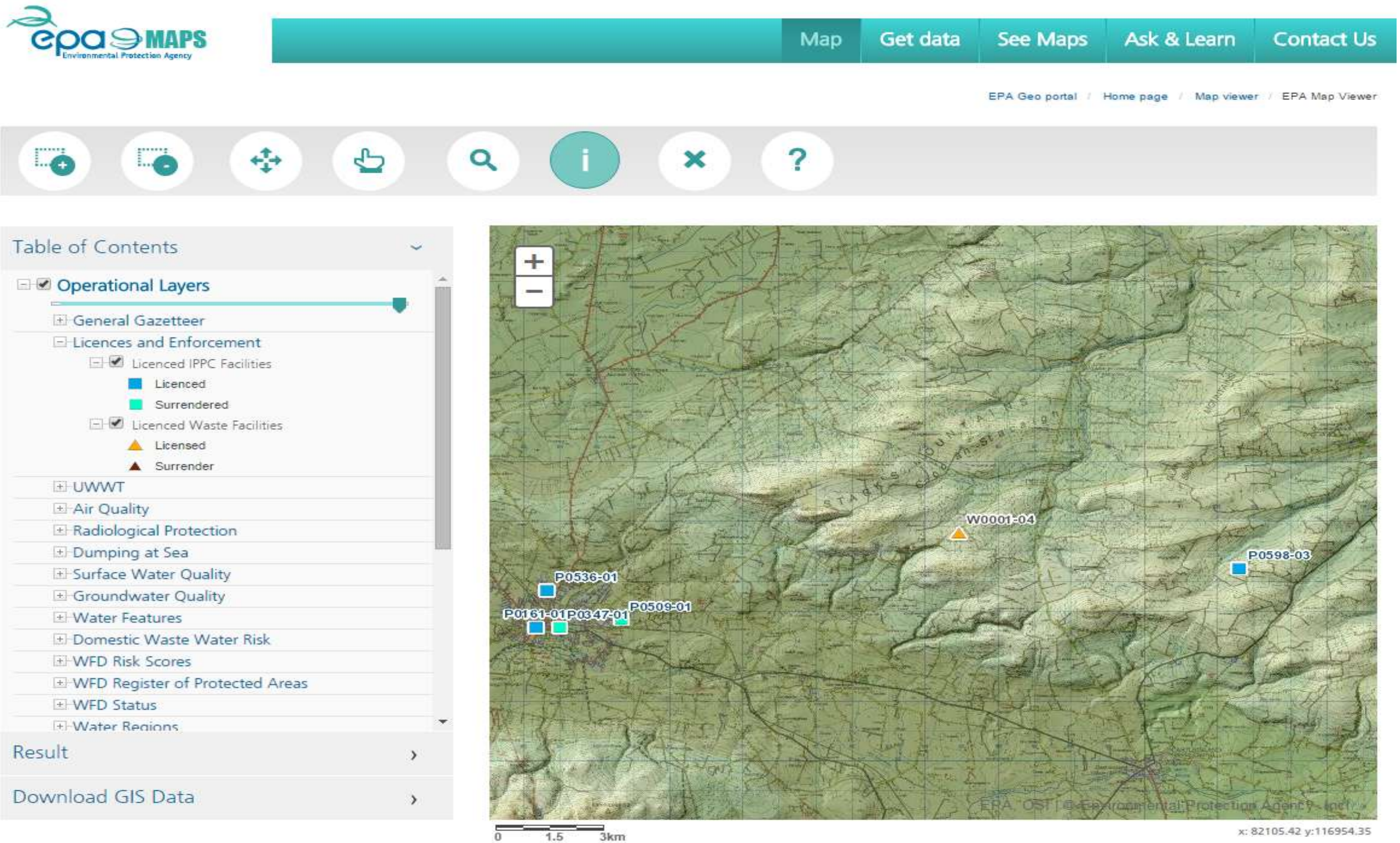



**Figure 3.9: IPPC licensed facilities within ~10 km of the North Kerry Landfill (extract from EPA maps)**

## 3.3 Pathway

The pathways and potential pathway linkages at the North Kerry Landfill site are summarised below.

### 3.3.1 Rainfall

Rainwater that percolates through waste becomes leachate. As per the engineered design of the North Kerry Landfill, rain falling on the site is prevented from entering the waste body by means of a capping system covering all of the waste body. Leachate is discharged to the leachate holding lagoons on site and disposed of offsite at one of two licensed Wastewater Treatment Plants. Despite the capping in place, a small percentage of rainfall may enter the waste body (differential settlement may create cracks in soil cover or degradation of engineered caps may occur over time) and become leachate. This volume is however likely to be negligible.

The majority of rainfall runs off as storm water and is eventually discharged to the Glashoreag River. It initially drains via the surface water drainage system into the surface water lagoons located onsite. The surface water lagoons then discharge to the small streams surrounding the landfill, before subsequently flowing into the Glashoreag River. Rainfall which falls on any roofs or paved areas is drained to gulleys and subsequently to the surface water lagoons.

### 3.3.2 Leachate Migration

The risk of leachate movement to groundwater at the North Kerry Landfill is controlled by the lining and capping system in place. While negligible amounts of leachate may form from rainfall entering into the waste body and subsequently migrating to groundwater, significant migration of leachate will only occur if the lining and capping system fails or if leaks occur from the leachate collection pipes, leachate collection sumps, leachate detection manholes or leachate lagoons. It should be noted that these scenarios represents highly unlikely events.

The potential leachate migration pathway should the above unlikely scenarios occur is as follows.

The leachate would percolate vertically downwards into the substrata. It would be attenuated as it passed through the unsaturated zone composed of peat and clays. It would be diluted upon contact with the water table and would migrate laterally in the direction of groundwater flow. Upon reaching the small streams to the north of the site, it is likely that a fraction of the diluted and attenuated liquid would discharge to these streams and the remainder would follow the local groundwater flow patterns along them (in a northerly direction), with further discharge to the streams and subsequently the Glashoreag River along their course.

A further leachate migration pathway may arise should leachate leak or spill from the leachate holding lagoons onsite. Should this occur, some of the leachate may migrate to groundwater as above. It may also enter into the surface water drainage system and subsequently the surface water lagoons in a similar manner to the rainfall run off, above. This could potentially result in pollution of the small streams, the Glashoreag River and additional surface water bodies and habitats down-gradient of the site. Leaks or spills from the leachate holding lagoons represent a further unlikely scenario due to the management procedures currently in place on site to prevent this from occurring.

### 3.3.3 Groundwater Flow Velocity

If the leachate reaches the groundwater table it will be assimilated into the aquifer and will dilute. The rate of movement and dilution of leachate will be dictated by the nature and permeability of the underlying aquifer at the North Kerry Landfill. As previously described, there is no evidence of any appreciable thickness of low permeability peats and clays in the overburden sequence. Groundwater in both the overburden and the underlying bedrock is hydraulically connected.

Previous site investigations have identified the aquifer as having a very low transmissivity, indicating that the rate of groundwater flow through the bedrock is very slow.

### 3.3.4 Groundwater Flow Direction

The groundwater flow direction at the site is to the north.

Under the EPA (2011) guidance, groundwater risk pathways are assessed according to two main criteria:

- Aquifer classification
- Groundwater vulnerability

### 3.3.5 Aquifer Classification

From examining the available GSI information, the underlying bedrock aquifer is classified as a locally important aquifer, i.e. moderately productive only in local zones (as shown in
Figure 2.7).

### 3.3.6 Groundwater Vulnerability

Groundwater vulnerability, as defined by the GSI, is the term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. The factors used in assessing groundwater vulnerability include subsoil type and thickness, and recharge type. The GSI procedure whereby groundwater protection is assessed is outlined in the EPA-GSI publication 'Groundwater Protection Schemes'. The procedure proposes a matrix, which relates vulnerability, source and resource such that a particular site is given a Response ("R") to specific activities.

As mentioned previously, existing information regarding the site indicates that the overburden layer is relatively shallow and has a low permeability. Therefore, a vulnerability rating of high can be applied to the aquifer below the site. Table 3.4 details the aquifer vulnerability of the site.

**Table 3.4: GSI guidelines - aquifer vulnerability mapping**

| **Vulnerability rating** | **Hydrogeological Conditions** | | |
|---|---|---|---|
| | ***Subsoil Permeability (Type) and Thickness*** | | |
| | **High Permeability (Sand/gravel)** | **Moderate Permeability (e.g. Sandy soil)** | **Low Permeability (e.g. Clayey subsoil, clay.)** |
| Extreme (E) | 0 - 3.0 m | 0 - 3.0 m | 0 - 3.0 m |
| High (H) | >3.0 m | 3.0 -10.0 m | 3.0 - 5.0 m |
| Moderate (M) | N/A | >10.0 m | 5.0 - 10.0 m |
| Low (L) | N/A | N/A | >10 m |

Notes: N/A = Not Applicable
Precise permeability values not available.
Release point of contaminants is assumed to be 1-2m below ground level.
Highlighted area reflects site conditions at the North Kerry Landfill.

The GSI Online mapping data set identifies that groundwater vulnerability is classified as moderate for the majority of the site but high for the extreme south west corner of the site. This implies that surface pollutants can move from the potential contaminant sources at or close to ground level into the underlying aquifer at a relatively quicker rate at the extreme south west corner of the site than they can across the rest of the site.

An overview of the groundwater vulnerability of the site and surrounding area is presented over.

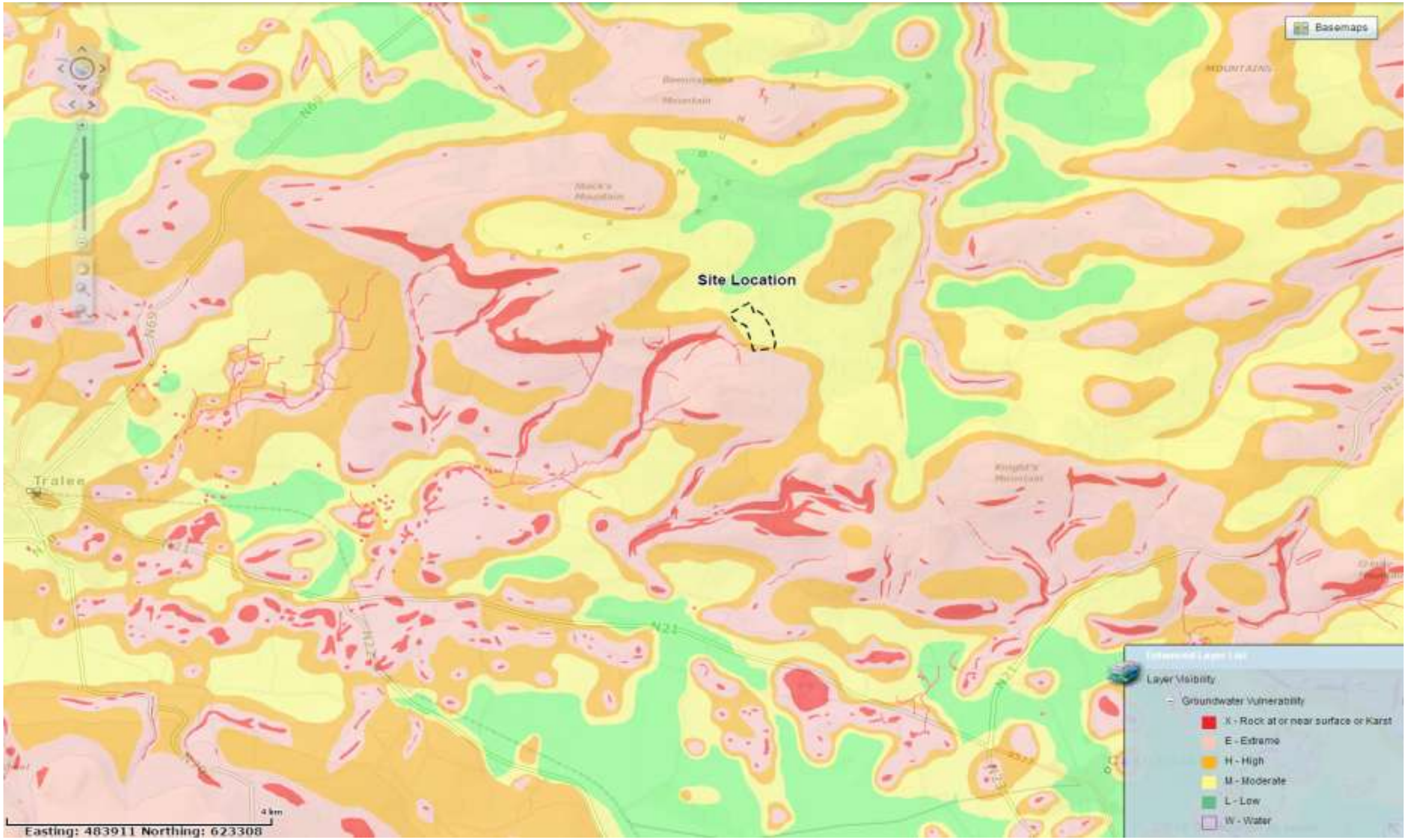



**Figure 3.10: Groundwater vulnerability map (extract from GSI maps)**

## 3.4 Receptor

Groundwater is considered a receptor under the EPA Guidance Document (2011) when it is being used for either public or private water supply. This section provides an overview of local groundwater abstractions, groundwater monitoring and groundwater quality.

### 3.4.1 Groundwater Extraction

Information gathered in 2003 as part of the EIS indicated that there were no domestic wells within the immediate vicinity of the site at this time. Two groundwater wells, used to meet the daily requirement of domestic dwellings, were recorded within 3 km of the site. However, both of these wells are located outside the sub-catchment of the landfill and as a result are not considered to be at risk of impact from subsurface contamination at the site.

The underlying bedrock aquifer beneath the North Kerry Landfill is classified as a locally important aquifer. It is confined by the overlying peat and clay layer that acts as a barrier to the bedrock beneath. While the overburden layer is relatively shallow, its composition alongside the lining and capping system in place across the entire landfill ensures that the risk to the bedrock aquifer is relatively low.

The small streams surrounding the landfill are the main surface water bodies at risk from groundwater discharges. Streams located to the north of the site are at a relatively higher risk than those located to the east and west of the site as the groundwater from the landfill flows in a northerly direction towards these streams. Surface water bodies outside the immediate vicinity of the site are unlikely to be affected by groundwater discharges unless they are connected by an adjoining river or stream. For example, if significant concentrations of pollutants entered into some of the small streams to the north of the site, they could potentially be carried downstream into the Glashoreag River and subsequently the Smearlagh River. A very significant pollution event could be carried even further downstream, into the River Feale and beyond. However, both of the above scenarios are considered unlikely.

The North Kerry Landfill is located within the Stacks to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA. However, this SPA is not considered to be groundwater dependent. The following environmentally designated sites which are located nearby the landfill, but not within its immediate vicinity, may be somewhat dependent on groundwater:

- Knockatarriv Bog NHA, located approximately 1.25 km to the south east of the site
- Lower River Shannon SAC, located approximately 2 km to the north and to the west of the site
- Knockariddera Bog NHA, located approximately 4 km to the south east of the site.

### 3.4.2 Groundwater Monitoring

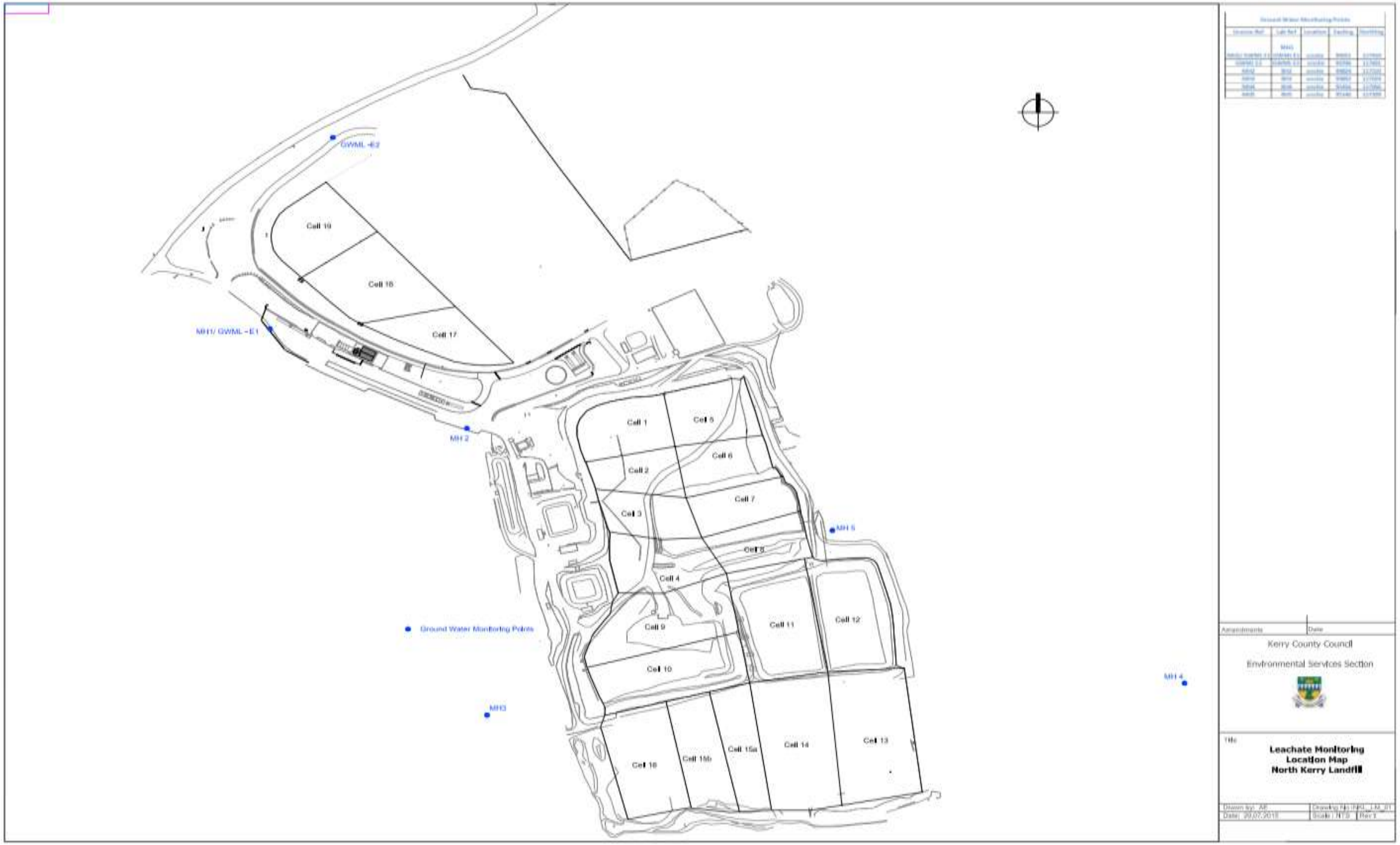
KCC monitor groundwater at 8 monitoring boreholes in the general vicinity of the site. These boreholes are located in various positions both upgradient and downgradient from the site. Five of the boreholes are located onsite while the remaining three are located off site. Of the three boreholes located off site, two of these are private boreholes. In accordance with the IED license, groundwater quality is monitored on a quarterly basis. Certain parameters, such as the metals, are analysed on an annual basis only. A summary of the frequency that all groundwater parameters are monitored at is presented in Appendix A.

The names and geographical locations of the 8 monitoring boreholes are summarised in Table 3.5. The locations of the onsite and off site monitoring boreholes are also presented in Figure 3.11 and Figure 3.12, respectively. Borehole logs were only available for MH1, MH2, MH3 and MH4. These are presented in Appendix C. Logs and photos of trial pits dug for the EIS in 2003 are also presented in Appendix C.

### Table 3.5: Groundwater monitoring points

| Borehole | Easting | Northing | Location |
|---|---|---|---|
| GWML-E1 | 94651 | 117410 | Onsite |
| MH2 | 94824 | 117310 | Onsite |
| MH3 | 94842 | 117024 | Onsite |
| MH4 | 95456 | 117056 | Off site |
| MH5 | 95146 | 117209 | Onsite |
| GWML-E2 | 94706 | 117601 | Onsite |
| Dennis O'Mahony* | 96417 | 116787 | Off site |
| Gerry Sugrue* | 92745 | 115369 | Off site |

Note: * = private borehole




## Figure 3.11: Onsite groundwater monitoring points


**Figure 3.12: Off-site groundwater monitoring points**

### 3.4.3 Review of Existing Groundwater Quality

Conductivity, ammoniacal nitrogen and chloride are three of the main groundwater parameters which have been analysed at the North Kerry Landfill in recent years. These parameters provide an indication of groundwater quality at the different borehole locations surrounding the site and subsequently present an overview of the groundwater quality of the site as a whole.

The results for conductivity, ammoniacal nitrogen and chloride are compared with the limit values from the Drinking Water Regulations (S.I. No. 278 of 2007) and the EPA Interim Guideline Values (IGVs) set out in the EPA report "Towards Setting Guideline Values for the Protection of Groundwater in Ireland (2001)." The groundwater boreholes are not used for drinking water. The Drinking Water Regulations (2007) are used for comparative purposes only.

Trigger values have also been set for conductivity, ammoniacal nitrogen and chloride for GWML-E1, MH2, MH3 and MH4 in the past. No trigger values were established for the remaining boreholes for varying reasons. For example, MH5 appears to monitor an aquifer which contains a lot of decaying organic matter, more than likely from natural sources. It was therefore considered that the trigger value for ammoniacal nitrogen used for the above boreholes would be too strict for MH5.

The above mentioned standard reference values and the applicable trigger values for conductivity, ammoniacal nitrogen and chloride are presented in Table 3.6.

**Table 3.6: EPA IGV values, limit values for Drinking Water Regulations and trigger values for conductivity, ammoniacal nitrogen and chloride**

| Parameter | Unit | EPA IGV Standard | S.I.No.278 of 2007 Standard | Trigger value for GWML-E1, MH2, MH3 and MH4 |
|---|---|---|---|---|
| Conductivity | uS/cm | 1000 | 2500 | 800 |
| Ammonium as N | mg/l | 0.15 | 0.3 | 0.225 |
| Chloride | mg/l | 30 | 250 | 200 |

Groundwater monitoring results at the 8 monitored boreholes for conductivity, ammoniacal nitrogen and chloride from 2001 to 2015 are summarised in Figure 3.13, Figure 3.14 and Figure 3.15. The data used to produce these figures was gathered by calculating the average (arithmetic mean) result for the parameter for the relative year of monitoring. This data is presented in Appendix D.

Monitoring results for conductivity, ammoniacal nitrogen and chloride since 2001 indicate that groundwater quality at most of the borehole sites is of a good standard.

Conductivity levels at all boreholes fall below applicable trigger levels, EPA IGV Standards and limit values for Drinking Water Regulations (S.I. No. 278 of 2007). Ammoniacal nitrogen concentrations also generally fall below all of the above. A notable exception to this is MH5, which has displayed particularly high ammoniacal nitrogen concentrations in recent years. As mentioned previously, this is likely due to MH5 sampling from an aquifer which contains a lot of decaying organic matter, more than likely from natural sources. Chloride concentrations at all boreholes fall below applicable trigger limits and Drinking Water Regulations. However, EPA IGV Standards have been exceeded at a number of sites in recent years.

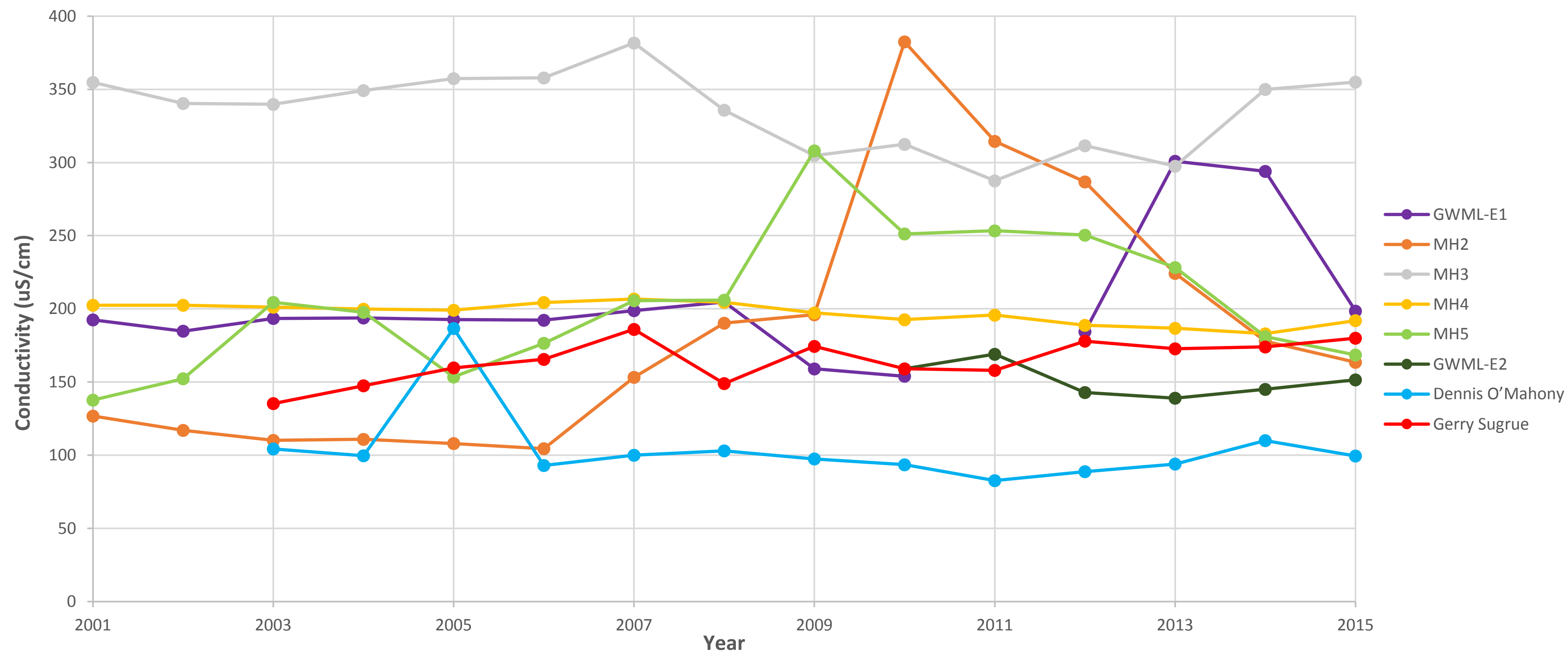



**Figure 3.13: Groundwater monitoring 2001-2015: Conductivity (average – uS/cm)**

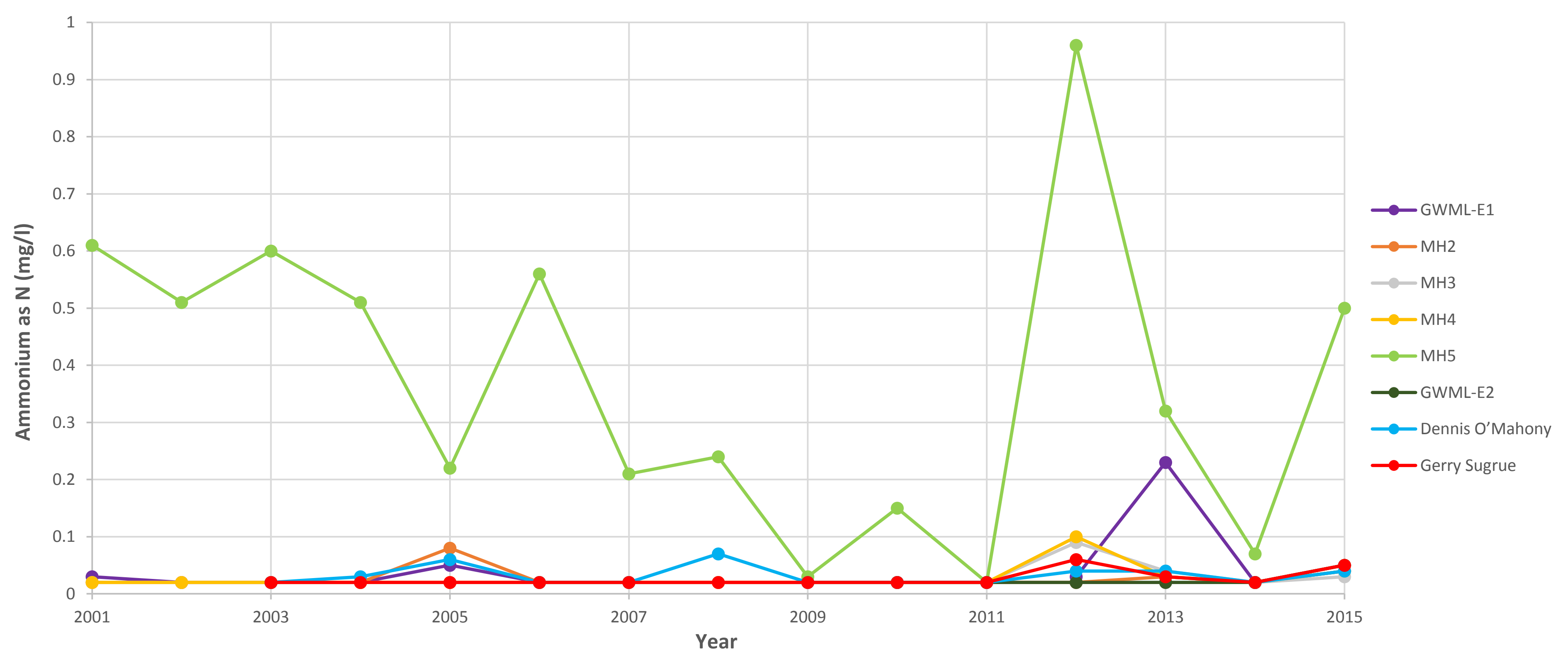



**Figure 3.14: Groundwater monitoring 2001-2015: Ammonium as N (average – mg/l)**

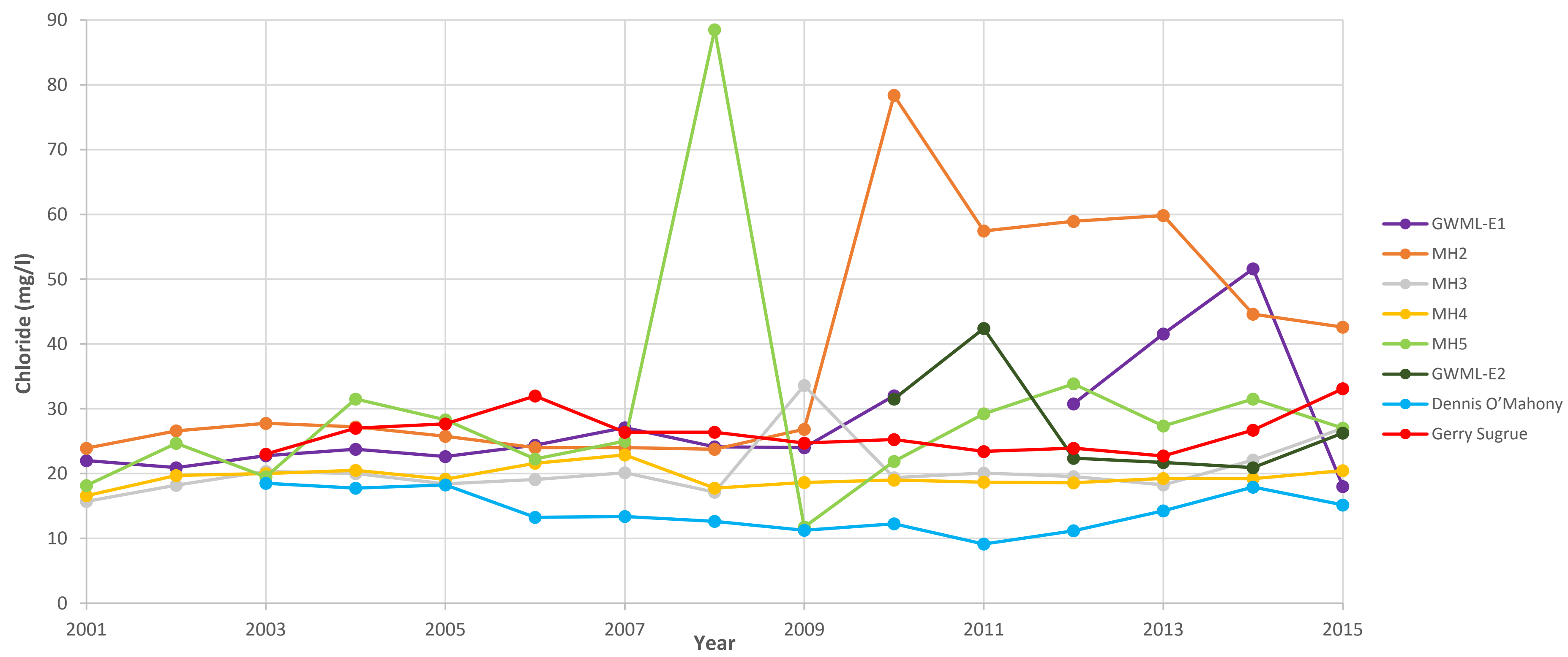



**Figure 3.15: Groundwater monitoring 2001-2015: Chloride (average – mg/l)**

A summary of results obtained from the annual groundwater analysis conducted between 2012 and 2014 is presented in Table 3.7, Table 3.8 and Table 3.9.

Most recorded parameters in recent years have met the EPA IGV Standards and limit values for Drinking Water Regulations (S.I. No. 278 of 2007). The exceptions to this have often been iron and manganese. The high levels of iron and manganese recorded are thought to be reflective of the high concentrations of these parameters in the bedrock of the area.

Set trigger values for lead and nickel have occasionally been exceeded in recent years. Concentrations for these parameters have exceeded the set trigger value at GWML-E1 only. The high lead and nickel levels recorded at this monitoring point were likely due to the fact that this well was bored relatively recently and thus some leaching of its casing may still be occurring.

The most recent annual groundwater analysis results, from the analysis conducted in 2014, indicate that no trigger values were exceeded for any of the recorded parameters at any of the monitoring points.

## Table 3.7: Annual groundwater analysis results 2012 (recorded on $21^{st}/22^{nd}$ November 2012)

| Parameter | Units | EPA IGV Standards | S.I. No. 278 of 2007 Standards | Trigger value for GWML-E1, MH2, MH3 and MH4 | GWML-E1 | MH2 | MH3 | MH4 | MH5 | GWML-E2 | Dennis O'Mahony | Gerry Sugrue |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity as CaCO3 | mg/l | - | - | | 116 | 24 | 132 | 80 | 76 | 35 | 20 | 43 |
| Boron | mg/l | 1.0 | 1.0 | 0.75 | 0.009 | 0.004 | 0.012 | 0.004 | 0.002 | 0.004 | 0.004 | 0.008 |
| Cadmium | mg/l | 0.005 | 0.005 | 0.003 | 0.0005 | 0.0001 | 0.00002 | 0.00002 | 0.00002 | 0.00005 | 0.00005 | 0.00004 |
| Calcium | mg/l | 200 | - | - | 34.9 | 14 | 19.4 | 9.2 | 5.4 | 5.4 | 4.9 | 14.8 |
| Chromium | mg/l | 0.03 | 0.05 | 0.03 | 0.029 | 0.001 | 0.001 | 0.001 | 0.003 | 0.001 | 0.001 | 0.001 |
| Copper | mg/l | 0.2 | 2 | 1.5 | 0.058 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | 0.067 | 0.14 |
| Fluoride | mg/l | 1.0 | 0.8 | 1.0 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
| Iron | mg/l | 0.2 | 0.2 | - | **23.62** | **0.78** | **1.81** | **0.83** | **61.61** | **0.21** | **0.91** | 0.12 |
| Lead | mg/l | 0.01 | 0.025 | 0.01 | **0.052** | 0.001 | 0.001 | 0.0004 | 0.002 | 0.001 | 0.002 | 0.003 |
| Magnesium | mg/l | 50 | - | - | 5.1 | 5.56 | 17.43 | 10.12 | 2.1 | 6.63 | 2.08 | 7.7 |
| Manganese | mg/l | 0.05 | 0.05 | - | **1.35** | **0.62** | **1.90** | **4.02** | **0.39** | **0.244** | **0.151** | **0.031** |
| Mercury | mg/l | 0.001 | 0.001 | 0.00075 | 0.00001 | 0.00005 | 0.0003 | 0.0001 | 0.00001 | 0.000009 | 0.00004 | 0.0003 |
| Nickel | mg/l | 0.02 | 0.02 | 0.015 | **0.039** | 0.0034 | 0.0017 | 0.0072 | 0.0068 | 0.0046 | 0.0025 | 0.0051 |
| Potassium | mg/l | 5 | - | 10 | 2.44 | 0.85 | 1.46 | 1 | 1.12 | 0.82 | < 0.5 | 0.79 |
| Sodium | mg/l | 150 | 200 | 150 | 11.8 | 27 | 21.3 | 14.6 | 17.8 | 14.7 | 6.7 | 13 |
| Sulphate as SO4 | mg/l | 200 | 250 | - | 12.6 | < 2 | < 2 | < 2 | 4.1 | 2.3 | < 2 | 5.8 |
| Total Oxidised Nitrogen | mg/l | - | - | 37.5 | 8.68 | 20.25 | < 0.02 | 0.2 | < 0.02 | 3.33 | 1.89 | 14.05 |
| Zinc | mg/l | 0.1 | - | - | 0.09 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | 0.13 |

Note:
Items highlighted in bold are in exceedance of EPA IGV Standards and Drinking Water Regulations
Items highlighted in red are in exceedance of set trigger values in addition to exceeding the above

## Table 3.8: Annual groundwater analysis results 2013 (recorded on 13th November 2013)

| Parameter | Units | EPA IGV Standards | S.I. No. 278 of 2007 Standards | Trigger value for GWML-E1, MH2, MH3 and MH4 | GWML-E1 | MH2 | MH3 | MH4 | MH5 | GWML-E2 | Dennis O'Mahony | Gerry Sugrue |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity as CaCO3 | mg/l | - | - | | 136 | 18 | 132 | 77 | 60 | 37 | 19 | 34 |
| Boron | mg/l | 1.0 | 1.0 | 0.75 | 0.017 | 0.006 | 0.008 | 0.005 | 0.005 | 0.007 | 0.005 | 0.009 |
| Cadmium | mg/l | 0.005 | 0.005 | 0.003 | 0.0001 | 0.0001 | 0.00002 | 0.00003 | 0.00002 | 0.00006 | 0.0001 | 0.00009 |
| Calcium | mg/l | 200 | - | - | 42.3 | 8.8 | 45.8 | 10.5 | 14.6 | 5.7 | 5.1 | 9.1 |
| Chromium | mg/l | 0.03 | 0.05 | 0.03 | 0.006 | 0.001 | 0.001 | 0.001 | 0.005 | 0.001 | 0.001 | 0.001 |
| Copper | mg/l | 0.2 | 2 | 1.5 | < 0.025 | < 0.025 | 0.05 | < 0.025 | < 0.025 | < 0.025 | 0.338 | 0.119 |
| Fluoride | mg/l | 1.0 | 0.8 | 1.0 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 | < 0.2 |
| Iron | mg/l | 0.2 | 0.2 | - | **3.69** | 0.075 | **1.63** | **1.11** | **43.68** | 0.12 | **2.51** | 0.071 |
| Lead | mg/l | 0.01 | 0.025 | 0.01 | **0.022** | 0.0003 | 0.004 | 0.0008 | 0.001 | 0.0009 | 0.004 | 0.001 |
| Magnesium | mg/l | 50 | - | - | 3.47 | 5.87 | 9.19 | 10.12 | 2.84 | 6.3 | 2.14 | 6.76 |
| Manganese | mg/l | 0.05 | 0.05 | - | **0.482** | **0.339** | **0.171** | **3.277** | **0.139** | **0.201** | **0.202** | **0.061** |
| Mercury | mg/l | 0.001 | 0.001 | 0.00075 | 0.0001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00001 | 0.00002 | 0.00001 |
| Nickel | mg/l | 0.02 | 0.02 | 0.015 | 0.005 | 0.0024 | 0.001 | 0.005 | 0.001 | 0.003 | 0.001 | 0.004 |
| Potassium | mg/l | 5 | - | 10 | 3.04 | 0.8 | 1.33 | 0.97 | 1.35 | 0.9 | < 0.5 | 0.73 |
| Sodium | mg/l | 150 | 200 | 150 | 15.6 | 26.2 | 12.9 | 14.5 | 17.8 | 14.8 | 6.8 | 12.2 |
| Sulphate as SO4 | mg/l | 200 | 250 | - | 8.4 | < 2 | 4.3 | < 2 | 4.4 | 2 | < 2 | 5.2 |
| Total Oxidised Nitrogen | mg/l | - | - | 37.5 | 12.01 | 3.7 | 0.63 | 0.3 | 2.67 | 2.07 | 0.63 | 7.75 |
| Zinc | mg/l | 0.1 | - | - | 0.02 | 0.01 | **0.15** | 0.01 | 0.01 | 0.01 | 0.07 | 0.05 |

Note:
Items in bold are in exceedance of EPA IGV Standards (when applicable) and Drinking Water Regulations
The item in red is in exceedance of EPA IGV Standards and the set trigger value for that monitoring point

## Table 3.9: Annual groundwater analysis results 2014 (recorded on 2nd December 2014)

| Parameter | Units | EPA IGV Standards | S.I. No. 278 of 2007 Standards | Trigger value for GWML-E1, MH2, MH3 and MH4 | GWML-E1 | MH2 | MH3 | MH4 | MH5 | GWML-E2 | Dennis O'Mahony | Gerry Sugrue |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Alkalinity as CaCO3 | mg/l | - | - | | 62 | 24 | 168 | 70 | 70 | 40 | 30 | 25 |
| Boron | mg/l | 1.0 | 1.0 | 0.75 | 0.013 | 0.006 | 0.017 | 0.006 | 0.006 | 0.007 | 0.005 | 0.009 |
| Cadmium | mg/l | 0.005 | 0.005 | 0.003 | <0.0007 | <0.0007 | <0.0007 | <0.0007 | <0.0007 | <0.0007 | <0.0007 | <0.0007 |
| Calcium | mg/l | 200 | - | - | 23.4 | 8.0 | 44.1 | 9.9 | 9.9 | 6.1 | 26.6 | 7.6 |
| Chromium | mg/l | 0.03 | 0.05 | 0.03 | 0.0012 | 0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 | <0.0008 |
| Copper | mg/l | 0.2 | 2 | 1.5 | 0.013 | 0.017 | 0.022 | 0.006 | 0.006 | 0.015 | 0.063 | 0.158 |
| Fluoride | mg/l | 1.0 | 0.8 | 1.0 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 | <0.20 |
| Iron | mg/l | 0.2 | 0.2 | - | 0.007 | **0.412** | **0.218** | 0.078 | 0.078 | **1.153** | **0.979** | 0.197 |
| Lead | mg/l | 0.01 | 0.025 | 0.01 | 0.006 | 0.003 | 0.001 | 0.001 | 0.001 | 0.004 | 0.003 | 0.007 |
| Magnesium | mg/l | 50 | - | - | 3.3 | 3.6 | 18.1 | 9.1 | 9.1 | 6.6 | 3.1 | 7.8 |
| Manganese | mg/l | 0.05 | 0.05 | - | **0.458** | **0.300** | **2.088** | **0.061** | **0.0619** | **0.629** | **0.421** | **0.093** |
| Mercury | mg/l | 0.001 | 0.001 | 0.00075 | 0.0001 | 0.00007 | 0.00005 | 0.00003 | 0.00003 | 0.00004 | 0.00003 | 0.00003 |
| Nickel | mg/l | 0.02 | 0.02 | 0.015 | 0.001 | 0.0017 | 0.0019 | 0.0017 | 0.0017 | 0.0058 | 0.0013 | 0.0085 |
| Potassium | mg/l | 5 | - | 10 | 2.0 | 0.8 | 1.9 | 0.9 | 0.9 | 1.0 | 0.3 | 0.8 |
| Sodium | mg/l | 150 | 200 | 150 | 20.1 | 21.7 | 23.5 | 13.3 | 13.3 | 15.5 | 9.4 | 13.5 |
| Sulphate as SO4 | mg/l | 200 | 250 | - | 9.5 | 1.6 | 7.9 | < 1 | < 1 | 3.1 | 1.3 | 5.8 |
| Total Oxidised Nitrogen | mg/l | - | - | 37.5 | 7.35 | 4.29 | < 0.12 | < 0.12 | < 0.12 | 1.01 | < 0.12 | 13.37 |
| Zinc | mg/l | 0.1 | - | - | 0.007 | 0.013 | 0.013 | 0.006 | 0.006 | 0.027 | 0.045 | **0.191** |

Note: Items in bold are in exceedance of EPA IGV Standards and Drinking Water Regulations

### 3.4.4 Surface Water Quality

The surface water catchment of the North Kerry Landfill and the streams and rivers in its immediate vicinity are presented in Figure 2.11. In accordance with the IED license, surface water quality is monitored at a number of locations, both onsite and off site.

There are 7 onsite monitoring points in total, namely SWML2, SWML3, SWML4, SWML5, SWML10m, SWML11 and SWMLE1. The locations of the onsite monitoring points are shown in Figure 3.16 and are detailed in Table 3.10 SWML6 to SMWL9 inclusive, as shown in Figure 3.16, are not individually monitored but are piped to SML10 where monitoring takes place. SWMLE1 is the new surface water lagoon located onsite.

SW1, SW2 and SW3 are the main off site monitoring points. Their locations are shown in Figure 3.17 and detailed in Table 3.11.

Visual and odour inspections of the above onsite and off site monitoring points are carried out weekly, while total suspended solids are monitored on a monthly basis. General monitoring of other important parameters takes place quarterly. Similar to groundwater monitoring at the site, certain parameters, such as metals, are analysed on an annual basis only. A summary of the frequency that all surface water parameters are monitored at is presented in Appendix A.

In addition to the chemical analysis of surface water quality at the above site, condition 8.9 of the IED license also requires annual biological assessments to take place at 7 separate off site biological stations, namely W1, W2, E1, E2, G1, G2 and N1. Their locations are shown in Figure 3.18 and detailed in Table 3.11. Monitoring of fish also takes place at some of these stations.

**Table 3.10: Surface water monitoring points**

| Monitoring Point | Easting | Northing | Location | Comments |
|---|---|---|---|---|
| SWML2 | 94816 | 117252 | Onsite | Western lagoon |
| SWML3 | 94868 | 117206 | Onsite | |
| SWML4 | 94896 | 117100 | Onsite | |
| SWML5 | 94895 | 117082 | Onsite | |
| SWML10 | 95086 | 117461 | Onsite | Eastern lagoon |
| SWML11 | 95064 | 117512 | Onsite | |
| SWMLE1 | 94592 | 117509 | Onsite | New surface water lagoon |
| SW1 | 95471 | 117047 | Off site | |
| SW2 | 95144 | 117969 | Off site | |
| SW3 | 94853 | 118263 | Off site | |

**Table 3.11: Biological assessment stations**

| Biological Station | Location with respect to the landfill |
|---|---|
| W1 | Drains its western side |
| W2 | Drains its western side |
| E1 | Drains its eastern side |
| E2 | Drains its eastern side |
| G1 | Drains its northern side |
| G2 | Drains its northern side |
| N1 | Drains its northern side |

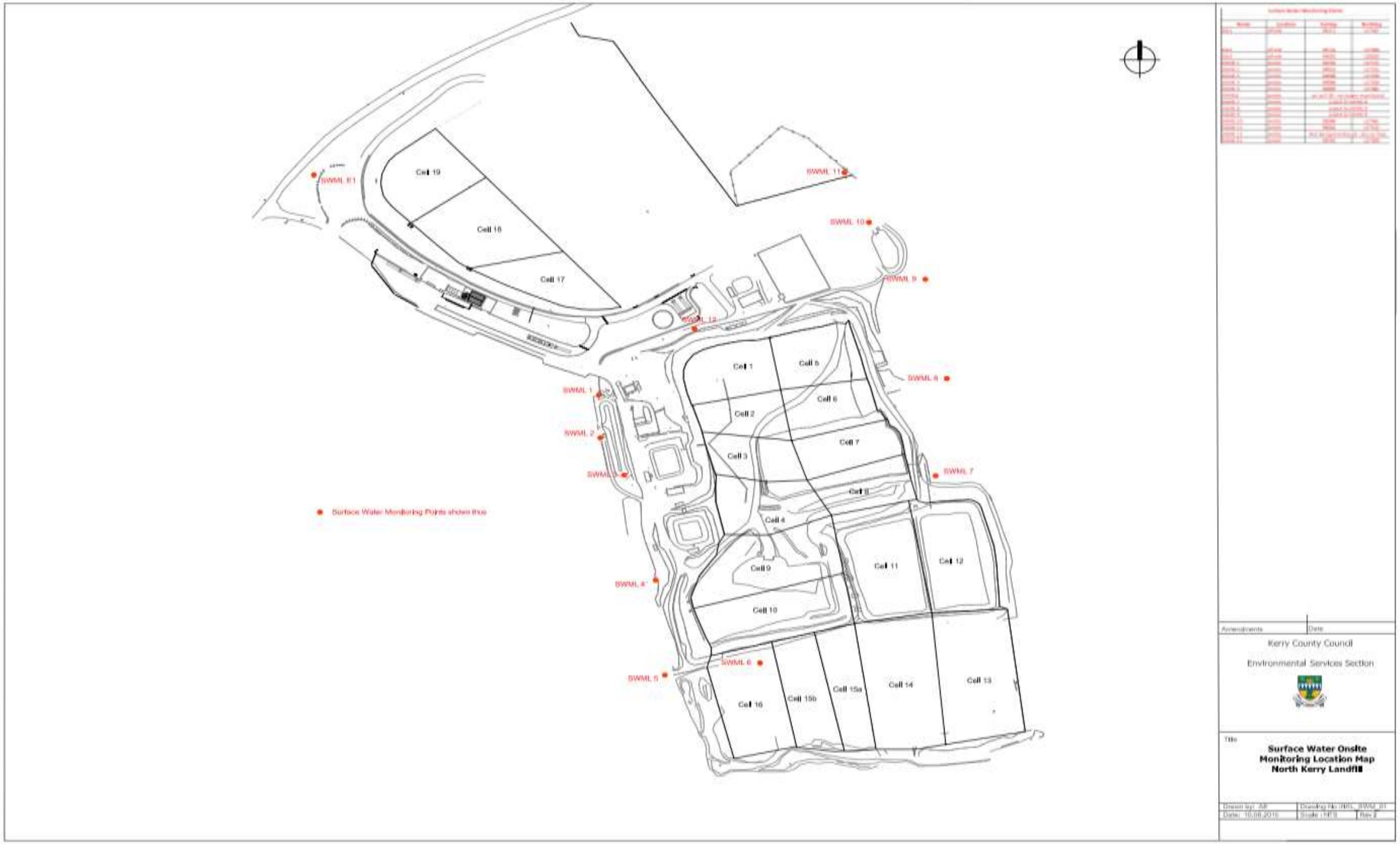
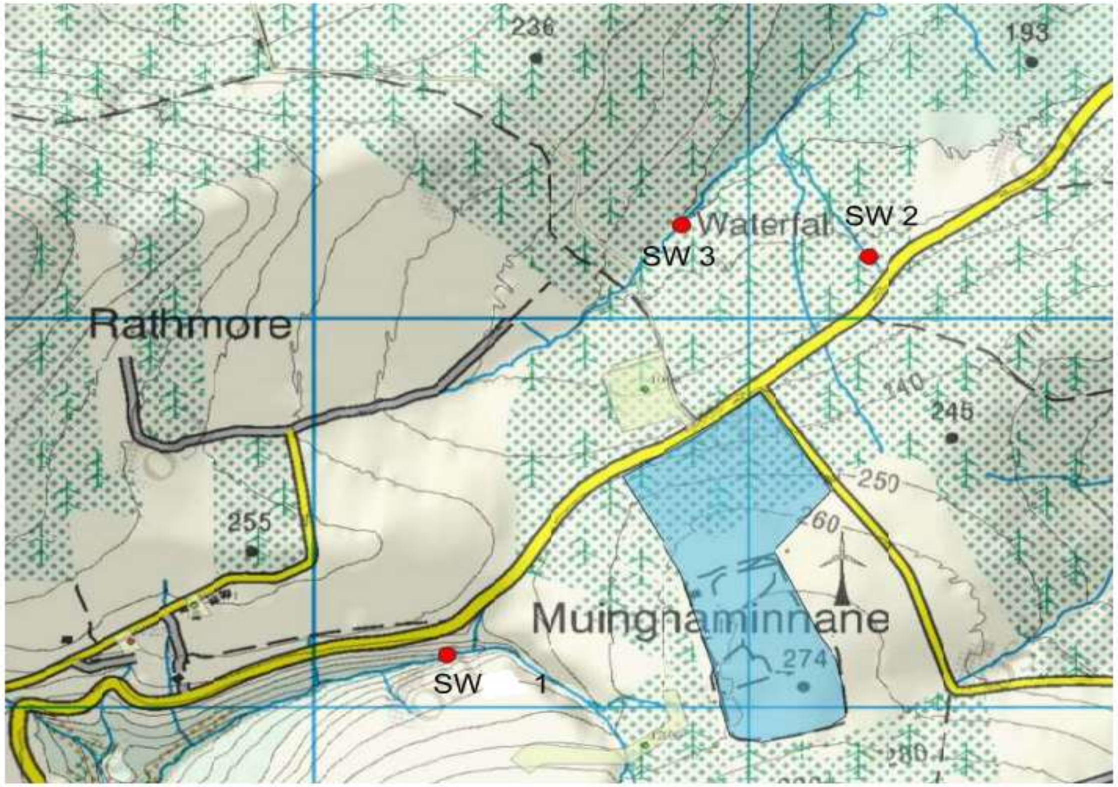



**Figure 3.16: Onsite surface water monitoring points**

| Off Site Surface Water Monitoring | | |
|---|---|---|
| Name | Easting | Northing |
| SW 1 | 95471 | 117047 |
| SW 2 | 95144 | 117969 |
| SW 3 | 94853 | 118063 |




Amendments | Date

Kerry County Council

Environmental Services Section

Title **Surface Water Monitoring Off Site**

**North Kerry Landfill**

| | |
|---|---|
| Drawn by: AE | Drawing No: OFF SWM |
| Date: 14.08.2016 | Scale: NTS | Rev 2 |

**Figure 3.17: Off site surface water monitoring points**

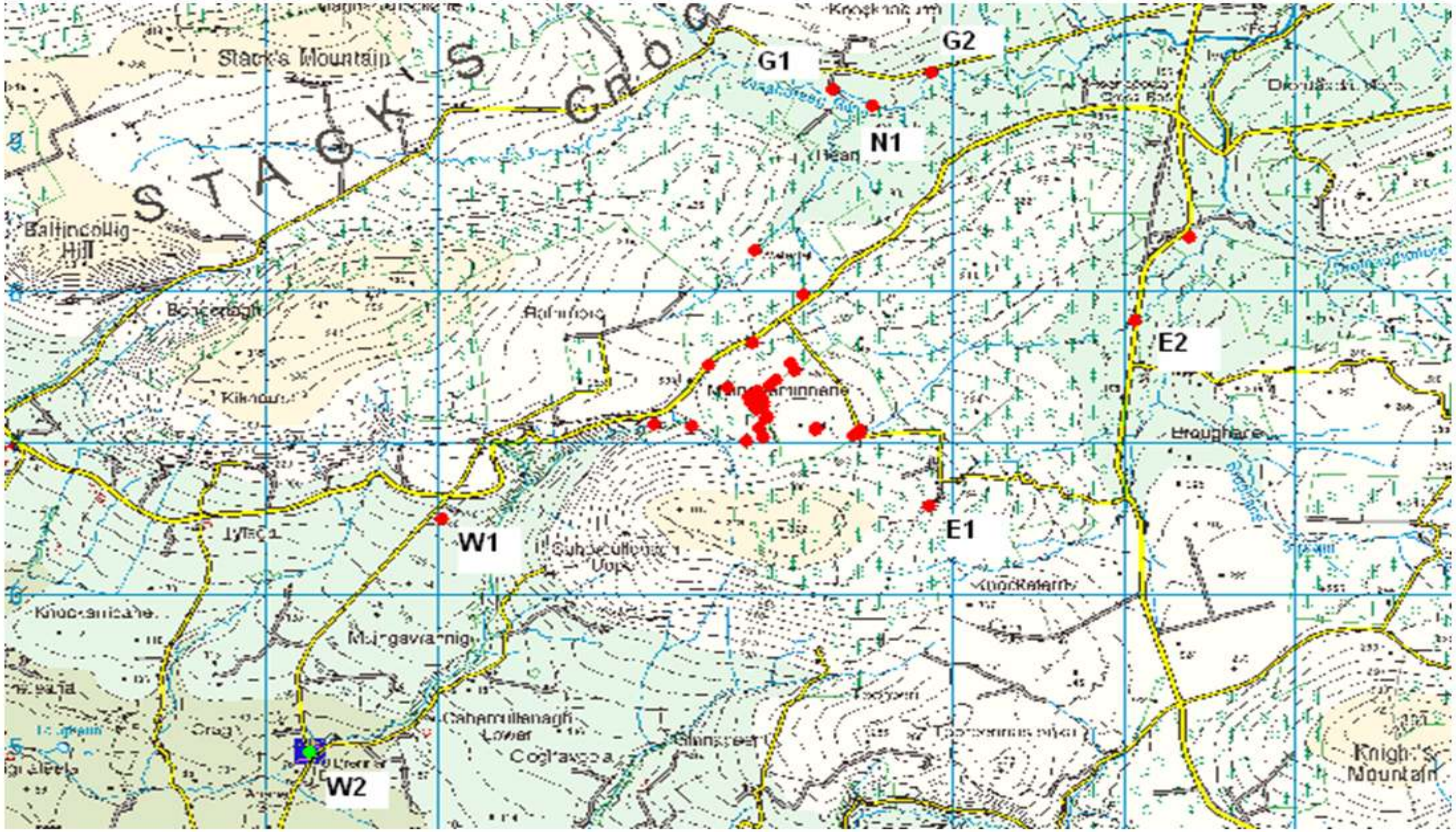



Figure 3.18: Biological assessment stations (extract from KCC invertebrate monitoring report, 2013)

In line with condition 6.5 of the IED licence no raw leachate, treated leachate or contaminated surface water is discharged to the Lee or Smearlagh River catchments. It is a condition of the license to carry out visual inspections on any surface water discharges or watercourses on or near the site. No significant contamination has been noted from any of the above visual inspections carried out in recent years.

Ammoniacal nitrogen, chloride, biochemical oxygen demand (BOD) and suspended solids are four important surface water parameters which have been analysed at the North Kerry Landfill surface water monitoring locations in recent years.

No trigger values were set for surface water parameters. The European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988) and the European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations 1989 (S.I. No. 294 of 1989) are used as standards for surface water quality. These standards are presented in Table 3.12 and are used to compare with the surface water quality monitoring results obtained from monitoring in recent years.

### Table 3.12: Surface water standard values

| Parameter | Unit | Surface Water Regulations[1] | | | Salmonid Regulations[2] |
|---|---|---|---|---|---|
| | | A1* | A2** | A3*** | |
| **Ammonium as N** | mg/l | 0.16 | 1.17 | 3.11 | 0.77 |
| **BOD** | mg/l | 5 | 5 | 7 | <5 |
| **Chloride as Cl** | mg/l | 250 | 250 | 250 | - |
| **Suspended Solids** | mg/l | 50 | - | - | ≤25 |

Note:
[1] S.I. No. 294/1989 — European Communities (Quality of Surface Water Intended for the Abstraction of Drinking Water) Regulations, 1989.
[2] S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, 1988.
* Category A1: Simple physical treatment and disinfection, e.g. rapid filtration and disinfection.
** Category A2: Normal physical treatment, chemical treatment and disinfection, e.g. prechlorination, coagulation, flocculation.
*** Category A3: Intensive physical and chemical treatment, extended treatment and disinfection, e.g. chlorination to break-point, coagulation, flocculation, decantation, filtration, adsorption (activated carbon), disinfection (ozone, final chlorination).

Surface water quality results at 7 of the onsite and 3 of the off site monitoring points for the above four parameters from 2011 to 2015 are summarised in Figure 3.19, Figure 3.20, Figure 3.21 and Figure 3.22. The data used to produce these figures was gathered by calculating the average (arithmetic mean) result for the parameter for the relative year of monitoring. This data is presented in Appendix E. A summary of results obtained from annual surface water analysis conducted between 2012 and 2014 is presented in Appendix F.

Recorded results from recent years indicate a generally good water quality. The most significant threat from the landfill on surrounding waters is from suspended solids. A1 values and the Salmonid Regulations standard for suspended solids have on occasion been exceeded at some of the monitoring points. High suspended solids in river waters may impair fish spawning grounds particularly in winter and spring. The occasionally high levels of suspended solids recorded are considered to be primarily due to the geographic and geological setting of the site rather than the influence of the landfill.

BOD and chloride results from all of the monitoring points over the last five years have been compliant with A1 values and the Salmonid Regulations standards. Ammoniacal nitrogen concentrations exceeded A1 values and the Salmonid Regulations Standard at one onsite monitoring point in 2011 and another in 2012. However, considerably lower ammoniacal nitrogen concentrations which meet both the A1 values and the Salmonid Regulations standard have since been recorded at these monitoring points in more recent years.

Surface water quality results recorded upstream of the landfill in recent years have not varied considerably from those recorded downstream of the landfill. Very similar concentrations have been recorded at the off site upstream monitoring points SW2 and SW3 and at the off site downstream monitoring points SW1.

This indicates that the landfill is unlikely to be having any discernible negative impact on the surface water features in its general surrounds.

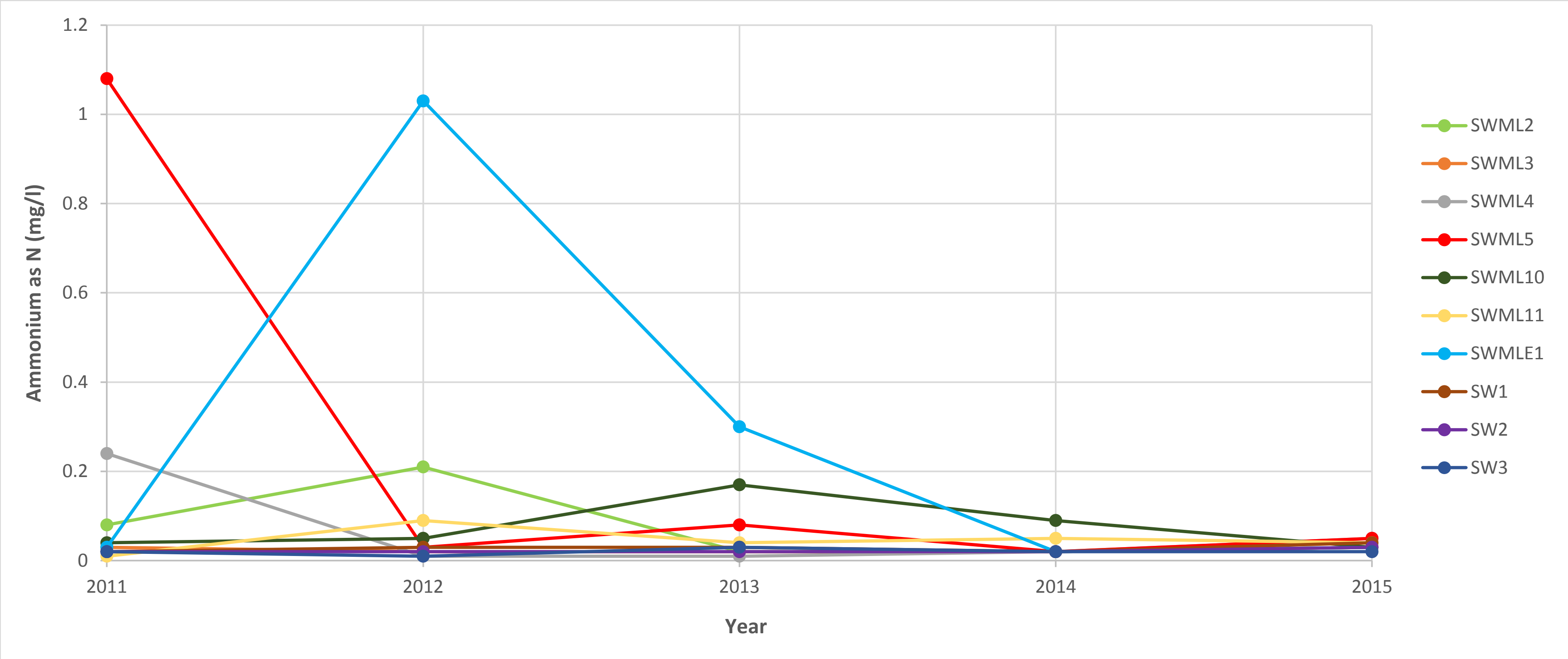



**Figure 3.19: Surface water monitoring 2011-2015: Ammonium as N (average – mg/l)**

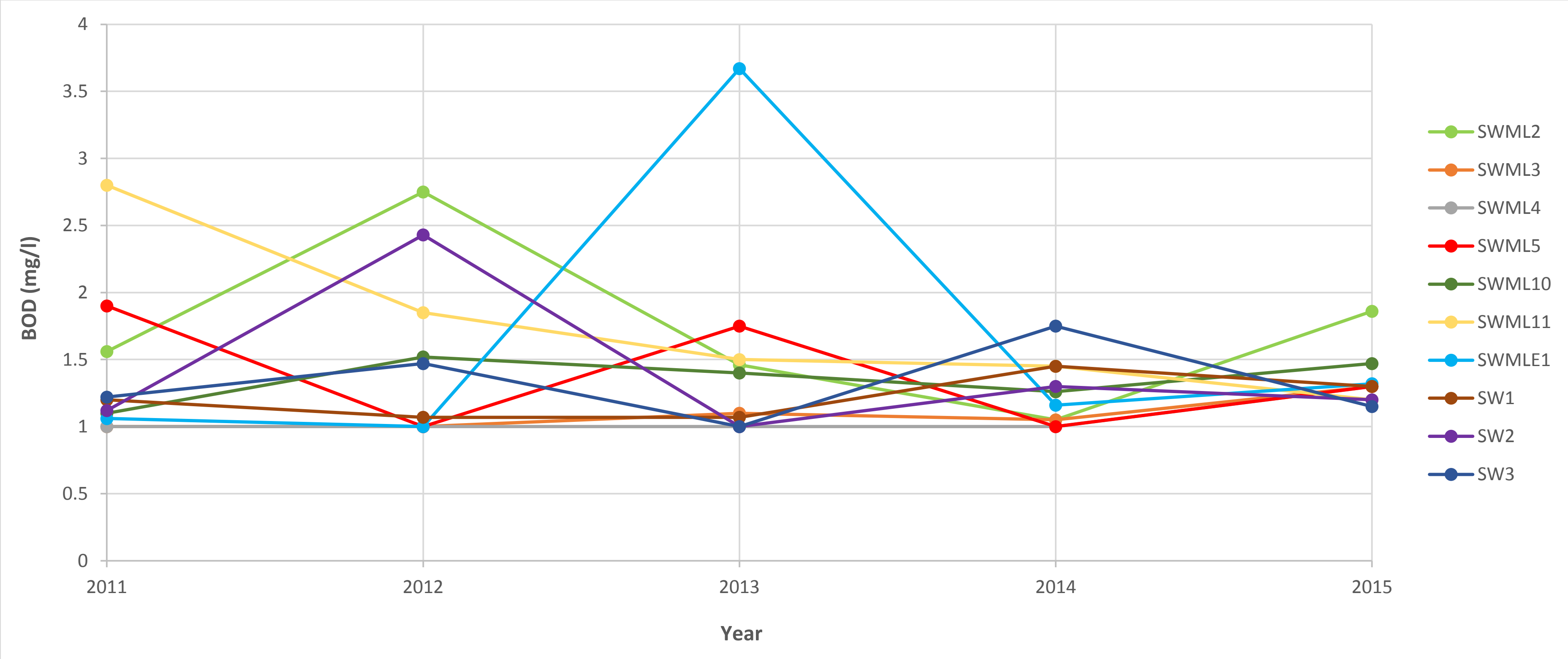



**Figure 3.20: Surface water monitoring 2011-2015: BOD (average – mg/l)**

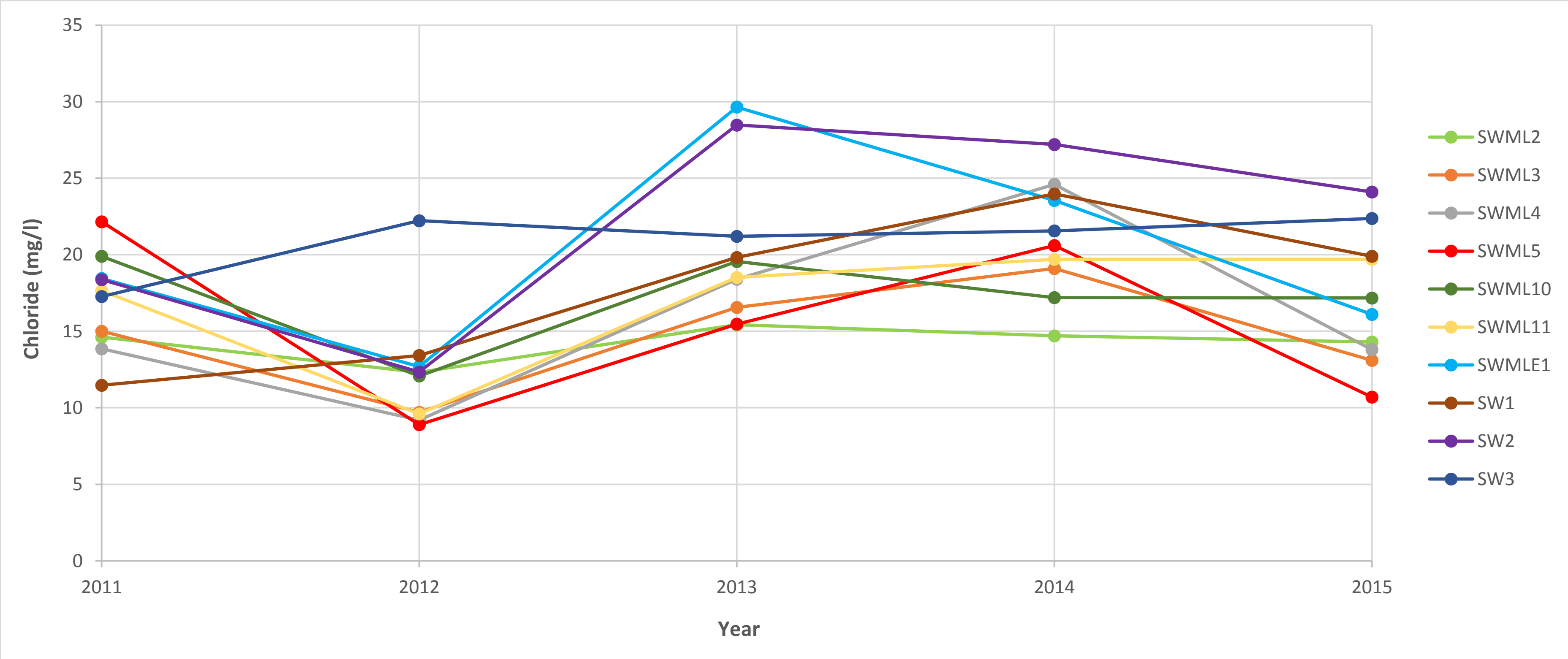



**Figure 3.21: Surface water monitoring 2011-2015: Chloride (average – mg/l)**

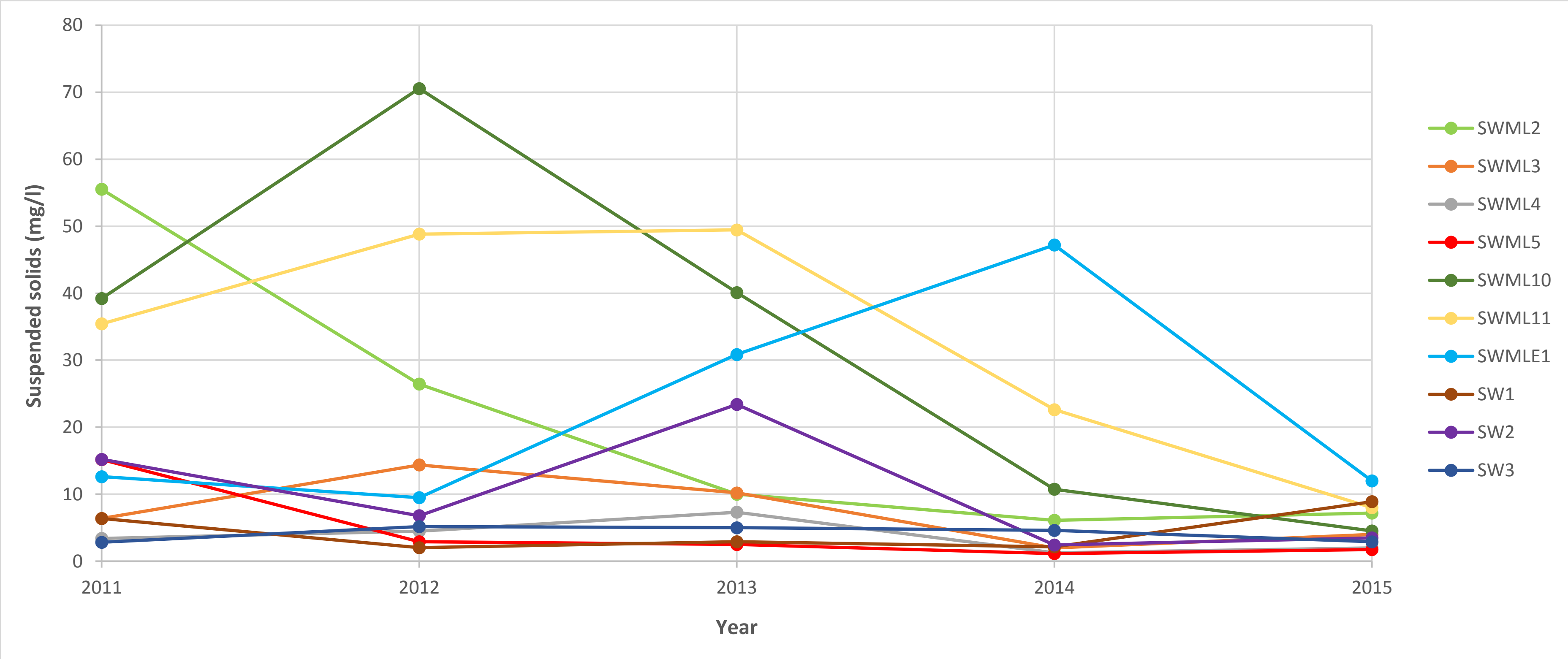



**Figure 3.22: Surface water monitoring 2011-2015: Suspended solids (average – mg/l)**

The biological assessments of the off site monitoring points make use of the Biological Quality Rating System for Rivers (Q Rating System), as outlined by the EPA. The Q Rating System ranges from Q1 to Q5, where Q5 denotes a pristine river and Q1 indicates serious pollution. The goals of the WFD were that designated river and stream stations should attain at least Good Status, i.e. Q4, before the end of 2015. The Q Rating System and its comparison with the WFD Quality Status is shown in Table 3.13.

### Table 3.13: Q Rating System/WFD Quality Status

| Q-Value | Water Quality | WFD Quality Status |
|---|---|---|
| Q5 | Pristine | High |
| Q4-5 | Very good | |
| Q4 | Good | Good |
| Q3-4 | Slightly Polluted | Moderate |
| Q3 | Moderately Polluted | Poor |
| Q2-3 | Moderate to Poor | |
| Q2 | Poor | |
| Q1-2 | Poor to bad | |
| Q1 | Bad | |

A summary of the surface water biological assessments carried out in 2012 and 2013 is presented in Table 3.14.

### Table 3.14: Q Rating Results 2012 and 2013

| Station | Year | Q-value | Water Quality | WFD Quality Status |
|---|---|---|---|---|
| W1 | 2012 | Q4 | Good | Good |
| | 2013 | Q3 | Moderately polluted | Poor |
| W2 | 2012 | Q4-5 | Very good | High |
| | 2013 | Q4-5 | Very good | High |
| E1 | 2012 | Q4-5 | Very good | High |
| | 2013 | Q4-5 | Very good | High |
| E2 | 2012 | Q3-4 | Slightly polluted | Moderate |
| | 2013 | Q3-4 | Slightly polluted | Moderate |
| G1 | 2012 | Q4-5 | Very good | High |
| | 2013 | Q4 | Good | Good |
| G2 | 2012 | Q4-5 | Very good | High |
| | 2013 | Q4 | Good | Good |
| N1 | 2012 | Q3-4 | Slightly polluted | Moderate |
| | 2013 | Q3-4 | Slightly polluted | Moderate |

Surface water biological quality has generally been of a good standard at most assessment stations in recent years. The good biological quality of the surface water is considered to be associated with the low intensity of agricultural activity and poor productivity of agricultural lands within the elevated catchment area of the Stacks Mountains. Q-value status have remained similar at biological assessment stations in recent years, with only slight variations having been recorded.

It is reasonable to conclude that the North Kerry Landfill is not having a discernible negative impact on the biological quality of the surface waters sampled.

## 3.5 SPR Linkages – Risk Screening

In accordance with the Guidance, SPR linkages are determined by identifying the "Source", "Pathways" and "Receptors".

No quantitative risk assessments have been carried out previously.

The "source" of potential groundwater contamination is the residual leachate contained within the landfill. Now that capping is in place over all of the landfill cells it is likely that the leachate volume will tend to zero over time.

The "pathway" is the underlying geology of the site, including both the overburden layer and the underlying bedrock aquifer. This pathway may arise as a result of potential failure of the lining and capping system in place.

The risk to groundwater dependent "receptors" is considered to be low. The two groundwater abstraction wells within 3 km of the site are located outside the sub-catchment of the landfill, while no habitats within the immediate vicinity of the North Kerry Landfill are dependent on groundwater.

## 3.6 Appropriate Tier of Assessment

The guidance recommends three separate tiers of assessment based on:

- Site input types
- Site input thresholds
- Risk of impact

Landfills due to the high risk of potential impact from leachate, are by default recommended to undertake a Tier 3 Assessment. A Tier 3 assessment is therefore required for this site.

The Tier 3 assessment requires a detailed review of existing monitoring and site investigation data for the site with specific reference to hydrology, hydrogeology and historical groundwater monitoring data in order to develop **source-pathway-receptor** (SPR) analyses.

A summary of the hydrology, hydrogeology and historical groundwater monitoring data is presented in Sections 2 and 3 of this report. No hazardous substances have been detected in the groundwater monitoring carried out in recent years.

# 4 ASSESSMENT OF CURRENT GROUNDWATER IMPACTS

## 4.1 Extent of Plume and Trends

A summary of the latest groundwater monitoring results for the site are presented in Section 3 of this report.

Generally, recorded concentrations for parameters in recent years have fallen below applicable trigger levels, EPA IGV Standards and limit values for Drinking Water Regulations (S.I. No. 278 of 2007). As discussed in Section 3, there are some exceptions to this. However, it is considered that these exceptions are unlikely to have been caused by the landfill.

The high ammoniacal nitrogen concentrations recorded at MH5 are thought to be due to the naturally high organic matter content in the aquifer from which this borehole samples. High iron and manganese concentrations recorded in recent years are considered to be reflective of the high concentrations of these parameters in the bedrock of the area, while the exceedance of lead and nickel trigger values at GWML-E1 are likely to have been caused by recent leaching of the casing at this borehole.

There have been no substantial upward trends in the concentrations of any of the recorded parameters between 2001 and 2015. The general trend has remained stable for most parameters during this period of monitoring, with few significant fluctuations observed.

With the lining and capping system in place over the landfill, leachate production will tend to zero over time as it will not be possible for rainfall to percolate through the landfill. However, as the waste is broken down over time a low residual flow rate of leachate is likely to remain for years to come. Therefore, the groundwater below the landfill remains at risk of being polluted from residual leachate.

## 4.2 Impact on Receptors

The risk posed to human beings from the groundwater which flows from the site and is extracted from the wells located nearby is considered to be low. This is due to the distance that these wells are located from the landfill site.

The risk to the bedrock aquifer itself is also considered to be low due to the lining and capping system which is in place across the entire landfill. The nature of the overlying peat and clay layer which confines it also reduce the risk to the bedrock aquifer.

The North Kerry Landfill is not located within a groundwater dependent terrestrial ecosystem. The Knockatarriv Bog NHA, located approximately 1.25 km to the south east of the site, may be somewhat dependent on groundwater. However, the distance that this ecosystem is from the site indicates that it is unlikely to be significantly impacted by any groundwater contamination issues at the site. The northerly groundwater flow direction at the site also reduces potential groundwater impacts on this ecosystem.

Monitoring of surface water quality at both onsite and off site locations in recent years have indicated that the landfill also poses a low risk to the surface waters in its surrounds.

## 4.3 Chemical Status of Groundwater Body

The chemical status of the groundwater body is reported in Section 3.

Iron has been the only parameter in recent years for which concentrations exceeding 100 times the relevant EPA IGV Standard have been recorded. These concentrations were recorded at GWML-E1 and MH5. As mentioned previously, the high concentration of this parameter in the bedrock of the area is considered to be the reason for these notably high concentrations.

Concentrations for all other parameters recorded in recent years have not exceeded 100 times the relevant EPA IGV Standard and are therefore not considered to be of significant concern.

# 5 REMEDIAL STRATEGY

The North Kerry Landfill has been fully capped in accordance with Condition 4.4 of the waste license. The surface of the cap was profiled to encourage surface water runoff and consequently reduce the risk of ponding and infiltration into the waste unit.
The final capping of the last section of the landfill was completed in March 2015.

In addition to the capping of the landfill, the HDPE lined containment cells have helped to virtually eliminate any leakage of leachate into the underlying groundwater.

A leachate management system was put in place in recent years which uses leachate wells to control leachate levels within the waste body. A SCADA system monitors leachate depths in cells 17 to 19and allows for the automatic pumping of leachate to covered leachate holding lagoons onsite. It is planned to extend the SCADA system to cells 1 to 16 in 2016.

The leachate management system reduces the head of leachate over the underlying peat and clays and consequently reduces deep percolate (leachate) inputs to groundwater. Leachate stored in the leachate holding lagoons is disposed via tankering at a licensed Wastewater Treatment Plant.

Quantities of leachate collected and disposed of offsite have steadily reduced each year since 2012.

No further remedial strategy is recommended for the North Kerry Landfill.

# 6 GROUNDWATER COMPLIANCE MONITORING

Groundwater compliance monitoring at the North Kerry Landfill is undertaken in accordance with Condition 8 and Schedule D of the IED license for the site. Monitoring is undertaken by qualified environmental staff with analysis undertaken by Kerry Co Co laboratory.

Compliance points for groundwater monitoring at the North Kerry Landfill are sampled quarterly. Certain parameters, such as metals, are analysed on an annual basis only. A summary of the frequency that all groundwater parameters are monitored at is presented in Appendix A.

The monitoring wells are located in various positions both upgradient and downgradient of the site. Five of the wells are located onsite, as shown in Figure 3.11. The remaining three are located off site, as shown in Figure 3.12. Of the three wells located off site, two of these are private wells.

The parameters that have been monitored in recent years and the compliance values that have been recorded for these parameters are reported on in Section 3.

# 7 SUMMARY, CONCLUSION & RECOMMENDATIONS

The North Kerry Landfill ceased waste acceptance for disposal on site in 2014. The final capping is in place over the landfill, with the last section having been completed in March 2015.
Recorded concentrations of ammoniacal nitrogen, iron, manganese, lead and nickel have been notably high at some of the groundwater monitoring points in recent years. Iron concentrations recorded at two of the onsite monitoring points in recent years exceeded 100 times the relevant EPA IGV Standard.

The elevated concentrations of ammoniacal nitrogen, iron and manganese recorded at times in recent years are thought to be due to unique natural conditions at or nearby the site. The high concentrations of lead and nickel, on the other hand, are likely to be as a result of recent borehole casing leaching at one of the monitoring points.

It is considered unlikely that the landfill is the direct cause of any of the above contamination which has been noted in recent years.

The full lining and capping of the landfill has represented the main action undertaken to limit any potential contamination from the site. Additionally, leachate is collected from the site on a continual basis through the use of a leachate collection and removal system.

The groundwater dependent private wells nearby the landfill are not considered to be at risk due to the distance that these wells are located from the landfill. No groundwater dependent habitats are located within the immediate vicinity of the landfill.

This hydrogeological risk assessment verifies that the North Kerry Landfill is in compliance with the Groundwater Regulations and does not pose a significant risk to groundwater or other environmental receptors.

The current groundwater monitoring network in place at the North Kerry Landfill is adequate to meet the aims of groundwater compliance monitoring required under the Groundwater Regulations. It is recommended that environmental monitoring, particularly with regard to groundwater, leachate and surface water, continues to be carried out at both the onsite and off site monitoring points. This monitoring will help to ensure that the site continues to meet the aims and goals established in the Groundwater Regulations.

It is also recommended that visual inspections of the landfill capping are undertaken annually to ensure that the integrity of the final capping is maintained.

# Appendix A

## Monitoring Frequencies for Leachate, Groundwater and Surface Water Parameters




# North Kerry Landfill: Leachate Monitoring Analytical Parameters

## Continuous Monitoring:

- Leachate Level (measured by Scada System).

## Quarterly:

- Visual Inspection / Odour
- Temperature ° C.

## Annually:

- Ammonium as $NH_4$
- Conductivity uS/cm.
- pH pH units
- Biological Oxygen Demand : BOD mg/l
- Chemical Oxygen Demand : COD mg/l
- Chloride mg/l.
- Total Phosphate / Orthophosphate mg/l.
- Total Oxidised Nitrogen mg/l N.
- Fluoride mg/l.
- Sulphate mg/l.
- Mercury ug/l.
- Cyanide (total) ug/l.
- Metals / Non Metals (boron, cadmium, chromium(total), copper, iron, lead, magnesium, manganese, nickel, potassium, sodium and zinc).

## Once Off:

- List I/II Organic Substances (once off monitoring at two leachate monitoring locations, to be agreed with the EPA)

# North Kerry Landfill: Groundwater Monitoring Analytical Parameters

**Monthly**:

- Groundwater level.

**Quarterly:**

- Visual Inspection / Odour.
- Ammonium as $NH_4$ mg/l.
- Colour Hz units.
- Turbidity NTU's
- Hardness mg/l $CaCO_3$
- Chloride mg/l.
- Dissolved Oxygen mg/l.
- Conductivity uS/cm.
- pH.
- Temperature °C.
- Total Organic Carbon mg/l

**Annually:**

- Total Alkalinity mg/l $CaCO_3$
- Sulphate mg/l
- Total Phosphate / Orthophosphate mg/l
- Total Oxidised Nitrogen mg/l
- Fluoride mg/l
- Cyanide ug/l
- Mercury ug/l
- Residue on evaporation mg/l
- Metals/Non Metals ( Boron, Cadium, Calcium, Chromium(total), Copper, Iron, Lead, Magnesium, Manganese, Nickel, Potassium, Sodium, Zinc ug/l).
- List l/ll Organic Substances

# North Kerry Landfill - Surface Water Monitoring.
## Analytical Parameters.

### Weekly:

- **Visual Inspection/ Odour.**

### Monthly:

- **Total Suspended Solids.**

### Quarterly:

- **Dissolved Oxygen mg/l.**
- **Temperature**
- **Ammonium as $NH_4$**
- **Conductivity uS/cm.**
- **pH** pH units
- **Biological Oxygen Demand : BOD mg/l**
- **Chemical Oxygen Demand : COD mg/l**
- **Chloride mg/l.**

### Annually:

- **Metals/Non Metals:**

**(Boron, Copper, Iron, Lead Zinc Cadmium, Nickel, Chromium(total), Manganese, Potassium, Sodium , Calcium, and Magnesium.).**

- **Mercury.**
- **Sulphate mg/l**
- **Total Alkalinity mg/l**
- **Total Phosphate/Orthophosphate mg/l**
- **Total Oxidised Nitrogen , TON mg/l.**

### Once Off:

- **List I/II Organic Substances (once off monitoring at two surface water monitoring locations to be agreed with Agency)**

# Appendix B

## 2001 to 2015 Annual Leachate Quality Analysis Results for LL1, LL2 and LL3




## LL1 annual leachate quality analysis 2001 to 2015

| | 28-Nov-01 | 13-Nov-02 | 04-Nov-03 | 03-Nov-04 | 15-Nov-05 | 14-Nov-06 | 06-Nov-07 | 11-Nov-08 | 03-Nov-09 | 17-Nov-10 | 21-Nov-12 | 13-Nov-13 | 02-Dec-14 | 11-Nov-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ammonium (as N) (mg/l)** | 565 | 356 | 498 | 365 | 267 | 377 | 459 | 214 | 250 | 184 | 281 | 226 | 165 | 142 |
| **TON (mg/l)** | 0.75 | 1.88 | 0.42 | 1.23 | 1.68 | 3.55 | 0.76 | 0.8 | 1.52 | 2.26 | 6.8 | 3.39 | 1.19 | <0.5 |
| **pH (pH units)** | 7.9 | 7.6 | 8.1 | 7.4 | 7.2 | 7.5 | 7.6 | 7.5 | 7.6 | 7.5 | 7.5 | 7.6 | 7.2 | 7.4 |
| **BOD (5day) (mg/l)** | 54 | 35.4 | 34 | 454 | 647 | 259 | 32 | 12.5 | 21.8 | 15.8 | 840 | 178 | - | 53 |
| **Conductivity @ 20°C (uS/cm)** | 7130 | 4445 | 6570 | 5120 | 4150 | 5430 | 7010 | 3320 | 2710 | 2470 | 4280 | 3570 | 2580 | 2570 |
| **COD (mg/l)** | 746 | 520 | 748 | 1165 | 1240 | 910 | 640 | 272 | 316 | 227 | 1700 | 670 | 230 | 313 |
| **Total Cyanide (mg/l)** | <0.02 | <0.02 | <0.02 | <0.1 | <0.005 | <0.05 | - | 0.007 | 0.013 | <0.005 | 0.052 | - | - | - |
| **Chloride (mg/l)** | 635 | 630 | 1020 | 710 | 380 | 770 | 758 | 270 | 250 | 208.5 | 380.1 | 353.4 | 218.8 | 259.6 |
| **Sulphate (mg/l)** | <5 | 6 | <10 | <10 | <10 | <10 | 117.7 | <10 | <10 | <10 | <2 | <2 | 57.8 | <5 |
| **Sodium (mg/l)** | 590 | 318 | 590 | 397 | 426 | 348 | 712.8 | 241.6 | 210.2 | 158.3 | 354.4 | 342.7 | 202.6 | - |
| **Calcium (mg/l)** | 63 | 58.8 | 129 | 130 | 184 | 72 | 130.2 | 66.6 | 74.1 | 65.4 | 124.9 | 105.8 | 81.6 | - |
| **Magnesium (mg/l)** | 74 | 42 | 76 | 65 | 58 | 49 | 92.67 | 28.77 | 16.59 | 18.53 | 55.36 | 46.21 | 25.9 | - |
| **Potassium (mg/l)** | 349 | 218 | 326 | 243 | 286 | 222 | 380.6 | 124.1 | 88.94 | 81.1 | 217.1 | 187.3 | 109.5 | - |
| **Boron (mg/l)** | 1.212 | 1.13 | 1.68 | 1.6 | 0.719 | 0.74 | 2.939 | 0.431 | 0.499 | 0.385 | 0.999 | 0.959 | 0.52 | - |

| | 28-Nov-01 | 13-Nov-02 | 04-Nov-03 | 03-Nov-04 | 15-Nov-05 | 14-Nov-06 | 06-Nov-07 | 11-Nov-08 | 03-Nov-09 | 17-Nov-10 | 21-Nov-12 | 13-Nov-13 | 02-Dec-14 | 11-Nov-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mercury (ug/l)** | <5 | <10 | <10 | <5 | 0.681 | 0.26 | <0.009 | 5.099 | <0.009 | <0.009 | 0.055 | <0.009 | 0.03 | - |
| **Cadmium (ug/l)** | <5 | <10 | 56 | <10 | 0.181 | 0.12 | 0.674 | <0.02 | 0.134 | <0.02 | 0.129 | 0.084 | <0.7 | - |
| **Chromium (ug/l)** | 48 | 60 | 67 | 39 | 35.2 | 67 | 60.08 | <1.1 | 17.25 | 16.46 | 69.746 | 54.87 | 18.1 | - |
| **Nickel (ug/l)** | 50 | - | 60 | 30 | 38 | 41 | 45 | <0.8 | 11.73 | 16.58 | 37.389 | 28.707 | 16.9 | - |
| **Lead (ug/l)** | <5 | <10 | 20 | <10 | 3.5 | 4.18 | 3.359 | <0.2 | 2.836 | 1.818 | 2.88 | 2.487 | 2.9 | - |
| **Copper (mg/l)** | <0.03 | 0.05 | 0.03 | <0.025 | 0.04 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 | <0.025 | 0.010 | - |
| **Manganese (ug/l)** | 1200 | 2500 | 3100 | 2880 | 3920 | 3110 | 4506 | 3269 | 1206 | 2955 | 3607.5 | 2345 | 3800.8 | - |
| **Zinc (ug/l)** | 70 | 70 | 90 | 210 | 200 | 170 | 90 | 330 | 60 | 20 | 90 | 50 | 19 | - |
| **Iron (ug/l)** | 9300 | 7500 | 15200 | 9930 | 9400 | 7200 | - | 9590 | 5140 | 7920 | 9158.96 | 7303 | 13940 | - |
| **Flouride (mg/l)** | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | 0.207 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.20 | <0.1 |
| **Total Phosphorous (mg/l)** | 2.056 | 2.521 | 3.224 | 1.416 | 1.154 | 1.7 | 1.252 | 0.561 | 0.971 | 0.538 | 1.044 | 1.007 | 0.43 | - |

## LL2 annual leachate quality analysis 2001 to 2015

| | 13-Nov-02 | 04-Nov-03 | 03-Nov-04 | 15-Nov-05 | 14-Nov-06 | 06-Nov-07 | 11-Nov-08 | 03-Nov-09 | 17-Nov-10 | 30-Nov-11 | 21-Nov-12 | 13-Nov-13 | 02-Dec-14 | 11-Nov-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonium (as N) (mg/l) | 578 | 698 | 411 | 236 | 321 | 568 | 634 | 623 | 432 | 477 | 20.8 | 191 | 232.00 | 160 |
| TON (mg/l) | 0.73 | 0.52 | 0.78 | 5.83 | 0.52 | 9.23 | 27.27 | 25.16 | 34.9 | 106.09 | 0.32 | 4.09 | <0.12 | 0.93 |
| pH (pH units) | 8 | 7.8 | 7.7 | 7.4 | 7.6 | 8 | 7.4 | 7.8 | 7.7 | 7.6 | 8 | 7.7 | 8.0 | 7.4 |
| BOD (5day) (mg/l) | 198 | 93 | 38 | 20 | 23 | 546 | 1352 | 254 | 306 | 683 | 12.3 | 25 | 58 | 50 |
| Conductivity @ 20°C (uS/cm) | 8810 | 9080 | 5190 | 3580 | 4360 | 8610 | 8670 | 7010 | 6590 | 6540 | 2020 | 3140 | 3040 | 2800 |
| COD (mg/l) | 1070 | 1188 | 540 | 277 | 382 | 2050 | 4040 | 1014 | 1320 | 1385 | 231 | 411 | 583 | 314 |
| Total Cyanide (mg/l) | <0.02 | <0.02 | <0.1 | <0.005 | <0.05 | - | 0.155 | 0.111 | 0.087 | 0.065 | <0.025 | - | - | - |
| Chloride (mg/l) | 960 | 1240 | 630 | 345 | 495 | 910.5 | 690 | 710 | 55 | 581 | 178.3 | 368.8 | 337.9 | 318.8 |
| Sulphate (mg/l) | <5 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 23.2 | 8.8 | 5.5 | 66.2 |
| Sodium (mg/l) | 669 | 900 | 401 | 352 | 285 | 880.5 | 651.5 | 661.6 | 557.6 | 610.6 | 155.5 | 342.1 | 287.9 | - |
| Calcium (mg/l) | 105.1 | 83 | 48 | 98 | 43 | 122 | 482.4 | 110.1 | 132.9 | 239 | 41.4 | 52.8 | 60.9 | - |
| Magnesium (mg/l) | 154 | 117 | 58 | 40 | 31.7 | 114.5 | 123.7 | 75.56 | 74.62 | 130.75 | 18.78 | 27.04 | 27.6 | - |
| Potassium (mg/l) | 508 | 595 | 280 | 217 | 167 | 527.4 | 413.9 | 331.2 | 351.6 | 380.71 | 92.2 | 169.99 | 142.9 | - |
| Boron (mg/l) | 2.81 | 3.32 | 1.07 | 0.914 | 0.53 | 2.697 | 1.705 | 1.249 | 0.991 | 1.444 | 0.574 | 0.771 | 0.672 | - |

| | 13-Nov-02 | 04-Nov-03 | 03-Nov-04 | 15-Nov-05 | 14-Nov-06 | 06-Nov-07 | 11-Nov-08 | 03-Nov-09 | 17-Nov-10 | 30-Nov-11 | 21-Nov-12 | 13-Nov-13 | 02-Dec-14 | 11-Nov-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mercury (ug/l)** | <10 | <10 | <5 | 0.273 | 0.64 | 0.956 | 3.308 | <0.009 | <0.009 | 0.625 | 0.072 | <0.009 | 0.0288 | - |
| **Cadmium (ug/l)** | <10 | 12 | <10 | 0.455 | <0.2 | 0.13 | 0.123 | 0.215 | 0.078 | 0.194 | <0.02 | 0.039 | <0.7 | - |
| **Chromium (ug/l)** | 10 | 103 | 36 | 59.6 | 28 | 107.5 | 92.31 | 27.35 | 77.79 | 45.018 | 17.809 | 25.529 | 27.2 | - |
| **Nickel (ug/l)** | - | 84 | 49 | 38.9 | 36 | 77 | 44.65 | 31.97 | 93.84 | 59.751 | 20.21 | 28.534 | 30.1 | - |
| **Lead (ug/l)** | 30 | 16 | <10 | 11.2 | 6.93 | 10.38 | 21.22 | 9.462 | 10.15 | 6.651 | 1.242 | 1.281 | 4.2 | - |
| **Copper (mg/l)** | 0.04 | 0.03 | 0.043 | 0.06 | 0.05 | 0.039 | <0.025 | 0.06 | 0.044 | <0.025 | <0.025 | <0.025 | 0.018 | - |
| **Manganese (ug/l)** | 1300 | 1000 | 1910 | 2220 | 2290 | 3013 | 8107 | 936 | 2477 | 2365 | 855.2 | 1669 | 1610.6 | - |
| **Zinc (ug/l)** | 160 | 170 | 70 | 40 | 40 | 990 | 1730 | 1070 | 300 | 290 | 20 | 10 | 32 | - |
| **Iron (ug/l)** | 6300 | 4600 | 8380 | 8620 | - | - | 8170 | 3330 | 7010 | 4900 | 3638.87 | 12050.83 | 13819 | - |
| **Flouride (mg/l)** | <0.2 | 0.218 | <0.2 | <0.2 | 0.207 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.20 | 0.1 |
| **Total Phosphorous (mg/l)** | 2.224 | 4.969 | 2.701 | 1.203 | 2.1 | 2.671 | 7.795 | 4.359 | 3.66 | 4.041 | 0.588 | 0.963 | 1.29 | - |

## LL3 annual leachate quality analysis 2001 to 2015

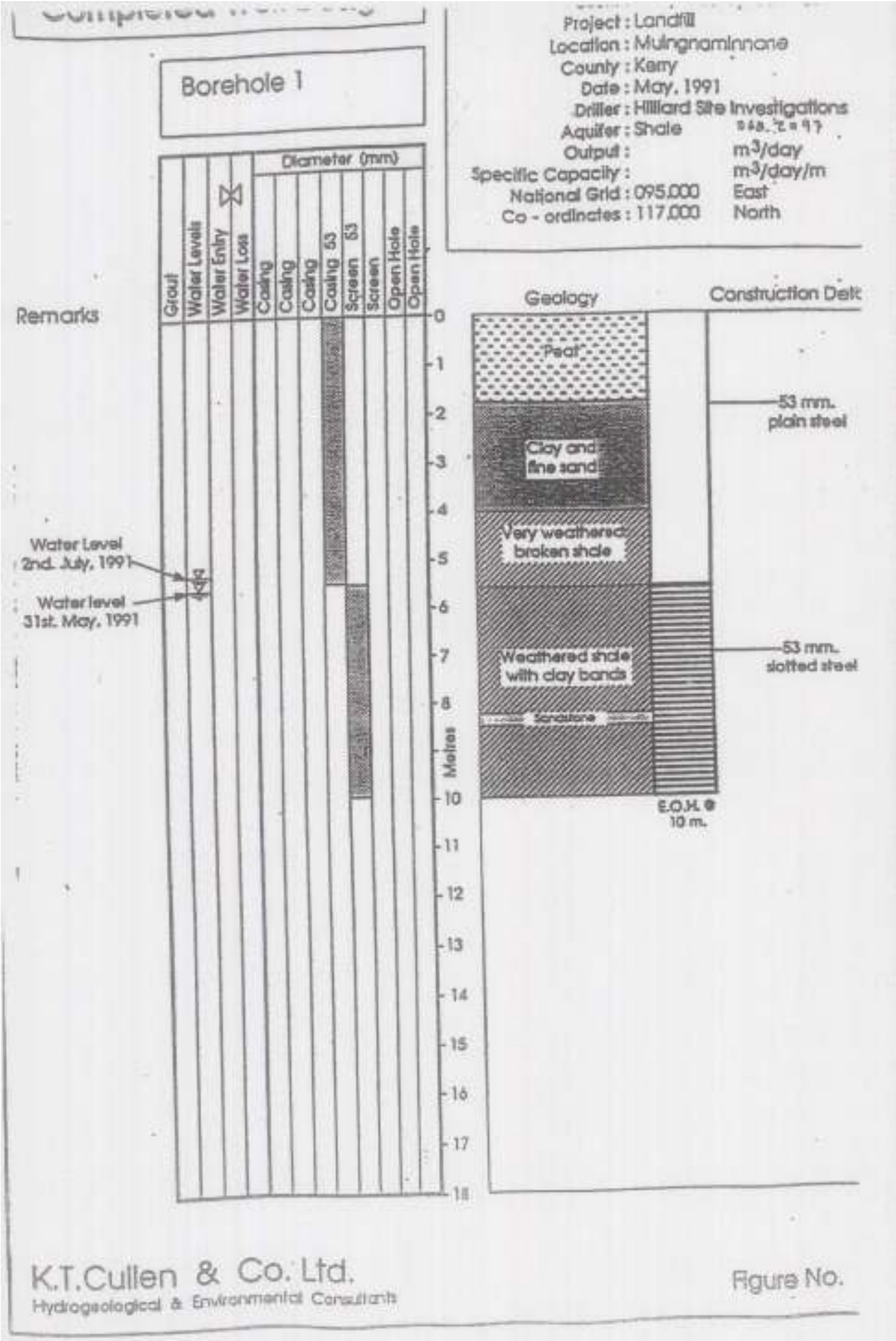
| | 28-Nov-01 | 13-Nov-02 | 04-Nov-03 | 03-Nov-04 | 15-Nov-05 | 14-Nov-06 | 06-Nov-07 | 11-Nov-08 | 03-Nov-09 | 17-Nov-10 | 30-Nov-11 | 21-Nov-12 | 13-Nov-13 | 02-Dec-14 | 11-Nov-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ammonium (as N) (mg/l)** | 7.49 | 13.2 | 35.0 | 27.8 | 5.65 | 4.20 | 2.17 | 7.18 | 2.26 | 1.26 | 1.56 | 0.47 | 0.37 | 0.09 | 0.05 |
| **TON (mg/l)** | 1.03 | 1.53 | 0.45 | 1.61 | 1.75 | 6.19 | 0.64 | 1.44 | 6.86 | 1.36 | 4.4 | 0.66 | 4.8 | <0.12 | <0.5 |
| **pH (pH units)** | 7.2 | 6.8 | 6.5 | 7.3 | 6.6 | 7.4 | 7.4 | 7.6 | 7.6 | 7.6 | 7.6 | 7.5 | 7.6 | 8.0 | 7.5 |
| **BOD (5day) (mg/l)** | 77 | 576 | 624 | 178 | 470 | 18 | 55 | 12.6 | 19.8 | 5.8 | 3.8 | 6.1 | 2.7 | 2.1 | 1.3 |
| **Conductivity @ 20°C (uS/cm)** | 1151 | 958 | 1280 | 972 | 952 | 530 | 311 | 438 | 317 | 293 | 179 | 174 | 176 | 136 | 106 |
| **COD (mg/l)** | 438 | 1020 | 1400 | 505 | 667 | 188 | 242 | 148 | 279 | 111 | 35 | 72 | 43 | <10 | <15 |
| **Total Cyanide (mg/l)** | <0.02 | <0.02 | <0.02 | <0.1 | <0.005 | <0.05 | - | 0.015 | 0.02 | 0.017 | <0.025 | <0.025 | - | - | - |
| **Chloride (mg/l)** | 143 | 130 | 210 | 150 | 120 | 87 | 27.5 | 76 | 43 | 41.5 | 26 | 14.3 | 18.4 | 5.6 | 6.2 |
| **Sulphate (mg/l)** | 57 | 35 | 44.6 | 10.8 | <10 | <10 | <10 | <10 | <10 | <10 | <10 | 2.3 | <2 | <1 | <5 |
| **Sodium (mg/l)** | 75 | 40 | 77 | 51 | 76 | 22 | 21.4 | 26.5 | 15.2 | 12.7 | 8 | 5.9 | 7.7 | 4.8 | - |
| **Calcium (mg/l)** | 56 | 106.3 | 170 | 62 | 127 | 25 | 36.5 | 25.9 | 31.9 | 19.6 | 18.8 | 21 | 23.6 | 24.1 | - |
| **Magnesium (mg/l)** | 17 | 16.9 | 30 | 13 | 15 | 4.6 | 2.48 | 4.67 | 3.76 | 2.98 | 2.57 | 1.83 | 1.97 | 1.0 | - |
| **Potassium (mg/l)** | 133 | 81.7 | 174 | 118 | 161 | 8.07 | 41.19 | 39.78 | 34.45 | 39.31 | 18.51 | 19.8 | 17.41 | 4.1 | - |
| **Boron (mg/l)** | 0.158 | 0.15 | 0.33 | 0.42 | <0.05 | <0.05 | 0.971 | <0.05 | <0.05 | 0.015 | 0.034 | 0.016 | 0.021 | 0.006 | - |

| | 28-Nov-01 | 13-Nov-02 | 04-Nov-03 | 03-Nov-04 | 15-Nov-05 | 14-Nov-06 | 06-Nov-07 | 11-Nov-08 | 03-Nov-09 | 17-Nov-10 | 30-Nov-11 | 21-Nov-12 | 13-Nov-13 | 02-Dec-14 | 11-Nov-15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Mercury (ug/l)** | <1 | <10 | <10 | <5 | 0.162 | 0.34 | 0.342 | 0.017 | <0.009 | <0.009 | 0.04 | 0.018 | 0.02 | - | - |
| **Cadmium (ug/l)** | <0.02 | <0.02 | <0.02 | <10 | 0.217 | 0.26 | 2.886 | 0.131 | 0.369 | 0.126 | 0.484 | 0.099 | 0.034 | <0.7 | - |
| **Chromium (ug/l)** | <1.1 | 20 | 11 | 18 | 7.3 | 12.3 | 13.6 | <1.1 | 4.377 | <1.1 | <1.1 | <1.1 | <1.1 | <0.8 | - |
| **Nickel (ug/l)** | <0.8 | - | 16 | 14 | 12.2 | 9.7 | 19 | 1.018 | 6.563 | 2.267 | 1.838 | 1.545 | 0.872 | <1.0 | - |
| **Lead (ug/l)** | <0.2 | 20 | 10 | 11 | 12.6 | 15.2 | 19.33 | 7.001 | 18.03 | 4.812 | 2.993 | 2.985 | 0.991 | 1.6 | - |
| **Copper (mg/l)** | 0.04 | 0.03 | <0.025 | <0.025 | 0.04 | 0.07 | 0.035 | <0.025 | 0.032 | <0.025 | <0.025 | <0.025 | <0.025 | 0.008 | - |
| **Manganese (ug/l)** | 600 | 600 | 890 | 460 | 410 | <100 | 72 | 836 | 88 | 124 | 55 | 75.1 | 40 | 35.8 | - |
| **Zinc (ug/l)** | 110 | 150 | 270 | 120 | 170 | 150 | 560 | 90 | 140 | 50 | 40 | 40 | 30 | 13 | - |
| **Iron (ug/l)** | 4500 | 5000 | 8600 | 4100 | 3930 | - | - | 3010 | 3880 | 800 | 460 | 567.02 | 222.21 | 366 | - |
| **Flouride (mg/l)** | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.20 | <0.1 |
| **Total Phosphorous (mg/l)** | 2.903 | 3.812 | 7.74 | 4.579 | 3.709 | 1.98 | 0.11 | 0.789 | 1.093 | 0.862 | 0.588 | 1.094 | 0.624 | 0.03 | - |

# Appendix C

Borehole and Trial Pit Logs

## MH1 borehole log



# MH2 borehole log

| BRG Ltd.<br>35 Cleevaun,<br>Naas, Co Kildare<br>Tel: 045 874386 | | | Borehole No<br>**BH - 2**<br>Sheet 1 of 2 |
|---|---|---|---|
| Project Name<br>TES - North Kerry Landfill | Project No.<br>TES1 | Co-ords: 94780E - 117550N | Hole Type<br>Rotary |
| Engineer:<br>TES Consulting Engineers Ltd | | Level: 0.00 m AOD | Scale<br>1:50 |
| Client: | | Dates: 14/05/2003-15/05/2003 | Logged By<br>G Reid |

| Well | Water Strikes | Samples & In Situ Testing: Depth (m) | Type / Results: TCR | SCR | RQD | FI |
|---|---|---|---|---|---|---|
| | | 1.20-1.85 | 85 | 0 | 0 | >50 |
| | | 1.85-2.50 | 85 | 0 | 0 | >50 |
| | | 2.50-2.95 | 85 | 0 | 0 | >50 |
| | | 2.95-3.30 | 85 | 0 | 0 | >50 |
| | | 3.30-3.50 | 85 | 0 | 0 | >50 |
| | | 3.50-3.80 | 85 | 0 | 0 | >50 |
| | | 3.80-4.80 | 85 | 0 | 0 | >50 |
| | | 4.80-5.50 | 85 | 0 | 0 | >50 |
| | | 5.50-5.80 | 85 | 0 | 0 | >50 |
| | | 5.80-7.30 | 85 | 0 | 0 | >50 |
| | | 7.30-8.00 | 85 | 79 | 79 | 22 |
| | | 8.70-10.00 | 85 | 28 | 28 | >50 |

| Depth (m) | Level (m AOD) | Stratum Description |
|---|---|---|
| 0.80 | -0.80 | Dark brown, peaty, TOPSOIL |
| 1.20 | -1.20 | Loose light brown GRAVEL, fine-coarse grained rounded siltstone fragments (<10-70mm) Water loss at 1.0m |
| 3.30 | -3.30 | Strong, light brown, fine grained SILTSTONE, moderately weathered. DISC: 1/ planar/rough dip 30, 2/ planar/rough dip T 75. minor clay on discontinuity surfaces. 2.55-2.7m broken zone fine-medium rounded gravel sized fragments |
| 3.50 | -3.50 | Thinly laminated, light brown SHALE, strong sub-vertical cleavage, moderately weathered. DISC: 1/ irregular-planar / rough dip 30, 2/irregular-planar - rough dip 75 |
| 3.80 | -3.80 | Strong light brown, fine grained SILTSTONE, moderately weathered |
| 5.80 | -5.80 | Strong, dark green - grey fine grained SILTSTONE, moderately weathered, DISC: 1/ irregular-planar/rough dip 30, 2/irregular-planar/rough dip 7<br>4.9-5.1 intensely fractured zone |
| 7.30 | -7.30 | Strong, light grey/brown fine SILTSTONE, DISC: irregular-planar / rough dip 70-80 |
| | | Strong Lightgrey/green SILTSTONE weak to moderate weathering. slight discolouration around jointing. DISC: irregular-planar / rough dip 50-70 |

Continued next sheet

Remarks: 50mm ID plastic piping inserted

| BRG Ltd.<br>35 Cleevaun,<br>Naas, Co Kildare<br>Tel: 045 874386 | | | Borehole No<br>**BH - 2**<br>Sheet 2 of 2 |
|---|---|---|---|
| Project Name<br>TES - North Kerry Landfill | Project No.<br>TES1 | Co-ords: 94780E - 117550N | Hole Type<br>Rotary |
| Engineer:<br>TES Consulting Engineers Ltd | | Level: 0.00 m AOD | Scale<br>1:50 |
| Client: | | Dates: 14/05/2003-15/05/2003 | Logged By<br>G Reid |

| Well | Water Strikes | Rotary Coring Depth (m) | TCR | SCR | RQD | FI | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 10.00 | -10.00 | | Strong, light brown, fine grained SILTSTONE, moderately weathered, DISC, irregular-planar / rough dip 70-80 |
| | | 10.00-10.80 | 95 | 47 | 47 | 28 | | | | |
| | | 10.80-11.50 | 95 | 43 | 43 | 22 | | | | |
| | | 11.50-12.30 | 95 | 47 | 47 | 29 | | | | |
| | | 12.30-13.10 | 80 | 0 | 0 | >50 | | | | |
| | | 13.10-14.80 | 95 | 47 | 47 | 18 | | | | |
| | | 14.80-15.00 | 85 | 0 | 0 | >50 | 15.00 | -15.00 | | End of Borehole at 15.00 m |
| | | | TCR | SCR | RQD | FI | | | | |

Remarks: 50mm ID plastic piping inserted

## MH3 borehole log

| | | |
|---|---|---|
| BRG Ltd.<br>35 Cleevaun,<br>Naas, Co Kildare<br>Tel: 045 874386 | | Borehole No<br>**BH - 3**<br>Sheet 1 of 2 |
| Project Name<br>TES - North Kerry Landfill | Project No.<br>TES1 | Co-ords: 94894E - 117724N |
| | | Hole Type<br>Rotary |
| Engineer:<br>TES Consulting Engineers Ltd | Level: - | Scale<br>1:50 |
| Client: | Dates: 16/05/2003-22/05/2003 | Logged By<br>G Reid |

| Well | Water Strikes | Samples & In Situ Testing: Depth (m) | Type | Results | | | Depth (m) | Level (mAOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | TCR | SCR | RQD | FI | | | | |
| | | | | | | | | | | Light brown, angular GRAVEL, fragments of siltstone, highly weathered |
| | | 2.00-4.00 | 80 | 0 | 0 | >50 | 2.00 | | | Strong grey to light brown, fine grained SILTSTONE, weak to moderate weathering. Multiple randomly orientated fracture surfaces |
| | | 4.00-6.50 | 85 | 0 | 0 | >50 | 4.00 | | | Strong, green-gray fine SILTSTONE, weak to moderate weathering, very broken core |
| | | 6.50-7.00 | 85 | 0 | 0 | >50 | 6.50 | | | Strong, dark green / green fine grained SILTSTONE, weakly to moderately weathered DISC: close to medium spaced, irregular-planar / rough dip 50-70 |
| | | 7.00-8.25 | 95 | 0 | 0 | >50 | | | | |
| | | 8.25-8.50 | 98 | 50 | 50 | 12 | 8.25 | | | Strong, light buff,Fine grained IGNEOUS, Tuff, irregular banding. DISC: randomly orientated |
| | | 8.50-9.40 | 95 | 0 | 0 | >50 | 8.50 | | | Strong, light green, fine grained SILTSTONE,weak to moderate weathering, DISC: closely to medium spaced, irregular-planar/rough dip 50-70 |
| | | 9.40-10.00 | 95 | 60 | 60 | 32 | | | | |

Continued next sheet

Remarks:

| BRG Ltd.<br>35 Cleevaun,<br>Naas, Co Kildare<br>Tel: 045 874386 | | | Borehole No<br>**BH - 3**<br>Sheet 2 of 2 |
|---|---|---|---|
| Project Name<br>TES - North Kerry Landfill | Project No.<br>TES1 | Co-ords: 94894E - 117724N | Hole Type<br>Rotary |
| Engineer:<br>TES Consulting Engineers Ltd | | Level: - | Scale<br>1:50 |
| Client: | | Dates: 16/05/2003-22/05/2003 | Logged By<br>G Reid |

| Well | Water Strikes | Rotary Coring Depth (m) | TCR | SCR | RQD | FI | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 10.00-12.70 | 80 | 0 | 0 | >50 | | | | Strong, light green, fine grained SILTSTONE, weak to moderate weathering, DISC: closely to medium spaced, irregular-planar/rough dip 50-70 |
| | | | | | | | 12.20 | | | Strong, grey/green SILTSTONE, highly fractured zone. |
| | | 12.70-13.00 | 60 | 0 | 0 | >50 | 13.00 | | | Strong, dark grey/green fine grained SILTSTONE / MUDSTONE, soapy texture, weak to moderate weathering; DISC, very closely spaced planar / rough dip 50-70 |
| | | 13.00-15.00 | 85 | 0 | 0 | >50 | | | | |
| | | | | | | | 15.00 | | | End of Borehole at 15.00 m |
| | | | TCR | SCR | RQD | FI | | | | |

Remarks:

## MH4 borehole log

| BRG Ltd.<br>35 Cleevaun,<br>Naas, Co Kildare<br>Tel: 045 874386 | | | Borehole No<br>**BH - 4**<br>Sheet 1 of 2 |
|---|---|---|---|
| Project Name<br>TES - North Kerry Landfill | Project No.<br>TES1 | Co-ords: 95017E - 117816N | Hole Type<br>Rotary |
| Engineer:<br>TES Consulting Engineers Ltd | | Level: - | Scale<br>1:50 |
| Client: | | Dates: 23/05/2003 | Logged By<br>G Reid |

| Well | Water Strikes | Samples & In Situ Testing: Depth (m) | Type / Results: TCR | SCR | RQD | FI | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | Fill |
| | | | | | | | 1.00 | | | Soft, light brown/yellow CLAY |
| | | 2.80-4.00 | 20 | 0 | 0 | >50 | 2.80 | | | Strong, light brown, fine grained, SILTSTONE, very broken with poor recovery |
| | | 4.00-5.50 | 75 | 10 | 10 | 45 | 4.00 | | | Strong, light gray/green, fine grained SANDSTONE, weak to moderately weathered, subvertical quartz veining. DISC: planar / rough dip 70 |
| | | 5.50-7.00 | 80 | 0 | 0 | | 5.50 | | | Soft light brown CLAY, with small angular gravel fragments |
| | | 7.00-8.40 | 80 | 0 | 0 | >50 | 7.00 | | | Strong, light green/brown fine grained SILTSTONE/MUDSTONE friable/fissile texture, moderately weathered. DISC, closely spaced, planar with clay infill dip 50-70 |
| | | 8.40-10.00 | 85 | 0 | 0 | >50 | 8.40 | | | Strong; olive green fine grained MUDSTONE soapy texture, weak to moderate weathering. DISC. Closely spaced planar / roug to smooth dip 50-70 |

Continued next sheet

Remarks:

BRG Ltd.
35 Cleevaun,
Naas, Co Kildare
Tel: 045 874386

| | | | |
|---|---|---|---|
| Project Name<br>TES - North Kerry Landfill | Project No.<br>TES1 | Co-ords: 95017E - 117816N | Borehole No<br>**BH - 4**<br>Sheet 2 of 2 |
| Engineer:<br>TES Consulting Engineers Ltd | | Level: - | Hole Type<br>Rotary |
| Client: | | Dates: 23/05/2003 | Scale<br>1:50 |
| | | | Logged By<br>G Reid |

| Well | Water Strikes | Rotary Coring Depth (m) | TCR | SCR | RQD | FI | Depth (m) | Level (m AOD) | Legend | Stratum Description |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 10.00-11.00 | 95 | 86 | 78 | 24 | | | | Strong, olive green fine grained MUDSTONE soapy texture, weak to moderate weathering. DISC: Closely spaced planar / roug to smooth dip 50-70 |
| | | 11.00-11.70 | 80 | 0 | 0 | >50 | 11.70 | | | |
| | | 11.70-12.80 | 98 | 80 | 70 | 33 | | | | Strong grey/green SILTSTONE, weak weathering DISC: Planar / rough to smooth dip 50-70 |
| | | 12.80-13.00 | 95 | 0 | 0 | >50 | 13.00 | | | |
| | | | | | | | | | | End of Borehole at 13.00 m |

11
12
13
14
15
16
17
18
19

TCR SCR RQD FI

Remarks:

## Trial pit logs

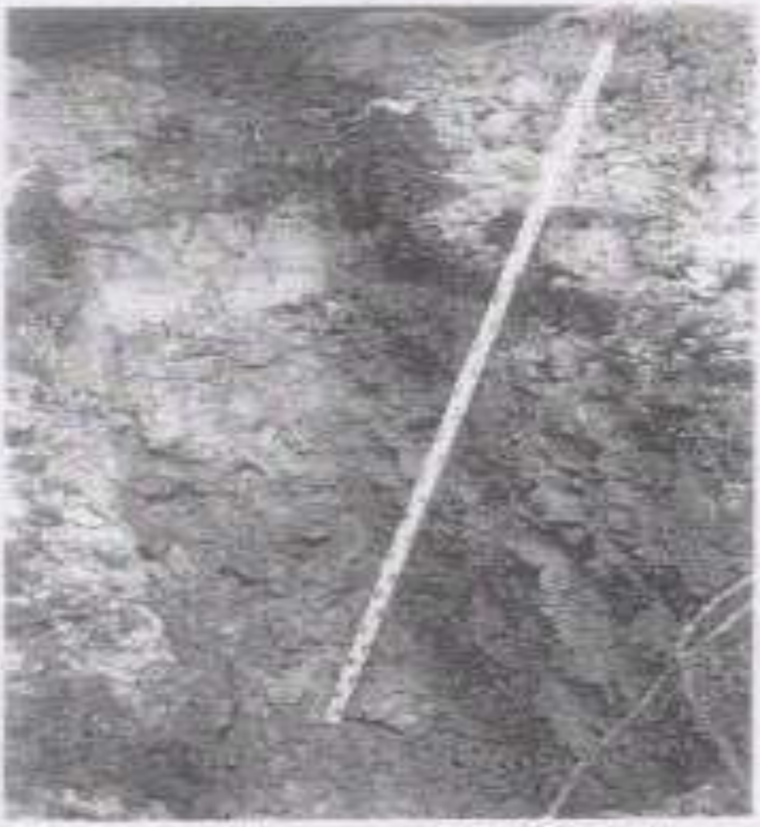
| | | |
|---|---|---|
| Trial Pit No. 1 | 0.0m-1.6m | Peat |
| | 1.6m-2.0m | Loose Shale |
| | 2.0m-2.8m | Shale with grey Clay bands |
| | 2.8m-3.4m | Shale with brown Clay bands |
| | 3.4m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 3 | 0.0m-3.4m | Peat (Made ground) |
| | 3.4m-4.4m | Peat (Natural) |
| | 4.4m-4.7m | Grey Clay |
| | 4.7m | Pit terminated due to limit of excavator |
| Trial Pit No. 4 | 0.0m-0.3m | Peat |
| | 0.3m-1.0m | Grey Clay |
| | 1.0m-1.6m | Grey Clay with Shale |
| | 1.6m-2.2m | Shale with brown Clay bands |
| | 2.2m-2.5m | Shale |
| | 2.5m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 5 | 0.0m-0.8m | Peat |
| | 0.8m-1.2m | Yellow Clay |
| | 1.2m-1.8m | Weathered Shale and Clay |
| | 1.8m-3.7m | Soft Shale |
| | 3.7m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 6 | 0.0m-0.3m | Peat |
| | 0.3m-0.7m | Grey Clay |
| | 0.7m-1.8m | Shale with Clay bands |
| | 1.8m-2.1m | Shale |
| | 2.1m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 7 | 0.0m-1.4m | Peat |
| | 1.4m-1.9m | Grey Clay |
| | 1.9m-3.0m | Grey Clay with Shale |
| | 3.0m-3.3m | Shale with Clay |
| | 3.3m | Pit terminated due to hardness/compactness of material |

| | | |
|---|---|---|
| Trial Pit No. 8 | 0.0m-1.4m | Peat |
| | 1.4m-1.9m | Grey Clay |
| | 1.9m-3.0m | Grey Clay with Shale |
| | 3.0m-3.8m | Shale with Clay |
| | 3.8m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 9 | 0.0m-0.7m | Peat |
| | 0.7m-1.2m | Grey Clay |
| | 1.2m-1.9m | Brown Clay with Shale bands |
| | 1.9m-2.3m | Shale with Clay bands |
| | 2.3m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 10 | 0.0m-0.3m | Peat |
| | 0.3m-0.9m | Yellow Clay (soft and damp) |
| | 0.9m-2.4m | Soft Shale |
| | 2.4m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 10A | 0.0m-0.3m | Peat |
| | 0.3m-1.2m | Shale with Clay bands |
| | 1.2m-2.1m | Shale |
| | 2.1m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 11 | 0.0m-0.5m | Peat |
| | 0.5m-1.3m | Grey Clay |
| | 1.3m-2.3m | Yellow Clay with Shale |
| | 2.3m-3.0m | Soft Shale |
| | 3.0m | Pit terminated due to hardness/compactness of material |
| Trial Pit No. 12 | 0.0m-0.2m | Peat |
| | 0.2m-0.6m | Grey Clay |
| | 0.6m-1.2m | Grey Clay with Shale bands |
| | 1.2m-2.3m | Shale with grey Clay bands |
| | 2.3m-2.6m | Shale |
| | 2.6m | Pit terminated due to hardness/compactness of material |

**Trial pit photos**

Trial Pit No. 1 – Material excavated to 3.4m below ground level

Trial Pit No. 3 – Material excavated to 4.7m below ground level



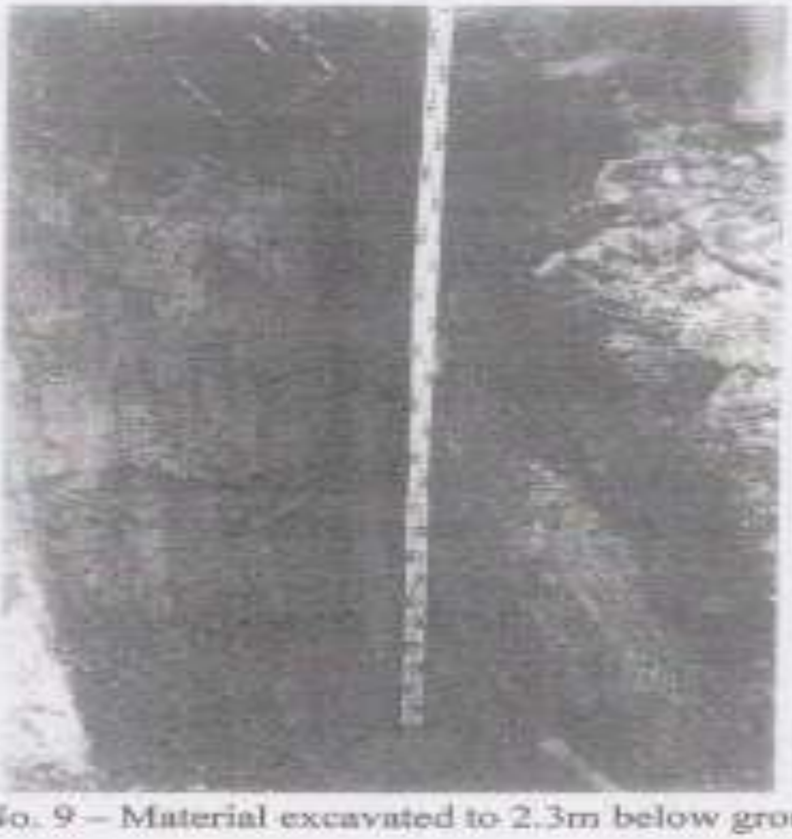
Trial Pit No. 4 – Material excavated to 2.5m below ground level

Trial Pit No. 5 – Material excavated to 3.7m below ground level

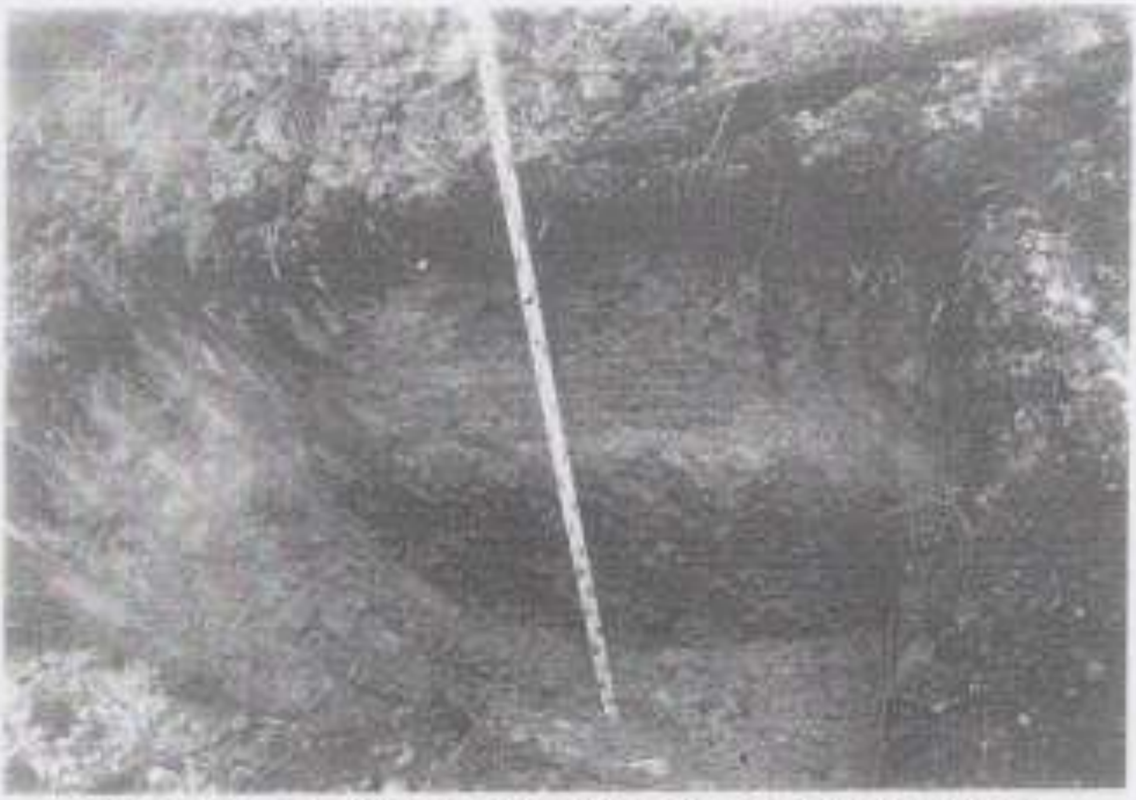
Trial Pit No. 6 – Material excavated to 2.1m below ground level

Trial Pit No. 7 – Material excavated to 3.3m below ground level

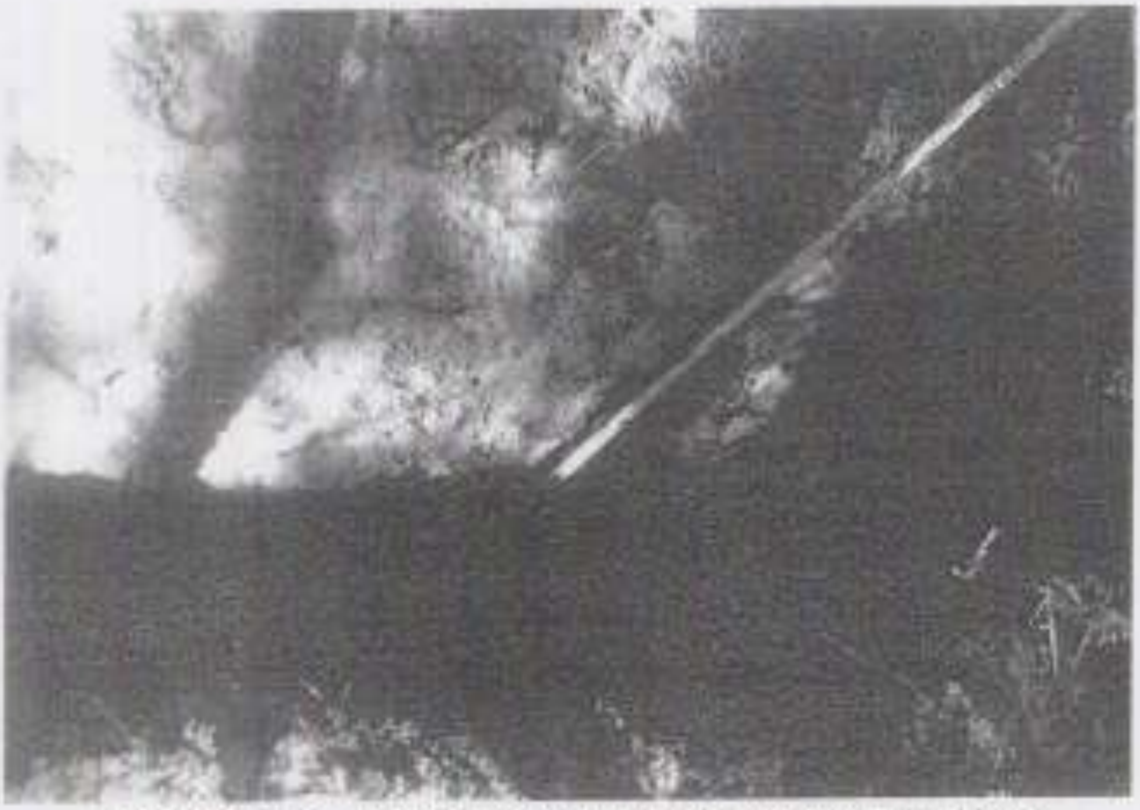
Trial Pit No. 8 – Material excavated to 3.8m below ground level



Trial Pit No. 9 – Material excavated to 2.3m below ground level

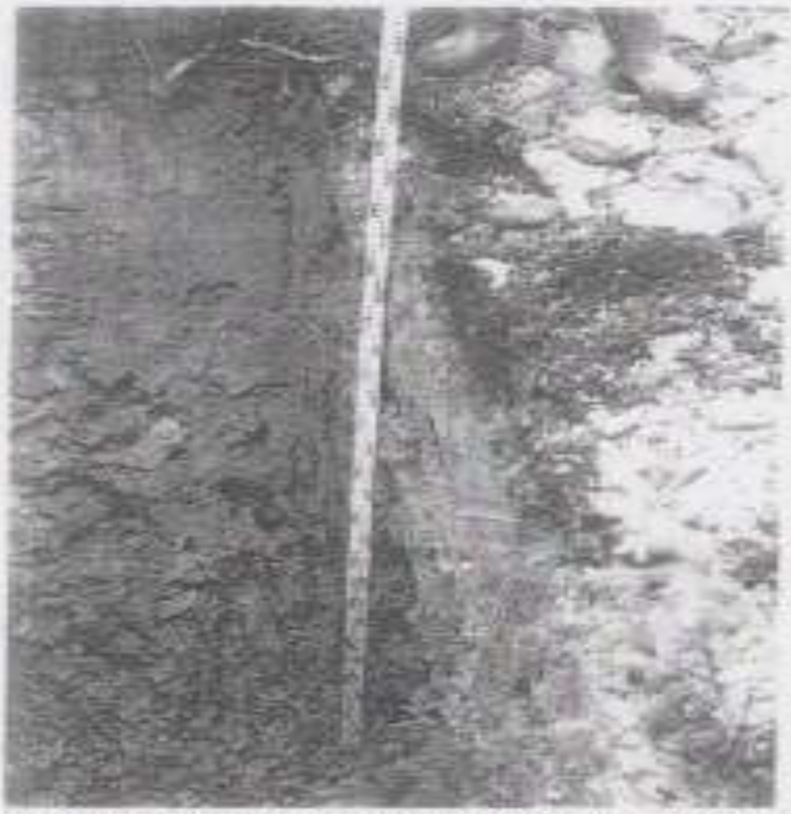


Trial Pit No. 10 – Material excavated to 2.4m below ground level



Trial Pit No. 10a – Material excavated to 2.1m below ground level

Trial Pit No. 11 – Material excavated to 3.0m below ground level



Trial Pit No. 12 – Material excavated to 2.6m below ground level

# Appendix D

## 2001 to 2015 Average Groundwater Monitoring Results for Conductivity, Ammoniacal Nitrogen and Chloride

## 2001 to 2015 average groundwater monitoring results for conductivity (uS/cm)

| | GWML-E1 | MH2 | MH3 | MH4 | MH5 | GWML-E2 | Dennis O'Mahony | Gerry Sugrue |
|---|---|---|---|---|---|---|---|---|
| 2001 | 192.5 | 126.75 | 354.8 | 202.5 | 137.67 | - | - | - |
| 2002 | 184.8 | 117 | 340.4 | 202.5 | 152.29 | - | - | - |
| 2003 | 193.5 | 110.17 | 339.73 | 201.17 | 204.45 | - | 104.33 | 135.33 |
| 2004 | 193.83 | 110.86 | 349.22 | 199.83 | 197.67 | - | 99.67 | 147.5 |
| 2005 | 192.72 | 108 | 357.4 | 199.09 | 153.46 | - | 186.64 | 159.7 |
| 2006 | 192.25 | 104.5 | 357.83 | 204.4 | 176.5 | - | 93 | 165.5 |
| 2007 | 198.83 | 153.25 | 381.67 | 206.75 | 205.6 | - | 100 | 186 |
| 2008 | 204.75 | 190.25 | 335.8 | 204.5 | 206 | - | 103 | 149 |
| 2009 | 159.00 | 196 | 304.8 | 197.25 | 308 | - | 97.5 | 174.4 |
| 2010 | 154 | 382.5 | 312.43 | 192.6 | 251.25 | 159 | 93.5 | 159 |
| 2011 | - | 314.5 | 287.5 | 195.75 | 253.33 | 169 | 82.67 | 158 |
| 2012 | 184.4 | 286.8 | 311.5 | 188.8 | 250.4 | 142.86 | 88.8 | 178 |
| 2013 | 300.9 | 224.25 | 297.5 | 186.75 | 228.25 | 139 | 94 | 172.75 |
| 2014 | 294 | 178 | 350 | 183 | 181 | 145 | 110 | 174 |
| 2015 | 198.5 | 163.5 | 355 | 192 | 168.5 | 151.5 | 99.5 | 180 |

## 2001 to 2015 average groundwater monitoring results for ammoniacal nitrogen (mg/l)

| | GWML-E1 | MH2 | MH3 | MH4 | MH5 | GWML-E2 | Dennis O'Mahony | Gerry Sugrue |
|---|---|---|---|---|---|---|---|---|
| 2001 | 0.03 | 0.02 | 0.02 | 0.02 | 0.61 | - | - | - |
| 2002 | 0.02 | 0.02 | 0.02 | 0.02 | 0.51 | - | - | - |
| 2003 | 0.02 | 0.02 | 0.02 | 0.02 | 0.6 | - | 0.02 | 0.02 |
| 2004 | 0.02 | 0.02 | 0.02 | 0.02 | 0.51 | - | 0.03 | 0.02 |
| 2005 | 0.05 | 0.08 | 0.02 | 0.02 | 0.22 | - | 0.06 | 0.02 |
| 2006 | 0.02 | 0.02 | 0.02 | 0.02 | 0.56 | - | 0.02 | 0.02 |
| 2007 | 0.02 | 0.02 | 0.02 | 0.02 | 0.21 | - | 0.02 | 0.02 |
| 2008 | 0.02 | 0.02 | 0.02 | 0.02 | 0.24 | - | 0.07 | 0.02 |
| 2009 | 0.02 | 0.02 | 0.02 | 0.02 | 0.03 | - | 0.02 | 0.02 |
| 2010 | 0.02 | 0.02 | 0.02 | 0.02 | 0.15 | 0.02 | 0.02 | 0.02 |
| 2011 | - | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| 2012 | 0.03 | 0.02 | 0.09 | 0.1 | 0.96 | 0.02 | 0.04 | 0.06 |
| 2013 | 0.23 | 0.03 | 0.04 | 0.03 | 0.32 | 0.02 | 0.04 | 0.03 |
| 2014 | 0.02 | 0.02 | 0.02 | 0.02 | 0.07 | 0.02 | 0.02 | 0.02 |
| 2015 | 0.04 | 0.05 | 0.03 | 0.04 | 0.5 | 0.05 | 0.04 | 0.05 |

## 2001 to 2015 average groundwater monitoring results for chloride (mg/l)

| | GWML-E1 | MH2 | MH3 | MH4 | MH5 | GWML-E2 | Dennis O'Mahony | Gerry Sugrue |
|---|---|---|---|---|---|---|---|---|
| 2001 | 22 | 23.9 | 15.7 | 16.6 | 18.15 | - | - | - |
| 2002 | 20.9 | 26.6 | 18.19 | 19.7 | 24.67 | - | - | - |
| 2003 | 22.75 | 27.75 | 20.33 | 20 | 19.51 | - | 18.5 | 23 |
| 2004 | 23.75 | 27.2 | 20 | 20.5 | 31.5 | - | 17.75 | 27 |
| 2005 | 22.63 | 25.75 | 18.43 | 19.13 | 28.3 | - | 18.25 | 27.67 |
| 2006 | 24.38 | 24 | 19.08 | 21.6 | 22.25 | - | 13.25 | 31.98 |
| 2007 | 27.08 | 24 | 20.13 | 22.88 | 25 | - | 13.38 | 26.38 |
| 2008 | 24.13 | 23.75 | 17.13 | 17.75 | 88.5 | - | 12.63 | 26.38 |
| 2009 | 24 | 26.83 | 33.6 | 18.63 | 11.75 | - | 11.25 | 24.7 |
| 2010 | 32 | 78.38 | 19.36 | 19 | 21.88 | 31.5 | 12.25 | 25.25 |
| 2011 | - | 57.45 | 20.08 | 18.68 | 29.23 | 42.4 | 9.13 | 23.4 |
| 2012 | 30.76 | 58.92 | 19.53 | 18.58 | 33.86 | 22.36 | 11.18 | 23.9 |
| 2013 | 41.55 | 59.83 | 18.25 | 19.25 | 27.35 | 21.7 | 14.25 | 22.73 |
| 2014 | 51.6 | 44.6 | 22.1 | 19.2 | 31.5 | 20.9 | 17.9 | 26.7 |
| 2015 | 18 | 42.6 | 27 | 20.45 | 27 | 26.25 | 15.15 | 33.1 |

# Appendix E

## 2011 to 2015 Average Surface Water Monitoring Results for Ammoniacal Nitrogen, BOD, Chloride and Suspended Solids

## 2011 to 2015 average surface water monitoring results for ammoniacal nitrogen (mg/l)

| | SWML2 | SWML3 | SWML4 | SWML5 | SWML10 | SWML11 | SWMLE1 | SW1 | SW2 | SW3 |
|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 0.08 | 0.03 | 0.24 | 1.08 | 0.04 | 0.01 | 0.03 | 0.02 | 0.02 | 0.02 |
| **2012** | 0.21 | 0.02 | 0.01 | 0.03 | 0.05 | 0.09 | 1.03 | 0.03 | 0.02 | 0.01 |
| **2013** | 0.02 | 0.02 | 0.01 | 0.08 | 0.17 | 0.04 | 0.3 | 0.03 | 0.02 | 0.03 |
| **2014** | 0.02 | 0.02 | 0.02 | 0.02 | 0.09 | 0.05 | 0.02 | 0.02 | 0.02 | 0.02 |
| **2015** | 0.03 | 0.03 | 0.05 | 0.05 | 0.03 | 0.04 | 0.03 | 0.04 | 0.03 | 0.02 |

## 2011 to 2015 average surface water monitoring results for BOD (mg/l)

| | SWML2 | SWML3 | SWML4 | SWML5 | SWML10 | SWML11 | SWMLE1 | SW1 | SW2 | SW3 |
|---|---|---|---|---|---|---|---|---|---|---|
| **2011** | 1.56 | 1 | 1 | 1.9 | 1.1 | 2.8 | 1.06 | 1.2 | 1.12 | 1.22 |
| **2012** | 2.75 | 1 | 1 | 1 | 1.52 | 1.85 | 1 | 1.07 | 2.43 | 1.47 |
| **2013** | 1.46 | 1.1 | 1 | 1.75 | 1.4 | 1.5 | 3.67 | 1.07 | 1 | 1 |
| **2014** | 1.05 | 1.05 | 1 | 1 | 1.26 | 1.45 | 1.16 | 1.45 | 1.3 | 1.75 |
| **2015** | 1.86 | 1.3 | 1.3 | 1.3 | 1.47 | 1.2 | 1.32 | 1.3 | 1.2 | 1.15 |

## 2011 to 2015 average surface water monitoring results for chloride (mg/l)

| | SWML2 | SWML3 | SWML4 | SWML5 | SWML10 | SWML11 | SWMLE1 | SW1 | SW2 | SW3 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 14.61 | 15 | 13.85 | 22.15 | 19.9 | 17.65 | 18.45 | 11.47 | 18.37 | 17.27 |
| 2012 | 12.32 | 9.7 | 9.2 | 8.9 | 12.08 | 9.6 | 12.7 | 13.42 | 12.33 | 22.22 |
| 2013 | 15.42 | 16.56 | 18.4 | 15.47 | 19.56 | 18.52 | 29.65 | 19.82 | 28.47 | 21.2 |
| 2014 | 14.7 | 19.1 | 24.6 | 20.6 | 17.2 | 19.7 | 23.55 | 23.97 | 27.2 | 21.56 |
| 2015 | 14.3 | 13.1 | 13.8 | 10.7 | 17.17 | 19.7 | 16.1 | 19.9 | 24.1 | 22.37 |

## 2011 to 2015 average surface water monitoring results for suspended solids (mg/l)

| | SWML2 | SWML3 | SWML4 | SWML5 | SWML10 | SWML11 | SWMLE1 | SW1 | SW2 | SW3 |
|---|---|---|---|---|---|---|---|---|---|---|
| 2011 | 55.52 | 6.4 | 3.42 | 15.18 | 39.21 | 35.44 | 12.62 | 6.38 | 15.2 | 2.83 |
| 2012 | 26.45 | 14.38 | 4.5 | 2.92 | 70.53 | 48.83 | 9.5 | 2.03 | 6.81 | 5.18 |
| 2013 | 10 | 10.2 | 7.33 | 2.5 | 40.09 | 49.44 | 30.85 | 2.92 | 23.41 | 5 |
| 2014 | 6.12 | 2 | 1.25 | 1.16 | 10.76 | 22.62 | 47.2 | 2.17 | 2.43 | 4.61 |
| 2015 | 7.2 | 4 | 2 | 1.75 | 4.53 | 8 | 12 | 8.9 | 3.5 | 2.9 |

# Appendix F

## 2012 to 2014 Annual Surface Water Analysis Results

## Annual surface water analysis results 2012 (recorded on 21st November 2012)

| Parameter | Units | SWML2 | SWML3 | SWML4 | SWML5 | SWML10 | SWML11 | SWMLE1 | SW1 | SW2 | SW3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonium (as N) | mg/l | < 0.02 | 0.02 | 0.02 | 0.03 | 0.26 | 0.24 | 2.23 | 0.09 | 0.04 | 0.02 |
| TON | mg/l | 10.02 | 1.08 | 1.18 | 1.12 | 1.98 | 2.23 | 4.01 | 0.83 | 0.37 | 0.28 |
| BOD (5day) | mg/l | < 1 | < 1 | < 1 | < 1 | 2.6 | 2.7 | > 24 | 1.2 | < 1 | 1.4 |
| Conductivity @ 20°C | uS/cm | 199 | 202 | 172 | 185 | 205 | 208 | 273 | 46 | 69 | 59 |
| COD | mg/l | 19 | 27 | 10 | 15 | 105 | 105 | 80 | 37 | 149 | 64 |
| Dissolved Oxygen | mg/l | 8.9 | 10.8 | 7.1 | 10.6 | 11 | 10.9 | 9.6 | 10.9 | 10.9 | 11.6 |
| Suspended solids | mg/l | 15 | 7 | 3 | 4 | 410 | 426 | 30 | 2 | 4 | 7 |
| Molybdate Reactive Phosphorous | mg/l | 0.018 | 0.006 | 0.009 | 0.005 | 0.183 | 0.21 | 0.018 | 0.008 | 0.018 | 0.014 |
| Alkalinity | mg/l | 71 | 92 | 75 | 82 | 112 | 116 | 111 | 8 | 10 | 10 |
| Chloride | mg/l | 15.7 | 9.6 | 9.2 | 8.9 | 12.1 | 11 | 15.4 | 9.4 | 12.7 | 11.7 |
| Sulphate | mg/l | < 2 | 3.1 | 3.8 | 5.2 | 5.5 | 4.5 | 5.7 | < 2 | < 2 | < 2 |
| Sodium | mg/l | 11.7 | 7.7 | 7.5 | 7.3 | 7 | 6.9 | 13.5 | 6.9 | 9.9 | 8 |
| Calcium | mg/l | 28.3 | 35.2 | 28.8 | 31.3 | 38.4 | 38.3 | 39.2 | 2.4 | 0.6 | 2.9 |
| Magnesium | mg/l | 2.69 | 2.64 | 2.76 | 2.66 | 3.49 | 3.46 | 3.94 | 0.97 | 0.77 | 1.78 |
| Potassium | mg/l | 2.06 | 1.37 | 1.22 | 1.31 | 1.46 | 1.46 | 4.05 | < 0.5 | < 0.5 | 0.65 |
| Boron | mg/l | 0.01 | 0.006 | 0.004 | 0.003 | 0.004 | 0.004 | 0.017 | 0.003 | 0.007 | 0.004 |
| Mercury | ug/l | < 0.009 | 0.087 | 0.041 | < 0.009 | < 0.009 | 0.009 | < 0.009 | 0.029 | 0.044 | < 0.009 |
| Cadmium | ug/l | < 0.02 | < 0.02 | < 0.02 | < 0.02 | 0.023 | 0.032 | 0.023 | < 0.02 | < 0.02 | < 0.02 |
| Chromium | ug/l | < 1.1 | < 1.1 | < 1.1 | < 1.1 | 6.04 | 6.051 | 1.555 | < 1.1 | < 1.1 | < 1.1 |
| Nickel | ug/l | 1.072 | < 0.8 | < 0.8 | < 0.8 | 8.651 | 8.789 | 2.301 | < 0.8 | < 0.8 | < 0.8 |
| Lead | ug/l | 0.418 | < 0.2 | < 0.2 | < 0.2 | 6.687 | 6.967 | 1.304 | 0.482 | 1.21 | 0.373 |
| Copper | mg/l | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Manganese | ug/l | 26.9 | 50.1 | 11.8 | 94 | 469.2 | 447.1 | 851.4 | 49.3 | 11.3 | 130.9 |
| Arsenic | ug/l | < 0.5 | < 0.5 | < 0.5 | < 0.5 | 1.19 | 1.21 | 0.65 | < 0.5 | < 0.5 | < 0.5 |
| Zinc | ug/l | < 10 | < 10 | < 10 | < 10 | 20 | 20 | 10 | < 10 | 10 | < 10 |
| Iron | ug/l | 453.7 | 318.04 | 285.65 | 256.63 | 6533.24 | 6339.78 | 981.79 | 958.05 | 247.97 | 1230.2 |

## Annual surface water analysis results 2013 (recorded on 13th November 2013)

| Parameter | Units | SWML2 | SWML3 | SWML4 | SWML5 | SWML10 | SWML11 | SWMLE1 | SW1 | SW2 | SW3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonium (as N) | mg/l | < 0.02 | < 0.02 | - | < 0.02 | 0.09 | 0.06 | 0.05 | 0.02 | 0.04 | 0.03 |
| TON | mg/l | 0.59 | 0.66 | - | 0.32 | 1.17 | 1.2 | 3.3 | 0.42 | 0.47 | 0.47 |
| BOD (5day) | mg/l | 1.3 | 1.3 | - | < 1 | < 1 | 1.1 | 1 | 1 | 1 | < 1 |
| Conductivity @ 20°C | uS/cm | 184 | 203 | - | 236 | 180 | 177 | 194 | 66 | 99 | 83 |
| COD | mg/l | 30 | 18 | - | 77 | 27 | 23 | 12 | 37 | 137 | 37 |
| Dissolved Oxygen | mg/l | 12 | 11.9 | - | 10.2 | 10.7 | 10.2 | 10.4 | 11 | 11.2 | 11.3 |
| Suspended solids | mg/l | 4 | 8 | - | 1 | 8 | 10 | 7 | 2 | 8 | 4 |
| Molybdate Reactive Phosphorous | mg/l | 0.009 | 0.007 | - | < 0.005 | 0.01 | 0.01 | 0.01 | 0.006 | < 0.005 | 0.007 |
| Alkalinity | mg/l | 85 | 117 | - | 119 | 80 | 82 | 88 | 13 | 4 | 12 |
| Chloride | mg/l | 11.4 | 12.7 | - | 11 | 12.7 | 12.7 | 10.9 | 15.2 | 19.6 | 18.9 |
| Sulphate | mg/l | < 2 | < 2 | - | 4.9 | 4.9 | 4.9 | 3.5 | < 2 | 15 | < 2 |
| Sodium | mg/l | 7.8 | 8 | - | 8.3 | 8.8 | 8.6 | 8.4 | 10 | 13.6 | 11.7 |
| Calcium | mg/l | 35.6 | 39.1 | - | 46.3 | 32.3 | 30.6 | 35.4 | 3.9 | 0.3 | 3.6 |
| Magnesium | mg/l | 2.31 | 2.46 | - | 3.9 | 2.63 | 2.56 | 2.26 | 1.51 | 1.57 | 2.63 |
| Potassium | mg/l | 1.3 | 1.27 | - | 1.11 | 1.12 | 1.1 | 1.53 | 6.28 | < 0.5 | < 0.5 |
| Boron | mg/l | 0.007 | 0.007 | - | 0.004 | 0.006 | 0.005 | 0.008 | 0.005 | 0.007 | 0.007 |
| Mercury | ug/l | 0.025 | 0.02 | - | 0.014 | 0.019 | 0.018 | 0.026 | 0.01 | < 0.009 | < 0.009 |
| Cadmium | ug/l | < 0.02 | < 0.02 | - | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 | < 0.02 |
| Chromium | ug/l | < 1.1 | < 1.1 | - | < 1.1 | < 1.1 | < 1.1 | < 1.1 | < 1.1 | < 1.1 | < 1.1 |
| Nickel | ug/l | < 0.8 | < 0.8 | - | < 0.8 | < 0.8 | < 0.8 | < 0.8 | 0.813 | < 0.8 | < 0.8 |
| Lead | ug/l | 0.254 | 0.433 | - | 0.302 | 0.301 | 0.476 | 0.44 | 0.793 | 3.593 | 0.639 |
| Copper | mg/l | < 0.025 | < 0.025 | - | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 | < 0.025 |
| Manganese | ug/l | 91 | 59 | - | 12 | 134 | 79 | 107 | 42 | < 10 | 116 |
| Arsenic | ug/l | < 0.5 | < 0.5 | - | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 | < 0.5 |
| Zinc | ug/l | < 10 | < 10 | - | < 10 | 10 | < 10 | 10 | 10 | 10 | < 10 |
| Iron | ug/l | 259.99 | 231.87 | - | 67.36 | 579.85 | 578.28 | 103.75 | 833.86 | 292.9 | 778.74 |

## Annual surface water analysis results 2014 (recorded on 2nd December 2014)

| Parameter | Units | SWML2 | SWML3 | SWML4 | SWML5 | SWML10 | SWML11 | SWMLE1 | SW1 | SW2 | SW3 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Ammonium (as N) | mg/l | <0.02 | 0.02 | - | - | 0.12 | 0.09 | 0.02 | 0.03 | 0.03 | 0.03 |
| TON | mg/l | < 0.12 | < 0.12 | - | - | 1.151 | 1.107 | 2.037 | < 0.12 | 1.062 | < 0.12 |
| BOD (5day) | mg/l | 1.0 | <1.0 | - | - | 1.1 | 1.7 | 1.1 | 1.3 | 1.4 | 1.5 |
| Conductivity @ 20°C | uS/cm | 80 | 270 | - | - | 235 | 233 | 189 | 78 | 92 | 82 |
| COD | mg/l | 10 | 36 | - | - | 31 | 45 | 11 | 78 | 166 | 67 |
| Dissolved Oxygen | mg/l | 11.0 | 10.9 | - | - | 10.4 | 10.4 | 10.4 | 10.3 | 10.4 | 10.9 |
| Suspended solids | mg/l | 6 | 4 | - | - | 19 | 66 | 13 | 2 | 10 | 16 |
| Molybdate Reactive Phosphorous | mg/l | 0.01 | <0.005 | - | - | 0.01 | 0.02 | 0.01 | 0.01 | 0.49 | 0.02 |
| Alkalinity | mg/l | 99 | 121 | - | - | 104 | 105 | 76 | 11 | 10 | 11 |
| Chloride | mg/l | 10.4 | 14.4 | - | - | 13.7 | 13.6 | 12.9 | 17.7 | 20.8 | 16.3 |
| Sulphate | mg/l | < 1 | 5.0 | - | - | 4.7 | 4.6 | 4.6 | < 1 | 18.9 | < 1 |
| Sodium | mg/l | 8.1 | 10.3 | - | - | 9.7 | 10.4 | 10.5 | 10.2 | 13.5 | 10.9 |
| Calcium | mg/l | 38.9 | 41.9 | - | - | 33.6 | 35.6 | 30.1 | 4.7 | 17.8 | 4.0 |
| Magnesium | mg/l | 2.2 | 2.6 | - | - | 2.8 | 3.0 | 2.6 | 1.6 | 1.7 | 2.2 |
| Potassium | mg/l | 1.2 | 1.3 | - | - | 1.1 | 1.3 | 1.2 | 0.3 | 1.4 | 0.9 |
| Boron | mg/l | 0.006 | 0.007 | - | - | 0.006 | 0.006 | 0.005 | 0.005 | 0.009 | 0.007 |
| Mercury | ug/l | 0.065 | 0.065 | - | - | 0.055 | 0.061 | 0.042 | 0.049 | 0.032 | 0.061 |
| Cadmium | ug/l | <0.7 | <0.7 | - | - | <0.7 | <0.7 | <0.7 | <0.7 | <0.7 | <0.7 |
| Chromium | ug/l | <0.8 | <0.8 | - | - | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 | <0.8 |
| Nickel | ug/l | <1.0 | <1.0 | - | - | <1.0 | 38.3 | <1.0 | 1.1 | <1.0 | <1.0 |
| Lead | ug/l | <1.0 | 5.3 | - | - | <1.0 | <1.0 | 2.2 | 4.0 | 1.6 | 4.1 |
| Copper | mg/l | 0.010 | 0.025 | - | - | 0.007 | 0.009 | 0.011 | 0.012 | 0.005 | 0.011 |
| Manganese | ug/l | 23.9 | 22.9 | - | - | 121.3 | 169.4 | 159.7 | 71.2 | 19.5 | 531.6 |
| Arsenic | ug/l | <0.5 | <0.5 | - | - | <0.5 | 0.5 | <0.5 | <0.5 | <0.5 | 0.5 |
| Zinc | ug/l | <3 | 4 | - | - | <3 | 3 | 3 | 4 | 5 | 11 |
| Iron | ug/l | 131 | 177 | - | - | 639 | 812 | 198 | 1265 | 396 | 1842 |

## *Appendix K: Topographical Survey 2015*


KERRY COUNTY COUNCIL
ENVIRONMENT SECTION

(a) This Map is based on National Grid

(b) All Altitudes indicated are in Metres , and are referred to Ordnance Datum, which is Mean Sea Level at Malin Head, Co. Donegal (1970 Adjustment).

(c) These Maps are used under The Licensing Agreement between the Ordnance Survey Ireland and the County and City Managers

| Rev | Description | Reviewed | Approved | Date |
|---|---|---|---|---|
| 01 | XXXX | XX | XX | XXX |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

Project Name: **NORTH KERRY LANDFILL**

Component:

Job No.

Title: **2015 Topographical Survey**

Designed:

Drawn:

Checked:

File Name:

Original scales: **NTS**

Date: **Dec 2015**

Drawing No.

# *Appendix L: Side Slope Assessment*


# SLOPE STABILTY ASSESSMENT FOR NORTH KERRY LANDFILL

## KERRY COUNTY COUNCIL

## MARCH 2016

Comhar, Cabhair, Cairdeas

FEHILY TIMONEY & COMPANY

# SLOPE STABILTY ASSESSMENT FOR NORTH KERRY LANDFILL

# KERRY COUNTY COUNCIL

**User is Responsible for Checking the Revision Status of This Document**

| Rev. Nr. | Description of Changes | Prepared by: | Checked by: | Approved by: | Date: |
|---|---|---|---|---|---|
| A | Issue to Client | KK | CJC | BG | 30/03/'16 |

**Client:** Kerry County Council

**Keywords:** Slope, Stability, Assessment, Muingnaminnane, Kerry.

**Abstract:** Kerry County Council retained Fehily Timoney & Company (FT) to carry out a slope stability assessment of the landfill side slopes at North Kerry Landfill in order to comply with Condition 8.11.1 of Waste Licence W0001-04 (IED).

# TABLE OF CONTENTS

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# LIST OF APPENDICES

# 1 EXECUTIVE SUMMARY

FT completed a site walkover of the site on Tuesday 22nd March 2016 to examine the existing landfill slopes at North Kerry Landfill. All slopes within the site were inspected as part of the visual assessment with written and photographic notes taken. Slopes were inspected on foot generally traversing from toe to crest across the entire length of the slope.

The landfill cap is overgrown and vegetated with long grasses, scrubland and rushes with some trees and larger bushes. The topography of the cap is undulating and difficult to traverse on foot.

The results of this visual assessment indicate that the landfill body main slopes are considered to be stable, with the exception of the issues outlined below. However, the extents of visual assessment is restricted by the abundance of vegetation that has grown on the landfill cap. Therefore, FT cannot be sure that other areas of the landfill slopes are free from defect.

Issues arising from the visual assessment are as follows:

1. Waterlogged area of cap adjacent constructed wetland at southeast corner of Cells 1 to 16 (eastern slope). FT recommends filling and re-grading this area to resolve the issue.

2. Apparent ground movement on the western slope adjacent to haul road on cap. FT recommends a restriction of movement of heavy traffic on the adjacent haul road and that further monitoring of this area and be considered to investigate the issue.

3. Some minor issues were noted such as areas of bare vegetation which may result in erosion or waterlogging of slopes. FT recommends reseeding and re-profiling or similar particularly in relation to Cells 17, 18 and 19.

4. All slopes should be inspected annually as required by the conditions attached to IED Licence No. W0001-04. FT recommends that the vegetation growth on slopes be cut back and maintained such that more effective visual inspections can be completed on the landfill slopes in future.

The proposed remedial works, be they backfilling or other, should be implemented as soon as is possible. Remedial works should only be undertaken following appropriate investigation, risk assessments and method statements.

# 2 INTRODUCTION

## 2.1 Background

Fehily Timoney and Company (FT) was appointed by Kerry County Council to undertake a slope stability assessment of North Kerry Landfill, Muingnaminnane, Tralee Co. Kerry.

Previous slope stability assessments for the landfill were not available to FT prior to or during the preparation of this report.

## 2.2 Purpose

This 2016 assessment is in accordance with Condition 8.11.1 of the EPA waste licence issued to the site (Current IED Licence No: W0001-04) which states:

> *"The licensee shall carry out an annual stability assessment of the side slopes of the facility"*

## 2.3 Site Description

The facility is situated in north County Kerry, approximately 11 km west of the town of Tralee in the townland of Muingnaminnane.

The site was developed as a municipal landfill facility and recycling centre. The site ceased receiving waste for deposition in 2014. Kerry County Council is currently undertaking various works associated with the sites aftercare.

The landfill cap is overgrown and vegetated with long grasses, scrubland and rushes with some trees and larger bushes. The topography of the cap is undulating and difficult to traverse on foot.

## 2.4 Site Walkover

FT completed a site walkover of the site on the 22nd March 2016. All slopes within the site were inspected as part of the visual assessment with written and photographic notes taken. Slopes were inspected on foot generally traversing from toe to crest across the entire length of the slope.

All slopes were assessed for signs of instability or identification of potential factors which may impact the future stability of the landfill slopes.

A Slope Location Plan is included in Appendix 1 to this document.

# 3 CONDITIONS OF SURVEY

The condition survey completed was limited to a visual inspection of the exposed elements of the landfill slopes only and limited to readily accessible areas. The purpose of the condition survey was to assess and advise of issues relating to the stability of the landfill slopes as required by Waste License W0001-04 (IED).

No intrusive investigations or prolonged monitoring of defective areas wre carried out. FT did not undertake any work of a specific engineering nature such as engineering calculations, structural analyses, testing or measurements. This report reflects FT's interpretation of the site condition from visual inspections only. Recommendations in this report define where more detailed investigations maybe appropriate.

While issues relating to public safety and issues relevant for the safe use of the site may be raised in this report they should not be taken as an exhaustive list of all operational issues. A review of site operations is beyond the scope of this report.

This report is not a certification, a warranty or a guarantee and was scoped in accordance with the instructions given and the time allowed.

This report may not be relied upon by a third party for any purpose without the written consent of Fehily Timoney and Company. Furthermore, this report has been prepared and issued for the purposes of the addressee and no responsibility will be extended to any third party for the whole or any part of its contents.

# 4 SLOPE STABILITY OBSERVATIONS

## 4.1 CELLS 17, 18 and 19

Cells 17, 18 and 19 are shown in Figure No 1 (contained in Appendix A). These cells are the most recently filled cells to be completed and capped.

The main slopes were observed to be sparsely vegetated by grass, albeit that grass coverage is developing.

No indications of translational or rotational instabilities were observed. In FT's opinion the slopes are stable.

**Photo 1 – Southwest Slope**

**Photo 2 – Southwest Slope**

**Photo 3 – Southwest Slope**

**Photo 4 – Southwest Slope**

**Photo 5 – Southwest Slope**

**Photo 6 – Southwest Slope**


**Photo 7 – Southwest Slope**


**Photo 8 – Southwest Slope**

**Photo 9 – Southwest Slope**

**Photo 10 – Southwest Slope**

**Photo 11 – Northwest Slope**

**Photo 12 – Northwest Slope**

**Photo 13 – Northwest Slope**

**Photo 14 – Northwest Slope**

**Photo 15 – Northwest Slope**

**Photo 16 – Northeast Slope**

**Photo 17 – Northwest Slope**

**Photo 18 – Northeast Slope**

**Photo 19 – Northeast Slope**

**Photo 20 – Northeast Slope**

**Photo 21 – Northeast Slope**

**Photo 22 – Northeast Slope**


**Photo 23 – Northeast Slope**


**Photo 24 – Northeast Slope**


**Photo 25 – Northeast Slope**


**Photo 26 – Northeast Slope**


**Photo 27 – Northeast Slope**

## 4.2 CELLS 1 to 16

Cells 1 to 16, the oldest in the landfill, are shown in Figure No 1 (contained in Appendix A). Waste deposition commenced in Cells 1 through 10. All cells in this area are have been capped. The slopes to cells 1 to 16 vary in steepness from 1:1 to 1:10 approximately. The slopes are overgrown with scrubland, rushes and some small trees and bushes.

Whilst the slopes are considered to be generally stable there are two areas of concern where remedial works may be required at the following locations to address works described below:

a. ***Waterlogging of cap adjacent to constructed wetland at southeast corner of Cells 1 to 16 (eastern slope):*** This is evident in Photos No 67 to 70 inclusive (highlighted in red in the set of photos below). FT advises that surface water is being contained in a localised depression in the ground between the edge of the landfill cap and the berm enclosure of the wetland. The area is wet under foot and the depression can be confirmed by visual assessment. Note also that the depression is evident from a topographical survey completed by Kerry County Council earlier this year. This may cause future traffic access problems and increase the risk of a translational slope failure if trafficking occurs under water logged conditions.

b. ***Apparent ground movement on the western slope adjacent to haul road on cap:*** This is evident in Photos 90 through 103 and 111 through 117 (highlighted in red in the set of photos below). The photos indicate that ground movement occurred at this location in the past. The evidence shown in photos listed above includes severed service ducts, taut electrical cables passing between the sections of severed ducts, localised depressions in the ground and gaps between foundations of the electrical cabinets and the surrounding ground. The evidence relates to a 20m section parallel to the haul road with less dominant depressions for another 10 to 15m in either direction. FT advises that remedial works to ducts, cables and tension cracks to prevent water ingress may be required. We further advise that topographic monitoring of fixed stations should be carried out on a regular basis to determine if the failure is stable. Finally a review of historic records or trial pits should be excavated to determine if geogrids were installed.


**Photo 28: Northern slope**


**Photo 29: Northern slope**


**Photo 30: Northern Slope**


**Photo 31: Northern Slope**

**Photo 32: Northern Slope**

**Photo 33: Northern Slope**

**Photo 34: Northern Slope**

**Photo 35: Northern Slope**

**Photo 36: Northern Slope**

**Photo 37: Northern Slope**

**Photo 38: Eastern Slope**

**Photo 39: Eastern Slope**

**Photo 40: Eastern Slope**

**Photo 41: Eastern Slope**


**Photo 42: Eastern Slope**


**Photo 43: Eastern Slope**


**Photo 44: Eastern Slope**


**Photo 45: Eastern Slope**

**Photo 46: Eastern Slope**


**Photo 47: Eastern Slope**


**Photo 48: Eastern Slope**

**Photo 49: Eastern Slope**

**Photo 50: Eastern Slope**

**Photo 51: Eastern Slope**


**Photo 52: Eastern Slope**

**Photo 53: Eastern Slope**


**Photo 54: Eastern Slope**

**Photo 55: Eastern Slope**

**Photo 56: Eastern Slope**

**Photo 57: Eastern Slope**

**Photo 58: Eastern Slope**


**Photo 59: Eastern Slope**


**Photo 60: Eastern Slope**

**Photo 61: Eastern Slope**

**Photo 62: Eastern Slope**

**Photo 63: Eastern Slope**

**Photo 64: Eastern Slope**

**Photo 65: Eastern Slope**

**Photo 66: Eastern Slope**

**Photo 67: Eastern Slope**

Photo 68: Eastern Slope

Photo 69: Eastern Slope

Photo 70: Eastern Slope

Photo 71: Southern Slope

Photo 72: Southern Slope

Photo 73: Southern Slope

Photo 74: Southern Slope


Photo 75: Southern Slope


Photo 76: Western Slope

Photo 77: Western Slope


Photo 78: Western Slope

Photo 79: Western Slope

Photo 80: Western Slope


**Photo 81: Western Slope**


**Photo 82: Western Slope**


**Photo 83: Western Slope**


**Photo 84: Western Slope**


**Photo 85: Western Slope**


**Photo 86: Western Slope**


**Photo 87: Western Slope**


**Photo 88: Western Slope**


Photo 89: Western Slope


Photo 90: Western Slope


Photo 91: Western Slope


Photo 92: Western Slope


Photo 93: Western Slope


Photo 94: Western Slope

Photo 95: Western Slope


Photo 96: Western Slope


**Photo 97: Western Slope**


**Photo 98: Western Slope**


**Photo 99: Western Slope**


**Photo 100: Western Slope**


**Photo 101: Western Slope**


**Photo 102: Western Slope**


**Photo 103: Western Slope**


**Photo 104: Western Slope**

Photo 105: Western Slope

Photo 106: Western Slope

Photo 107: Western Slope

Photo 108: Western Slope

Photo 109: Western Slope

Photo 110: Western Slope

Photo 111: Western Slope

Photo 112: Western Slope

Photo 113: Western Slope

Photo 114: Western Slope

Photo 115: Western Slope

Photo 116: Western Slope

Photo 117: Western Slope

# 5 SUMMARY AND CONCLUSIONS

FT completed a site walkover and visual slope stability assessment of North Kerry Landfill on the 22nd March 2016. All slopes were walked in a toe to crest survey, photographed and examined for indications of instability.

The results of this visual assessment indicate that the landfill body main slopes are considered to be stable, with the exception of the issues outlined below. However, the accuracy of the visual assessment was restricted by the abundance of overgrown vegetation on the landfill cap. Therefore, FT cannot be sure that other areas of the landfill slopes are free from defects.

FT recommends actions as follows at locations listed below:

1. Re-grading of cap adjacent constructed wetland at southeast corner of Cells 1 to 16 (eastern slope) to: shed runoff, improve trafficability and reduce surcharge loading. The localised depression that has occurred at this location on the eastern slope may have been impacted by both settlement following waste degradation and additional surcharge loading caused by the constructed wetland area immediately adjacent to it.

   The area is noticeably waterlogged above the capping liner and waste below the liner may also be saturated in the event that the cap liner has been compromised. If the wetlands are to be retained a localised water balance should be carried out to evaluate whether or not the wetland containment has been compromised. If materials above the cap liner remain saturated there is an increased risk of a translational failures. If the waste is saturated there is an increased risk of a rotational failure within the waste body.

2. It is currently unclear as to the type of ground movement that has occurred on the western slope adjacent to haul road. The ground movements appear to have occurred at some time in the past or over a prolonged period given the extent of vegetation growth in the area and absence of tension cracks, shear planes or similar. The movement may also be in equilibrium at this point.

   FT reviewed the ground profile from two separate topographical surveys completed by Kerry County Council in 2012 and 2015. Both show similar ground contours for the landfill slope in this area. It is also noted that this area has a steeper gradient than other adjacent landfill slopes which may contribute to ground movement. FT notes that we do not have any As-Built information on the type of capping material or the type of geomembrane used in the cap construction at the time of writing of this report.

   It is recommended that:

   - ground movements as may be present at this location are investigated and monitored using topographic surveys (xyz) of fixed point (peg delineated) locations perpendicular to the shear plane along the slope at intervals not exceeding 10.0m and removed from the slope at top and bottom for a distance not less than 20m. The survey should be carried out quarterly for a time interval not less than 12 months with a view to establishing whether translational or rotational failures are evident.
   - Trial pits are excavated and or as-built records reviewed to determine whether or not geogrids are in place
   - In the event that no geogrids are present a translational stability assessment be carried out to determine if the slopes are theoretically stable.
   - Surcharge loading from machinery be avoided on these slopes and vegetation management as may be required to facilitate visual inspections and surveying should be carried out using a strimmer or similar.

3. Cells 17, 18 and 19 require reseeding and or topsoiling of bare vegetation areas to establish a robust cover and so mitigate the risk of rill erosion, poor trafficability and excessive surcharging on slopes.

4. Vegetation growth on slopes be cut back and maintained such that more effective visual inspections can be completed on the landfill slopes for future annual inspections as required by the conditions attached to IED Licence No. W0001-04.

The proposed remedial works, be they backfilling or other, should be implemented as soon as is possible. Remedial works should only be undertaken following appropriate investigation, risk assessments and method statements.

From a Safety & Health perspective, the undulating nature of the cap profile and hidden hazards such as gas well enclosures below ground level, hidden by vegetation and without protective covers are a concern and should be addressed by the Licensee at the earliest possible opportunity.

# APPENDIX 1

## Slope Location Plan

Sheet FTC-A1-2006 rev. C (template filed in O:Acad\Templates\Autocad) (May 2007) - template externally referenced

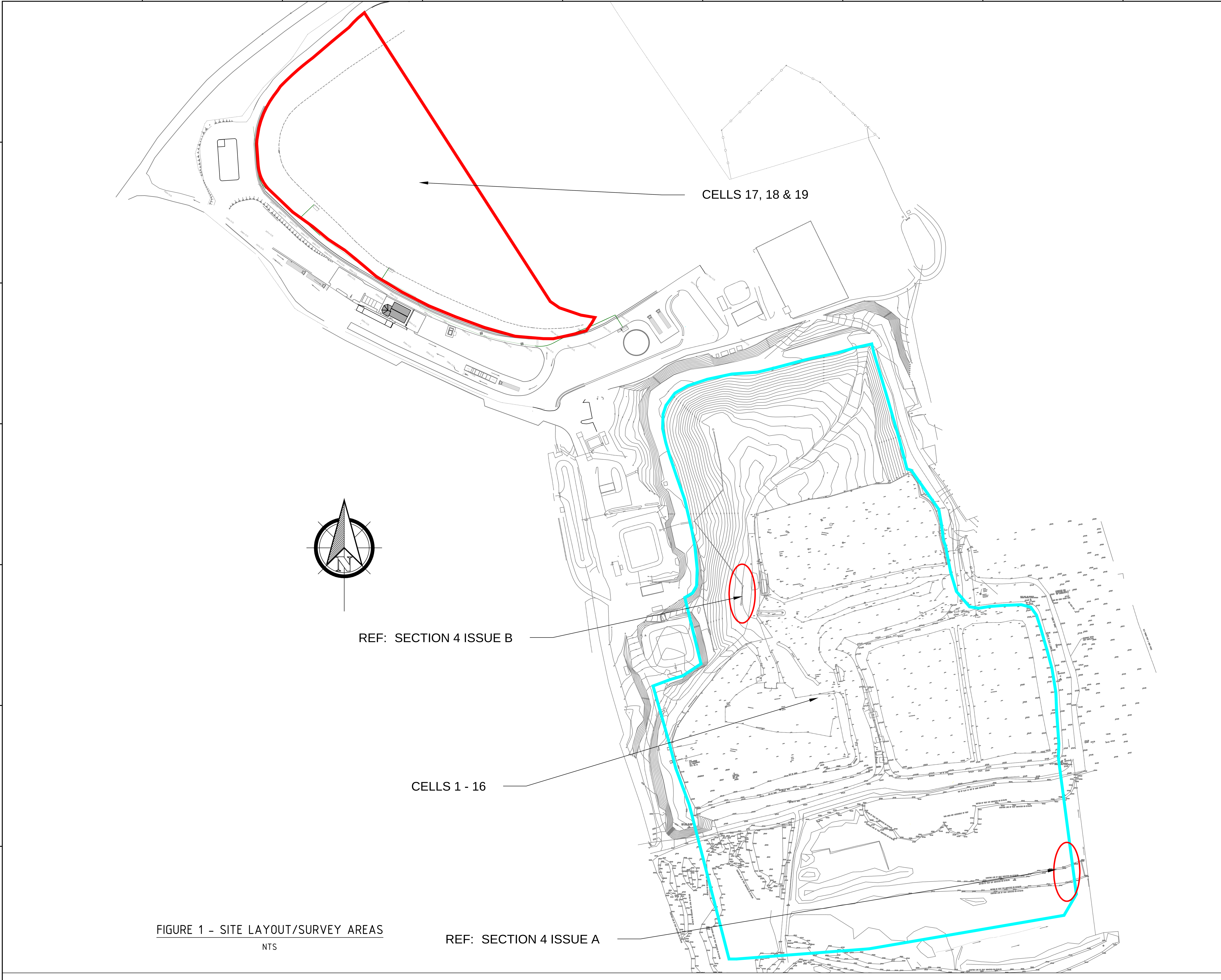


FIGURE 1 - SITE LAYOUT/SURVEY AREAS

NTS



| Rev. | Drawn | Chk'd | App'd | Rev Origin / Date | Description |
|---|---|---|---|---|---|
| A | KK | CJC | BG | Cork 30.03.16 | ISSUE FOR APPROVAL |

Revision History A

**Name of Client**

Kerry County Council

**Name of Job**

North Kerry Landfill
Slope Stability Assessment

**Title of Drawing**

FIGURE No 1 - Site Layout/Survey Areas

Scales Used: NTS

This Drawing was printed to A1-

Dwg. No.: LW1501705-100-001

Rev.: A

O:\ACAD\2015\LW15\017\05\LW1501705-100-001

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ORIGINAL DRAWING SIZE A1 - (841 x 594)

SCALE HORIZ.

SCALE - VERTICAL

# APPENDIX 2

## Photo Coordinates

| Photo No | Photo Name | Latitude (Degrees) | Longitude (Degrees) | Altitude (m) |
|---|---|---|---|---|
| 1 | LW1501705-001.JPG | 52.298402 | -9.542399 | 271 |
| 2 | LW1501705-002.JPG | 52.298537 | -9.543147 | 265 |
| 3 | LW1501705-003.JPG | 52.298891 | -9.543384 | 270 |
| 4 | LW1501705-004.JPG | 52.298889 | -9.543382 | 270 |
| 5 | LW1501705-005.JPG | 52.299161 | -9.544164 | 264 |
| 6 | LW1501705-006.JPG | 52.299158 | -9.544156 | 264 |
| 7 | LW1501705-007.JPG | 52.299314 | -9.543943 | 267 |
| 8 | LW1501705-008.JPG | 52.299318 | -9.543939 | 267 |
| 9 | LW1501705-010.JPG | 52.299212 | -9.544706 | 255 |
| 10 | LW1501705-011.JPG | 52.299349 | -9.544945 | 253 |
| 11 | LW1501705-012.JPG | 52.299537 | -9.544196 | 265 |
| 12 | LW1501705-013.JPG | 52.299537 | -9.544196 | 265 |
| 13 | LW1501705-014.JPG | 52.29985 | -9.544644 | 254 |
| 14 | LW1501705-015.JPG | 52.299684 | -9.544002 | 265 |
| 15 | LW1501705-016.JPG | 52.299684 | -9.543991 | 265 |
| 16 | LW1501705-017.JPG | 52.300177 | -9.543944 | 254 |
| 17 | LW1501705-018.JPG | 52.300171 | -9.543917 | 255 |
| 18 | LW1501705-019.JPG | 52.299522 | -9.54376 | 266 |
| 19 | LW1501705-020.JPG | 52.299525 | -9.543779 | 267 |
| 20 | LW1501705-021.JPG | 52.29932 | -9.543352 | 267 |
| 21 | LW1501705-022.JPG | 52.299318 | -9.543357 | 268 |
| 22 | LW1501705-023.JPG | 52.299378 | -9.542952 | 262 |
| 23 | LW1501705-024.JPG | 52.299213 | -9.542747 | 265 |
| 24 | LW1501705-025.JPG | 52.299216 | -9.542746 | 265 |
| 25 | LW1501705-026.JPG | 52.298851 | -9.542961 | 272 |
| 26 | LW1501705-027.JPG | 52.298852 | -9.542954 | 272 |
| 27 | LW1501705-028.JPG | 52.298525 | -9.541834 | 268 |
| 28 | LW1501705-031.JPG | 52.298072 | -9.540936 | 279 |
| 29 | LW1501705-034.JPG | 52.297877 | -9.540107 | 286 |
| 30 | LW1501705-035.JPG | 52.29787 | -9.540104 | 286 |
| 31 | LW1501705-036.JPG | 52.297671 | -9.539882 | 287 |
| 32 | LW1501705-037.JPG | 52.297671 | -9.539882 | 287 |
| 33 | LW1501705-038.JPG | 52.298221 | -9.539179 | 277 |
| 34 | LW1501705-039.JPG | 52.298221 | -9.539179 | 277 |
| 35 | LW1501705-040.JPG | 52.298395 | -9.539269 | 275 |
| 36 | LW1501705-041.JPG | 52.298395 | -9.539269 | 275 |
| 37 | LW1501705-043.JPG | 52.298427 | -9.538928 | 278 |
| 38 | LW1501705-044.JPG | 52.297816 | -9.538503 | 280 |
| 39 | LW1501705-045.JPG | 52.297789 | -9.538469 | 281 |
| 40 | LW1501705-046.JPG | 52.297783 | -9.538452 | 281 |
| 41 | LW1501705-047.JPG | 52.297615 | -9.538681 | 285 |
| 42 | LW1501705-048.JPG | 52.29762 | -9.538687 | 285 |
| 43 | LW1501705-049.JPG | 52.29762 | -9.538687 | 285 |
| 44 | LW1501705-050.JPG | 52.297268 | -9.538531 | 295 |
| 45 | LW1501705-051.JPG | 52.297273 | -9.53852 | 295 |
| 46 | LW1501705-052.JPG | 52.297273 | -9.53852 | 295 |
| 47 | LW1501705-053.JPG | 52.297016 | -9.537913 | 286 |
| 48 | LW1501705-054.JPG | 52.297016 | -9.537913 | 286 |

| | | | | |
|---|---|---|---|---|
| 49 | LW1501705-056.JPG | 52.296818 | -9.538393 | 291 |
| 50 | LW1501705-057.JPG | 52.296818 | -9.538393 | 291 |
| 51 | LW1501705-058.JPG | 52.29681 | -9.538362 | 291 |
| 52 | LW1501705-059.JPG | 52.296876 | -9.537152 | 292 |
| 53 | LW1501705-061.JPG | 52.296576 | -9.536888 | 293 |
| 54 | LW1501705-062.JPG | 52.296576 | -9.536888 | 293 |
| 55 | LW1501705-063.JPG | 52.29646 | -9.537052 | 293 |
| 56 | LW1501705-064.JPG | 52.29646 | -9.537052 | 293 |
| 57 | LW1501705-065.JPG | 52.296083 | -9.537055 | 291 |
| 58 | LW1501705-066.JPG | 52.296083 | -9.537055 | 291 |
| 59 | LW1501705-067.JPG | 52.295891 | -9.536625 | 290 |
| 60 | LW1501705-068.JPG | 52.29588 | -9.536628 | 290 |
| 61 | LW1501705-069.JPG | 52.295754 | -9.536683 | 290 |
| 62 | LW1501705-070.JPG | 52.295754 | -9.536683 | 290 |
| 63 | LW1501705-071.JPG | 52.295363 | -9.536514 | 290 |
| 64 | LW1501705-072.JPG | 52.295362 | -9.536531 | 290 |
| 65 | LW1501705-076.JPG | 52.294844 | -9.536738 | 289 |
| 66 | LW1501705-077.JPG | 52.294853 | -9.53674 | 289 |
| 67 | LW1501705-078.JPG | 52.294962 | -9.536667 | 288 |
| 68 | LW1501705-079.JPG | 52.295026 | -9.536647 | 287 |
| 69 | LW1501705-080.JPG | 52.295039 | -9.536667 | 287 |
| 70 | LW1501705-081.JPG | 52.295253 | -9.536867 | 289 |
| 71 | LW1501705-090.JPG | 52.294593 | -9.538834 | 292 |
| 72 | LW1501705-091.JPG | 52.294593 | -9.538834 | 292 |
| 73 | LW1501705-094.JPG | 52.294338 | -9.539399 | 294 |
| 74 | LW1501705-095.JPG | 52.29434 | -9.539393 | 294 |
| 75 | LW1501705-097.JPG | 52.294347 | -9.540226 | 289 |
| 76 | LW1501705-098.JPG | 52.294349 | -9.540223 | 289 |
| 77 | LW1501705-100.JPG | 52.294752 | -9.540349 | 290 |
| 78 | LW1501705-101.JPG | 52.294752 | -9.540349 | 290 |
| 79 | LW1501705-102.JPG | 52.295034 | -9.540095 | 294 |
| 80 | LW1501705-103.JPG | 52.295045 | -9.540109 | 294 |
| 81 | LW1501705-104.JPG | 52.29534 | -9.540583 | 289 |
| 82 | LW1501705-105.JPG | 52.295341 | -9.540581 | 289 |
| 83 | LW1501705-106.JPG | 52.295701 | -9.540371 | 293 |
| 84 | LW1501705-107.JPG | 52.295701 | -9.540371 | 293 |
| 85 | LW1501705-114.JPG | 52.296046 | -9.540776 | 281 |
| 86 | LW1501705-115.JPG | 52.296112 | -9.540185 | 288 |
| 87 | LW1501705-116.JPG | 52.29611 | -9.540185 | 288 |
| 88 | LW1501705-117.JPG | 52.29611 | -9.540185 | 288 |
| 89 | LW1501705-119.JPG | 52.296427 | -9.539756 | 290 |
| 90 | LW1501705-121.JPG | 52.296672 | -9.540132 | 290 |
| 91 | LW1501705-122.JPG | 52.296779 | -9.540184 | 290 |
| 92 | LW1501705-123.JPG | 52.296782 | -9.540179 | 290 |
| 93 | LW1501705-124.JPG | 52.296782 | -9.540179 | 290 |
| 94 | LW1501705-125.JPG | 52.296829 | -9.540161 | 290 |
| 95 | LW1501705-126.JPG | 52.296839 | -9.540121 | 289 |
| 96 | LW1501705-127.JPG | 52.296809 | -9.540127 | 289 |
| 97 | LW1501705-128.JPG | 52.296716 | -9.540131 | 288 |
| 98 | LW1501705-129.JPG | 52.296685 | -9.540009 | 289 |

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|---|---|---|---|---|
| 99 | LW1501705-130.JPG | 52.296868 | -9.539984 | 289 |
| 100 | LW1501705-132.JPG | 52.297052 | -9.540027 | 289 |
| 101 | LW1501705-133.JPG | 52.297255 | -9.540217 | 288 |
| 102 | LW1501705-134.JPG | 52.297084 | -9.540661 | 284 |
| 103 | LW1501705-135.JPG | 52.296965 | -9.540607 | 284 |
| 104 | LW1501705-136.JPG | 52.297038 | -9.540624 | 283 |
| 105 | LW1501705-139.JPG | 52.297932 | -9.541097 | 282 |
| 106 | LW1501705-140.JPG | 52.297651 | -9.540369 | 289 |
| 107 | LW1501705-141.JPG | 52.297658 | -9.540371 | 290 |
| 108 | LW1501705-142.JPG | 52.29771 | -9.540402 | 290 |
| 109 | LW1501705-143.JPG | 52.297822 | -9.540115 | 289 |
| 110 | LW1501705-144.JPG | 52.297836 | -9.540119 | 289 |
| 111 | LW1501705-145.JPG | | | |
| 112 | LW1501705-146.JPG | | | |
| 113 | LW1501705-147.JPG | | | |
| 114 | LW1501705-148.JPG | | | |
| 115 | LW1501705-149.JPG | | | |
| 116 | LW1501705-154.JPG | | | |
| 117 | LW1501705-155.JPG | | | |