WATERFORD COUNTY COUNCIL

COMHAIRLE CHONTAE PHORTLAIRGE

ANNUAL ENVIRONMENTAL REPORT 2008

TRAMORE WASTE DISPOSAL SITE

TRAMORE INTAKE & TRAMORE BURROWS

TRAMORE CO. WATERFORD

Waste Licence Register No. W0075-02

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Introduction

Waterford County Council was granted a Waste License (Ref 75 – 1) by the Environmental Protection Agency for the continued operation of an existing unlined landfill and civic waste facility at Tramore Co. Waterford on 25th September 2001. This is the sixth Annual Environmental Report, which has been prepared to meet the requirements of Condition 11.8 of Waste License W0075-02 and includes the monitoring period 1st January 2008 to 31st December 2008.

1. Reporting Period

This is the Sixth Annual Environmental Report for the Tramore Landfill Facility, which covers the period 1st January 2008 to 31st December 2008.

2. Waste Activities carried out at the Facility

Part 1 of the Waste Licence details the activities authorised by the licence:

Waste Management Act 1996: Third Schedule

Class 12. Repackaging prior to submission to any activity referred to in a preceding paragraph of this Schedule:

This activity is limited to the storage of waste at the Civic Waste Facility

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 Management Act, 1996, Fourth Schedule

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

This activity is limited to recycling of paper at the Civic Waste Facility

Class 3. Recycling or reclamation of metals and metal compounds:

This activity is limited to the storage of metal cans at the Civic Waste Facilityy

Class 4. Recycling or reclamation of other inorganic materials:

This activity is limited to the receipt, holding and recovery of inert wastes (such as bricks, cement, ceramics, soils) to be sent off site for reprocessing or to be used in the restoration of Tramore landfill site subject to the prior agreement of the Agency.

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:

This activity is limited to the use of inert material diverted from the landfill to be used as cover material, intermediate cover or the formation of embankments at the site.

Class 13. Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than the temporary storage, pending collection, on the premises where such waste is produced:

This activity is limited to the temporary storage of waste on site prior to being recycled, re-used or reclaimed.

3. Quantity and Composition of Waste Received, Disposed of and Recovered during the year & each year previous.

The quantity and composition of waste received, disposed of and removed for the reporting period 1st January 2008 – 31st December 2008 is attached in Appendix A.

The waste intake prior to 1995 is unknown as there was no weighbridge at the site. The 1995 estimation is taken from the EPA National Waste Database (1995). The 1996 figures have

been extracted from the Waterford County Council Waste Management Plan (1997). The 1997, 1998, 1999, 2000 and 2001 estimations are based on the 1996 figure assuming a 3% increase in waste growth per annum.

4. Calculated Remaining Capacity of the Site

The Landfill has ceased accepting waste after 31st December 2005.

5. Year in which Final Capacity is expected to be reached

Final capacity has been reached on the 31st December 2005.

6. Methods of Deposition of Waste

All waste, except residual household waste and hazardous waste, is recycled. Members of the public have no access to the landfill but utilise the civic amenity area, which was upgraded in 2003. The civic amenity area has receptacles, which accept the following materials: scrap metal, timber, household bulky items, dry recyclables, domestic waste, paint, fridges/freezers, cookers, washing machines, dryers, fluorescent tubes, waste oil (cooking and car), aerosols, textiles, pesticides, batteries (domestic and car) and glass. The civic amenity site accepts waste from domestic householders only.

7. Environmental-Monitoring

INTRODUCTION

This report is a compilation of environmental monitoring carried out on behalf of Waterford County Council at Tramore Landfill during the period January 2008 to December 2008.

Monitoring of surface waters, groundwaters, and leachate quality, as well as ecological monitoring, was carried out in accordance with the waste licence 75-1, conditions 8, and schedule D.
Sampling sites are as set out in table 1, and appendix 1.

SURFACE WATER STATIONS	GROUNDWATER STATIONS	LEACHATE STATIONS	NOISE	TOXICITY ASSESSMENT	ECOLOGICAL SURVEY	SEDIMENT & SHELLFISH
SW 1,2,3,4,5,6 Weekly visual/odour inspection Quarterly and annual chemical analysis	BH 2,5,8,9,10 RC 4,5 Monthly levels. Quarterly and annual chemical & microbiological analysis Note: BH2 to be redesignated a leachate borehole.	BH 1/1, 7 RC 6a LT1, LT2, LT3, LT4, LT5 Weekly levels. Quarterly and annual chemical analysis	B1, B2 Annual survey	Leachate Annual assessment of toxicity of leachate using appropriate organisms.	Annual ecological / biological survey of backstrand. Survey of birdlife and habitats.	Annual chemical quality of sediments, cockles and mussels from backstrand. Microbiological quality of shellfish from backstrand.

Table 1. Sampling sites and monitoring requirements

Baseline Monitoring

One of the purposes of compliance monitoring is to determine if there has been a release of contaminants to the environmental media, and to demonstrate compliance with landfill licence conditions. ***Baseline monitoring*** is monitoring which serves as a reference point to which later monitoring results are compared. For the purpose of this report, results obtained during the first licensed year of operation, September 2001 to September 2002, will be used as baseline monitoring data.

Key Parameters

In line with EPA reporting recommendations[1], results trends for key parameters are presented for surface waters (BOD), groundwaters (Ammonia & Iron) and leachates (Ammonia and COD).

[1] EPA – Landfill Monitoring Manual, 2nd Ed, 2004

Interference in metals analysis of aqueous samples from Tramore landfill and environs due to salinity.

The test method used to determine metals concentrations in aqueous samples from Tramore landfill is ICP-MS. Elements present in seawater can interfere with the test. The presence of chloride and other elements present in seawater combine with each other and the test carrier gas to form compounds which have the same atomic weights as some of the target test elements. The detector then wrongly identifies and measures these compounds as target test elements and thus gives falsely high results.

According to the Varian ICP-MS Application Note 32, the analysis of samples containing high levels of chloride typically produces polyatomic species in the plasma, which cause major interference in the most abundant isotopes of As V, Cr and Ni. The presence of other major elements such as Na, Ca and Mg in seawater can also produce polyatomic interference on isotopes of Cu, Co and Zn.

An example of this is the interference by chloride in the ICP-MS test for Arsenic. Chlorine, which has an atomic weight of c35, combines with the test carrier gas argon (mass 40). This Ar Cl complex has a combined mass of c75, which is close to atomic weight of Arsenic (75), and which leads to falsely high results.

A list of typical polyatomic interferences for the elements arsenic, chromium, copper and zinc are given in table 1.

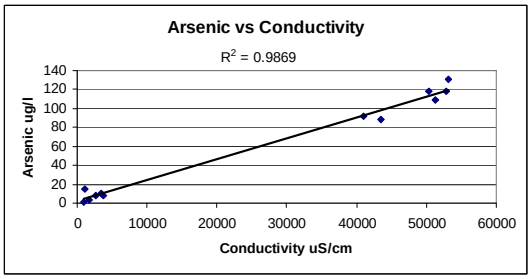
Table 1. Typical polyatomic interference – extract from Varian ICP-MS Application note 32.

Test target element	**Polyatomic interference**
^{75}Arsenic	$^{40}Ar\ ^{35}Cl$, $^{40}Ca\ ^{35}Cl$
^{52}Chromium	$^{40}Ar\ ^{12}C$, $^{40}Ca\ ^{12}C$, $^{35}Cl\ ^{16}O^{1}H$, $^{38}Ar\ ^{14}N$
^{63}Copper	$^{40}Ar\ ^{23}Na$, $^{40}Ca\ ^{23}Na$
^{64}Zinc	$^{32}S\ ^{16}O_2$, $^{32}S_2$, $^{36}Ar\ ^{14}N_2$, $^{40}Ar\ ^{23}Na\ ^{1}H$, $^{40}Ar\ ^{24}Mg$

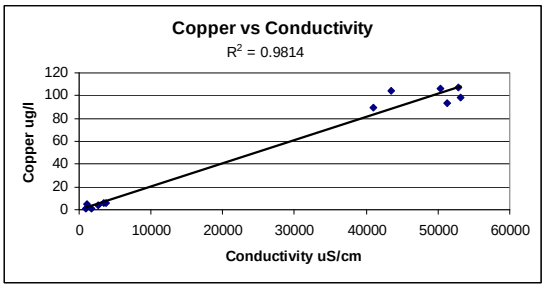
Examination of the Q2 2006 results of metals analysis from Tramore landfill provides evidence for such interference. Using conductivity as a proxy measure of salinity, it can be seen – see figures 1a-d - that there is a direct and strong correlation between salinity and measured metal concentration for

arsenic, chromium, copper and zinc. This holds true, even for open seawater samples, which would be expected to have very low levels of these metals.

Thus the reported results for these metals in saline samples (conductivity > 5000 us/cm) are unreliable and should be disregarded.



1a



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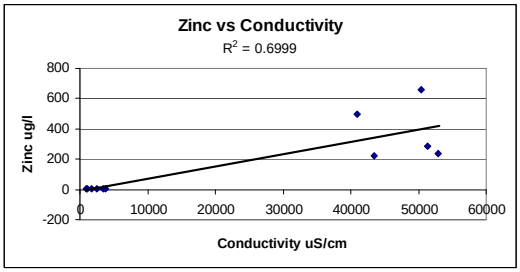

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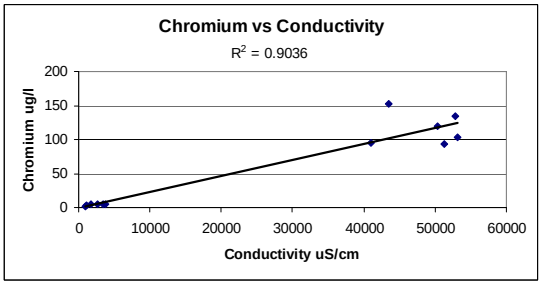


1d

Figure 1a-1d. Relationship between metals concentrations and conductivity in aqueous samples from Tramore landfill and environs, for the 2nd quarter period 2006.

7.1. SURFACE WATER.

7.1.1 Introduction

The surface water sampling sites are SW 1, 2, 3,4,5,6, as per appendix 1. Sampling was carried out in each quarter of 2008.

Results are presented in tables 1.1 to 1.4, and appendix C.

There are difficulties involved in monitoring surface water pollution from landfills adjacent to estuaries, as the salinity of the samples can interfere with many of the tests, (*ammonia, COD, arsenic, copper*). Additionally, many of the ions, which are considered indicators of leachate contamination, are also major components of sea/brackish water, *(chloride, sulphate, sodium, magnesium, calcium, boron).*

Following the convention of previous reports on Tramore landfill, the results are compared to the standards in the Drinking Water Regulations (SI no. 106, 2007), and Bathing Water Regulations (SI no. 155, 1992). Additionally, water quality criteria used in a recent DOELG / EPA report *("An Assessment of the Trophic Status of Estuaries and Bays in Ireland"*, DOELG/EPA, 2001) are used also. These standards are presented in the tables of results for comparison.

Where possible, results are also compared to results of baseline monitoring carried out between September '01 and September '02

7.1.2 Results

Visual and odour examination indicated that there was no obvious contamination at any of the sites. There was no observed odour or floating materials, which would interfere with bathing water use. Some of the samples at sites SW1-3 from the inner back strand were cloudy, but this is normal due to the effect of tidal flushes on silt and sand.

The conductivity results indicate that site S1 is brackish water while sites SW2 to SW6 are saline. pH and temperature are normal at all sites over the monitoring period and fall within relevant quality standards.

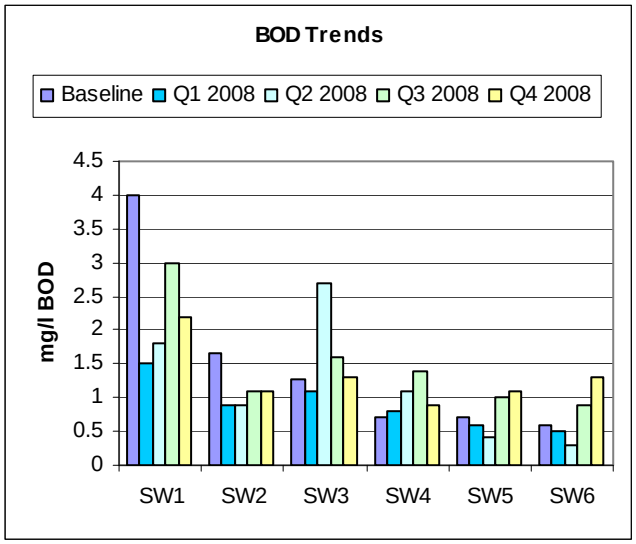
Dissolved oxygen levels were generally satisfactory at all the sites. The suspended solids levels seem quite high at all stations, and this may be due to silt/sand entrainment in the samples, as the BOD values do not indicate the presence of significant amounts of organic matter.

Ammonia and BOD were elevated at site SW1. The somewhat elevated ammonia levels recorded at sites SW2 to SW6 are most likely due to interference by salinity.

Key Parameter – BOD

The BOD test is a measure of the amount of oxygen consumed by microorganisms in breaking down organic matter in water.

Respiration by phytoplankton or their decay, can also lead to oxygen depletion during the BOD test resulting in a high BOD value. Natural seawaters are likely to have a BOD value < 2 mg/l BOD.



BOD was slightly elevated at times at SW1, but satisfactory at the other surface water sites. There was an elevated BOD recorded at SW3 in Q2. This spike is suspected to be due to algal activity.

7.1.3 Discussion

The results of analysis are in line with previous reports that indicated a slight elevation in organic matter and nutrients at site SW1. It is known that an off-site source is contributing to the organic load at SW1. There is no indication of any effect from the landfill on the surface water sites.

Table 1.1 Tramore Landfill Surface Water Monitoring Q1 2008

Test	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	Drinking Water Standards (SI 81 1988)	Bathing Water Standards (SI 155 1992)	Estuarine Water Standards (DOELG 2001)	Comment	Environmental significance
Ammonia mg/l N	**0.53**	0.1	nr	nr	nr	nr	0.23			Elevated at SW1. This is stormwater drain. The landfill is not deemed to be a factor.	No environmental effect from landfill
BOD mg/l O_2	1.5	0.9	1.1	0.8	0.6	0.5				satrisfactory at all stations	none
Dissolved Oxygen % Sat	84.5	95.8	96.2	98.1	99.1	98.7	-	70-120 95% compliance	70-130 (Brackish) 80-120 (Saline)	satisfactory at all stations	none
Conductivity µS/cm	1714	nm	nm	nm	nm	nm				brackish at SW1.	none
COD mg/l O2	45	nm	nm	nm	nm	nm				not measured in saline stations	n/a
Nitrite	0.005		0.006	0.002	0.002	0.001	0.1			satisfactory at all stations	none
Chloride	>237	**>4300**	**>534**	**>556**	**>552**	**>552**	250			chloride reflects brackish/saline nature of samples	none
pH	7.7	7.6	7.9	8	8	8	7-9			satisfactory at all stations	none
Suspended Solids mg/l	149	nm	46	41	167	86	None visible			Elevated at SW1, storm drain. Slightly elevated levels at SW3 to 6 may be due to saline interference in test.	none expected
Temperature °c	10	9.2	9.9	10	9.8	9.7	25			satisfactory at all stations	none
Orthophosphate mg/l P	0.03		0.037	0.035	0.033	0.033	2180			satisfactory at all stations	none
Total Oxidised Nitrogen mg/l N	0.9		<0.1	<0.1	<0.1	<0.1	11.3 N		1.4 (Brackish) 0.2 (saline)	satisfactory at all stations	none
Arsenic ug/l	<5	53.9	23	49.2	53.2	50.9				apparently elevated levels in saline samples due to saline interference in test. See fig 1.	none
Cadium mg/l	<5	<5	<5	<5	<5	<5				satisfactory at all stations	none
Calcium mg/l	46.2	262	132	248	259	260				results reflect presence of calcium in seawater.	none
Chromium ug/l	12.3	33.5	21.2	30.9	32.6	33.5				apparently elevated levels in saline samples due to saline interference in test. See fig 1.	none
Copper ug/l	7.68	124	44.5	101	116	125				apparently elevated levels in saline samples due to saline interference in test. See fig 1.	none
Iron ug/l	2020	882	898	883	940	972				there may be some salinity interference in iron test. This to be investigated.	none expected
Lead ug/l	<5	<5	<5	<5	<5	<5				satisfactory at all stations	none
Magnesium mg/l	21.4	806	351	709	744	767				results reflect presence of calcium in seawater.	none
Manganese ug/l	231	<50	<50	<50	<50	<50				satisfactory at all stations	none
Mercury ug/l	<5	<5	<5	<5	<5	<5				satisfactory at all stations	none
Potassium mg/l	8.74	248	108	224	236	241				results reflect presence of calcium in seawater.	none
Sodium mg/l	147	7240	2680	6520	6120	6440				results reflect presence of calcium in seawater.	none
Zinc ug/l	46.5	109	52.8	70.7	75	93.2				apparently elevated levels in saline samples due to saline interference in test. See fig 1.	none

At high saline concentrations salinity results are given instead of conductivity results. COD and ammonia results are not reported for high saline concentrations as the high salinities cause problems with the test methods.

Table 1.2 Surface Water Monitoring Q2 2008

Test	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	Drinking Water Standards (SI 278 2007)	Bathing Water Standards (SI 155 1992)	Estuarine Water Standards (DOELG 2001)	Comment	Environmental significance
Ammonia mg/l N	**1.8**	0.33	0.09	0.016	0.016	0.023	0.23			Elevated at SW1. This is stormwater drain. The landfill is not deemed to be a factor.	No environmental effect from landfill
Arsenic ug/l	<50	<50	<50	52.5	55.3	54.5	10			apparently elevated levels in saline samples due to saline interference in test. See fig 1.	none
BOD mg/l O_2	1.8	0.9	2.7	1.1	0.4	0.3				satrisfactory at all stations	none
Cadmium mg/l	<50	<50	<50	<50	<50	<50	5			satisfactory at all stations	none
Calcium mg/l	82	256	356	367	355	322				results reflect presence of calcium in seawater.	none
Chloride	386	697	699	696	696	697	250			chloride reflects brackish/saline nature of samples	none
Chromium ug/l	<50	<50	<50	<50	<50	<50	50			satrisfactory at all stations	none
COD mg/l O2	52									not measured in saline stations. Satisfactory at SW1	n/a
Conductivity µS/cm	3810	nm	nm	nm	nm	nm	2500			not measured in saline stations. Slughtly elevated at SW1 at SW2	none
Copper ug/l	<50	145	163	219	244	251	2000			apparently elevated levels in saline samples due to saline interference in test. See fig 1.	none
Dissolved Oxygen % Sat	116.3	106.7	160.2	137.5	109.1	109.6		70-120 95% compliance	70-130 (Brackish) 80-120 saline	Somewhat elevated at SW2 and SW3. Most likely due to algal activity	none expected
Iron ug/l	<500	<500	<500	<500	<500	<500	200			satrisfactory at all stations	none
Lead ug/l	<50	<50	<50	<50	<50	<50	25			satisfactory at all stations	none
Magnesium mg/l	51.6	754	681	709	1155	1057				results reflect presence of calcium in seawater.	none
Manganese ug/l	<500	<500	<500	<500	<500	<500	50			satisfactory at all stations	none
Mercury ug/l		nm	nm	nm	nm	nm	1			not measured this round	n/a
Orthophosphate mg/l P		nm	nm	nm	nm	nm	2180			not measured this round	n/a
pH	8	8	8.3	8.3	8	8.1	7-9			satisfactory at all stations	none
Potassium mg/l	<50	233	346	352	351	314				results reflect presence of calcium in seawater.	none
Salinity %	1.9	29.9	27.3	28.8	31.2	31.2				SW2, 3, 4, 5 and 6 are saline	none
Sodium mg/l	517	8058	7198	7456	7760	7801	200			results reflect presence of calcium in seawater.	none
Suspended Solids mg/l	30	43	80	70	nr	nr	None visible			Slightly elevated levels at SW2 to 4 may be due to saline interference in test. SW5 and SW6 not reported this round	none expected
Temperature °C	18.2	13.4	15.8	13.5	12.7	14.5	25			satisfactory at all stations	none
Total Oxidised Nitrogen mg/l N		nm	nm	nm	nm	nm	11.3 N		0.2 saline 1.4 (Brackish)	not measured this round	n/a
Zinc ug/l	<300	<300	<300	<300	<300	<300				Below limit of detection at all stations	none

At high saline concentrations salinity results are given instead of conductivity results. COD results are not reported for high saline concentrations as the high salinities cause problems with the test methods.

Table 1.3 Tramore Landfill Surface Water Monitoring Q3 2008

SURFACE WATER	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	Water quality standard (see key at bottom of	Comment	Environmental significance
Test									
Aluminium ug/l	-250	-500	-500	-500	-500	-500	200 DW	low	none
Ammonia mg/l N	1.7	0.4	0.12	0.021	0.009	-0.003	0.23 DW	elevated at SW1 and SW2, non-landfill source	slight local enrichment, non-landfill source
Antimony ug/l	-10	-20	-20	-20	-20	-20	5 DW	low	none
Arsenic µg/l	-10	69.2	67.2	66.6	65.4	64.4	10 DW	saline interference in test	none
Barium ug/l	-60	-120	-120	-120	-120	-120		low	none
Beryllium ug/l	-10	-20	-20	-20	-20	-20		low	none
Boron µg/l	2158	4740	4400	4380	4208	4156	1000 DW	reflects salinity	none
Cadmium µg/l	-10	-20	-20	-20	-20	-20	5 DW	low	none
Calcium mg/l	228	441	436	434	435	428		reflects salinity	none
BOD mg/l	3	1.1	1.6	1.4	1	0.9		satisfactory	none
Chloride mg/l Cl	nr	nm	nm	nm	nm	nm	250 DW	nm	
Chromium µg/l	16.4	41.4	38	38.2	36.8	36.8	50 DW	saline interference in test	none
Cobalt ug/l	-10	-20	-20	-20	-20	-20		low	none
COD mg/l	272	nr	nr	nr	nr	nr		likely saline interference at SW1	none
Conductivity µS/cm	19040	nm	nm	nm	nm	nm	2500 DW	reflects brackish water at SW1	none
Copper µg/l	49.5	151	150	154	146	143	2000 DW	saline interference in test	none
Dissolved Oxygen % sat	134.5	111.9	137.7	160	103.6	113.5	70-130 EST	elevated at SW3 and SW4, reflects algal activity in backstrand	natural biological activity in backstrand
Faecal Coliforms /100mls	4	1	2	0	0	0	1000 BW	low	none
Fluoride mg/l	nm	nm	nm	nm	nm	nm	0.8 DW	nm	
Iron µg/l	1781	-1000	-1000	-1000	-1000	-1000	200 DW	slightly elevated at SW1 -non-landfill source	none
Lead µg/l	-10	-20	-20	-20	-20	-20	25 DW	low	none
List I/II Organic substances	nm	nm	nm	nm	nm	nm	100 DW	nm	
Magnesium mg/l	424	1162	1068	1073	1066	1034		reflects salinity	none
Manganese µg/l	717	-1000	-1000	-1000	-1000	-1000	50 DW	low	none
Mercury ug/l	-5	-5	-5	-5	-5	-5	1 DW	low	none
Molybdenum ug/l	-10	-20	-20	-20	-20	-20		low	none
Nickel ug/l	-10	-20	-20	-20	-20	-20	20 DW	low	none
Nitrite as N	0.11	0.015	0.002	-0.001	-0.001	0.005	0.03 DW	low	none
Orthophosphate mg/l P	0.11	0.042	0.022	0.006	0.007	-0.006		low	none
pH	8	8	8.2	8.4	8.1	8.2	6.5-9.5	slightly alkaline water, as expected	none
Potassium mg/l	169	414	390	400	399	394		reflects	none
Salinity o/oo	11	34.4	33.8	34.1	34.3	34.3		SW1 brackish, other sites fully saline	none
Selenium ug/l	-10	218	202	213	106	205		saline interference in test	none
Silver ug/l	-10	-20	-20	-20	-20	-20		low	none
Sodium mg/l	4092	10510	9786	9896	9748	9550		reflects salinity	none
Sulphate mg/l SO4	778.3	2799	3023.5	2829.8	2939.5	2778.8		reflects salinity	none
Temperature °c	22.3	24.9	23.5	23.2	16.8	16.4		normal range	none
Thallium ug/l	-10	-20	-20	-20	-20	-20		low	none
Tin ug/l	-20	-40	-40	-40	-40	-40		low	none
Total Coliforms /100 mls	>2419	1733	>2419	1553	17	9	5000 BW	elevated SW1 to SW4, reflecting high level of microbial activity. Open water sites low	none - sites near bathing area satisfactory
Total Cyanide mg/l	nm	nm	nm	nm	nm	nm	0.05 DW	nm	
Total Organic Carbon mg/l C	nm	nm	nm	nm	nm	nm		nm	
Total Oxidised Nitrogen mg/l N	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	1.4 EST	low	none - levels comply with estuarine quality standard
Total Phenols	nm	nm	nm	nm	nm	nm		nm	
Uranium ug/l	-10	-20	-20	-20	78	-20		low, suspected saline interference at SW5	none
Vanadium ug/l	30	80.4	78	80.2	-120	78.8		suspected saline interference	none
Zinc µg/l	-60	-120	-120	-120		-120		low	none

DW - Drinking Water Regulations 2007, EST - DoEHLG Estuarine water report 2001, BW - Bathing water Regulations 2001

Table 1.4 Tramore Landfill Surface Water Monitoring Q4 2008

SURFACE WATERS - samples taken 6th and 20th Oct 2008	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6	Water quality standard (see key at bottom of table)	Comment	Environmental significance
Test									
Aluminium ug/l	-250	-250	-250	140	-250	-250	200 DW	low	none
Ammonia mg/l N	1.2	nr	nr	0.044	nr	nm	0.23 DW	Slightly elevated at SW1 (non-landfill stormwater source)	slight local enrichment, non-landfill source
Antimony ug/l	-5	6.1	5.5	-5	5.7	-5	5 DW	low	none
Arsenic µg/l	-5	36.5	21.9	34	36.5	-5	10 DW	saline interference in test. Suspected dilution/reporting error for SW6	none
Barium ug/l	-60	80.1	82.6	79	80.1	72.8		low	none
Beryllium ug/l	-5	-5	-5	-5	-5	-5		low	none
Boron µg/l	244	3510	2600	3800	3140	244	1000 DW	reflects salinity. Suspected dilution/reporting error for SW6	none
Cadmium µg/l	-5	-5	-5	-5	-5	-5	5 DW	low	none
Calcium mg/l	147	408	324	450	416	47.7		reflects salinity. Suspected dilution/reporting error for SW6	none
BOD mg/l	2.2	1.1	1.3	0.9	1.1	1.3		satisfactory	none
Chloride mg/l Cl	>2632	>4861	>4472	>1171	>5103	>4949	250 DW	nm	
Chromium µg/l	-5	27.2	25.2	17	29.5	6	50 DW	saline interference in test. Suspected dilution/reporting error for SW6	none
Cobalt ug/l	-5	-5	-5	-5	-5	-5		low	none
COD mg/l	nm	nm	nm	nm	nm	nm		Not measured due to saline interference	none
Conductivity µS/cm	nm	nm	nm	nm	nm	nm	2500 DW	not measured	none
Copper µg/l	-50	194	161	180	222	-50	2000 DW	saline interference in test. Suspected dilution/reporting error for SW6	none
Dissolved Oxygen % sat	12.9	116	105	99.5	97.2	97.4	70-130 EST	Very low at SW1, possible units error as BOD at SW1 was satisfactory	natural biological activity in backstrand
Faecal Coliforms /100mls	2419	8	173	11	3	0	1000 BW	Somewhat eleveated at SW1, satisfactory at other sites	none
Fluoride mg/l	nm	nm	nm	nm	nm	nm	0.8 DW	nm	
Iron µg/l	1640	547	606	470	574	113	200 DW	slightly elevated at SW1 -non-landfill source	none
Lead µg/l	-5	-5	-5	-5	-5	-5	25 DW	low	none
List I/II Organic substances	nm	nm	nm	nm	nm	nm	100 DW	nm	
Magnesium mg/l	255	1140	847	1100	1210	121		reflects salinity. Suspected dilution/reporting error for SW6	none
Manganese µg/l	301	-250	-250	-250	-250	-250	50 DW	low	none
Mercury ug/l	nm	nm	nm	nm	nm	nm	1 DW	low	none
Molybdenum ug/l	-5	17.3	14.2	14	17	7		low	none
Nickel ug/l	-5	-5	-5	-5	-5	-5	20 DW	low	none
Nitrite as N	nm	nm	nm	nm	nm	nm	0.03 DW	low	none
Orthophosphate mg/l P	nm	nm	nm	nm	nm	nm		low	none
pH	8.1	8.1	8.1	8	8	8	6.5-9.5	slightly alkaline water, as expected	none
Potassium mg/l	117	396	303	440	398	62.1		reflects salinity. Suspected dilution/reporting error for SW6	none
Salinity o/oo	6.6	32.6	22.4	32.3	33.5	33.8		SW1 brackish, other sites close to fully saline	none
Selenium ug/l	-5	156	111	190	161	-5		saline interference in test. Suspected dilution/reporting error for SW6	none
Silver ug/l	nm	nm	nm	nm	nm	nm		low	none
Sodium mg/l	2590	1470	7010	9500	10300	1070		reflects salinity. Suspected dilution/reporting error for SW6	none
Sulphate mg/l SO4	nm	nm	nm	nm	nm	nm		nm	none
Suspended solids mg/l	23	26	38	276	46	nm		Somewhat elevated, possible saline interference in test	none
Temperature °c	15.6	14.2	14.6	13	14.2	14.1		normal range	none
Thallium ug/l	-5	-5	-5	-5	-5	-5		low	none
Tin ug/l	49.8	108	107	120	107	106		Somewhat elevated, possible saline interference in test	none
Total Coliforms /100 mls	2419	105	2419	105	12	10	5000 BW	elevated SW1 to SW3, reflecting high level of microbial activity. Open water sites low	none - sites near bathing area satisfactory
Total Cyanide mg/l	nm	nm	nm	nm	nm	nm	0.05 DW	nm	
Total Organic Carbon mg/l C	nm	nm	nm	nm	nm	nm		nm	

7.2.2. Groundwater

7.2.1 INTRODUCTION

Samples were taken at sites BH2, BH5, BH8, BH9, BH10 and RC4. The frequency of sampling and range of parameters analysed were determined by schedule D of the licence.

Borehole locations are shown on appendix 1. Drilling records, where available, for groundwater boreholes are shown on table .

Table . Drilling records for groundwater boreholes.

Name	BH2	BH5	BH8	BH9	BH10A	RC4	RC5
Nominal Type	GW	GW	GW	GW	GW	GW	GW
Total Depth (m)	4.2	3.95	7.7	8.7	13	15.3	25
Strata (m)	Made ground: hardcore fill (0-0.5) Made ground; loose mixture of gravel and rubble with fill (0.5-1.0) Made Ground: soft black sandy silt with domestic refuse (1.0-1.7) Soft/loose mixture of silt and gravel: (1.7-2.5) medium dense well graded silty gravel: (2.5-3.0) Frim brown gravelly silty clay: (3.0-4.2)	Made ground; clay and sand fill (0-0.8) Made ground: medium dense silty sand with black domestic refuse (0.8-1.8) Made ground: firm to stiff light brown gravelly clay with traces of reduse (1.8-2.9) Very stiff light brown gravelly clay (2.9-3.95)	topsoil: (0-0.3) Soft grey brown sandy silty clay: (0.3-1.2) Firm grey brown sandy clay with some gravel: (1.2-1.9) Stiff to very stiff brown silty sandy gravelly clay with cobbles and boulders: (1.9-7.7)	Made ground: grey silty clay with wood, paper and plastic (0-0.4) Firm grey brown sandy clay with some gravel (0.4-2.2 Stiff to very stiff brown silty sandy gravelly clay with cobbles and boulders (2.2-7.4 Hard brown silty laminated clay with frequent cobble and boulder size fragments of shale (7.4-8.7	Made ground : stiff brown silty gravelly clay with concrete, brick and cobbles (0-1.3) Made ground: brick, ash, wood, plastic, paper and steel (1.3-4.2) Soft grey very silty sandy clay with shells (4.2-10.2) Large limestone cobbles and boulders (11.8-13.0)	open hole (0-9.7 gravel (9.7-11.7 Siltstone (11.7-15.3	Overburden (0-20 Siltstone (20-25)
Response zone (m)	none given	not given	refers to installation sheet			12 to 14 m	21 to 24.5
Designation based on drill record				GW	GW	GW	GW

7.2.2 RESULTS

Results are presented in table 2.1 to 2.4, and appendix D.

Groundwater monitoring results are compared with the Interim Guideline Values (IGVs) as outlined in the interim report by the environmental Protection agency, "*Towards Setting Guidelines for the Protection of Groundwater in Ireland*".

Elevated values for *Boron, Calcium, Chloride, Conductivity, Potassium and Sodium* reflect the impact of saline intrusion on borehole water characteristics. Additionally, the salinity of the samples interfered with some of the tests, (*ammonia, arsenic, copper).* Accordingly interpretation of test results for some parameters must bear this in mind.

Conductivity values were elevated in many of the boreholes, reflecting significant saline intrusion at this estuarine site. A discussion of the extent of saline intrusion is beyond the scope of this

environmental report, however detailed studies[2] of saline intrusion into these boreholes was carried out in 2002 and 2006.

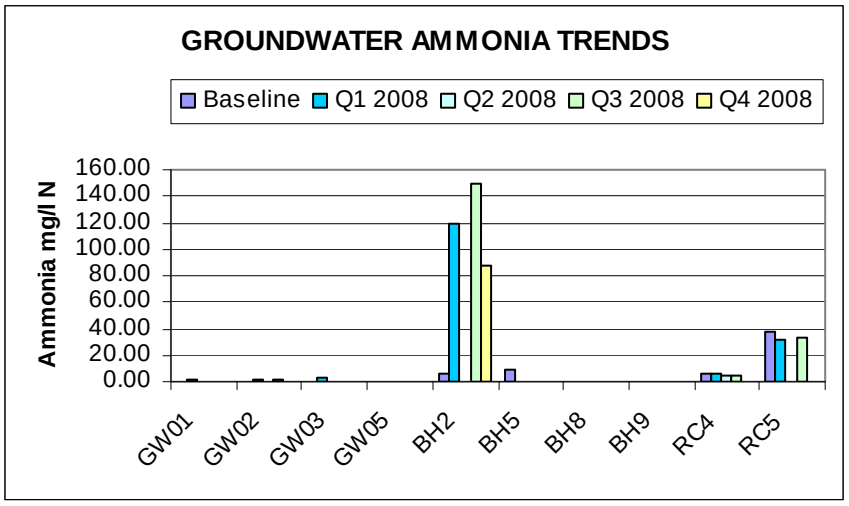
Heavy metals, list I/II organics, phenols and coliform bacteria were low at all boreholes throughout the monitoring period.

[2] Waterford County Council, Investigation into the Occurrence of Salinity Intrusion at Tramore Landfill Site, MCOS, 2002 and RPS 2006.

Key Parameter – Ammonia

AMMONIA

Ammonia occurs naturally in water bodies, including estuarine and marine waters, arising from the microbiological decomposition of nitrogenous organic matter. Fish and other aquatic organisms also excrete ammonia. Therefore unpolluted waters contain ammonia, usually < 0.1 mg/l N, although groundwaters in reducing conditions can contain higher levels.



Groundwater ammonia levels 2008

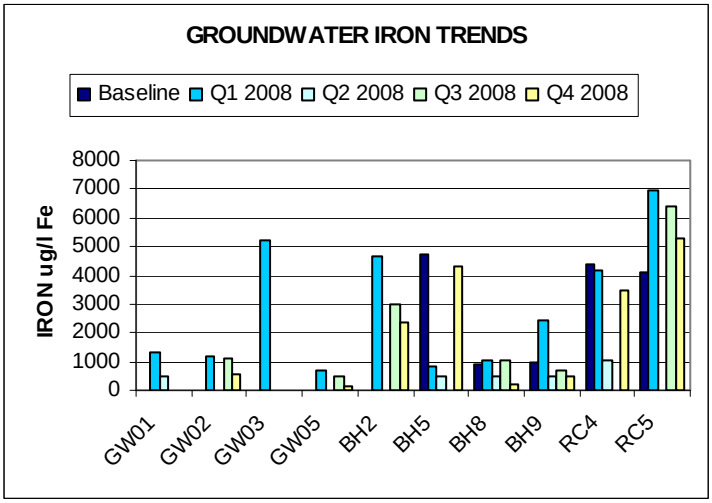
Ammonia levels were high (>5mg/l) in BH2, RC4 and RC5.

Results for 2008 were similar to baseline monitoring in most boreholes. A sharp decrease in ammonia in RC5 was observed in Q4, though ongoing monitoring will show if this trend continues.

Key Parameter - Iron

Iron is present in significant amounts in soils and rocks, principally in insoluble forms. However, many complex reactions, which occur naturally in ground formations can give rise to more soluble forms of iron, which will therefore be present in water passing through such formations.

Appreciable amounts of iron may therefore be present in groundwaters, especially in reducing conditions. Landfill leachate also contains significant amounts of iron. Leachate from Irish/UK landfills accepting mainly domestic waste, have been found to contain between 0.4 to 664 mg/l Fe, with a median value of 12 mg/l Fe. (Source: Department of the Environment, 1995).



Groundwater iron levels 2008

Iron levels were high (>5000ug/l) in GW3 and RC5 during the monitoring period.
Results for 2008 were similar to baseline monitoring.

7.2.3 DISCUSSION

The results of groundwater monitoring are in line with results from previous rounds of testing carried out since 1999. As indicated in previous reports, it appears that groundwater quality within the current working area is impacted by leachate from the landfill, as evidenced by elevated ammonia and iron levels at BH2, BH10 and RC4. Further investigation will be required to determine the cause of elevated iron and ammonia at RC5, which is some distance away from the current landfill site. Heavy metals, List I/II Organics, and phenols were low at all boreholes throughout the monitoring period.

Table 2.1 Tramore Landfill Groundwater Monitoring Q1 2008

Test	GW 01	GW 02	GW 03	GW 04	GW 05	BH2	BH 5	BH 8	BH 9	RC 4	RC 5	IGV	Comment	Environmental significance
Ammonia mg/l N	**1.2**	**2**	**2.9**		**0.4**	**120**	0.05	0.003	**0.24**	**5.7**	**>32**	0.15	elevated BH2, RC4 and RC5	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Arsenic µg/l	20.3	25.8	34.1	-	<5	32	37.4	<5	<5	**64.3**	**62.3**	10	The apparent elevated levels are associated with high chloride/conductivity, indicative of saline interference in the test	none
Chloride mg/l Cl	**>2700**	**>3100**	**>2800**		180	**555**	**>4600**	**348**	**>109**	**>5200**	**>539**	30	Chloride associated with salinity	none
Conductivity µS/cm	**19000**	**18000**	**17000**	-	938	**3500**	**42000**	nm	922	**51000**	nm	1000	Conductivity associated with salinity	none
Dissolved Oxygen	95.3	75.5	69		53.7	1.8	77.3	35.5	28.4	27.7	23.3	no abnormal change	low DO in BH2, indicative of reducing conditions	none, given dilution available in receiving waters (>50,000)
pH	7.8	7.6	7.2	-	7.7	7	7.7	7.6	7.3	7.2	**6.9**	6.5 to 9.5	within normal range	none
Temperature °c	11.4	11.2	11.1		10.3	11.7	10.7	nm	11.6	12.4	12	25	within normal range	none
Boron µg/l	831	980	734	-	83.1	1220	1900	184	87.6	**2930**	943	1000	Elevated boron levels associated with salinity	none
Cadmium µg/l	<5	<5	<5		<5	<5	<5	<5	<5	<5	<5	5	low in all groundwaters	none
Calcium mg/l	179	**242**	**293**	-	56.2	123	**219**	101	38.2	**351**	**330**	200	elevated calcium associated with salinity	none
Chromium µg/l	26.7	25.5	21.3		14.1	31.3	27.8	15.3	15.7	39.6	32.2	30	The apparent elevated levels are associated with high chloride/conductivity, indicative of saline interference in the test	none
Copper µg/l	54.6	44.5	40.5	-	8.02	10.3	83.5	21.5	12.7	147	121	30	The apparent elevated levels are associated with high chloride/conductivity, indicative of saline interference in the test	none
Iron µg/l	**1330**	**1160**	**5250**		**705**	**4650**	**856**	**1010**	**2430**	**4190**	**6960**	200	elevated iron at GW03, BH2, RC4, and RC5. This may be associated with landfill leachate, though RC5 requires further investigation as this is remote from the landdfill site.	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Lead µg/l	<5	<5	<5	-	<5	<5	5.81	<5	<5	<5	<5	10	low at all sites	none
Magnesium mg/l	**253**	**272**	**254**		14.7	**90.7**	**556**	**53**	18.9	**927**	**799**	10	Magnesium associated with salinity	none
Manganese µg/l	**775**	**439**	**1080**	-	**1120**	**1390**	<50	**190**	**761**	**6490**	**821**	50	elevated at RC4. May be associated with landfill leachate	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Mercury µg/l	<5	<5	<5		<5	<5	<5	<5	<5	<5	<5		low at all sites	none
Potassium mg/l	**74.2**	**72.8**	**57.3**	-	1.88	**90.1**	**166**	7.57	4.11	**271**	**147**	5	potassium associated with salinity	none
Sodium mg/l	**2920**	**2490**	**2350**		84.6	**330**	**5030**	**412**	73	**8700**	**7030**	150	sodium associated with salinity	none
Orthophosphate mg/l P	-	-	-	-	-	-	-	-	<0.006	<0.006	0.14	0.03		
Total Oxidised Nitrogen mg/l N	-	nm	nm	-	-	nm	nm	<0.1	0.5	nm	<0.1	no abnormal		
Total Organic Carbon mg/l C	19.7	15.5	10.6	-	1.3	30	2.6	<0.5	<0.5	2.2	4		some variation between boreholes, but no extreme levels recorded.	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Zinc µg/l	146	46	61.3		34.7	52	132	39.1	58.3	114	81.2	100	The apparent elevated levels are associated with high chloride/conductivity, indicative of saline interference in the test	none
Faecal Coliforms /100mls	0	**10**	**24**	-	**2**	**3**	0	**<10**	**<10**	0	**<10**	0	low numbers present in some of boreholes. Presence most likely due to surface sources, such as wildlife.	none, levels in boreholes lower than background levels in surface waters
Total Coliforms /100 mls	**1414**	**>2419**	**>2419**	-	**387**	**>2419**	**>2419**	**20**	**10**	0	**41**	0	moderate numbers present in boreholes.	none, levels in boreholes close to background levels in surface waters

Values in bold indicate exceedance
GW 04 No sample-Borehole to be redrilled
Total Oxidised Nitrogen (TON) was not analysed on the samples due to an oversight in the laboratory

Table 2.2 Tramore Landfill Groundwater Monitoring Q2 2008

Test	GW 01	GW 02	GW 03	GW 04	GW 05a	BH 1/1	BH 5	BH 8	BH 9	RC 4	RC 5	IGV	Comment	Environmental significance
Ammonia mg/l N	**0.59**				**0.11**	**18**	0.71	0.18	**0.19**	**4.7**		0.15	elevated BH1/1 and RC4	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Arsenic µg/l	<50				<50	<50	53.6	<50	<50	**55**		10	The apparent elevated level at RC4 associated with high chloride/conductivity, indicative of saline interference in the test	none
Boron µg/l	667				<500	<500	2266	<500	<500	**3686**		1000	Elevated boron level at RC4 associated with salinity	none
Cadmium µg/l	<50				<50	<50	<50	<50	<50	<50		5	low in all groundwaters	none
Calcium mg/l	145				58.3	112	**339**	117	<50	**409**		200	elevated calcium associated with salinity	none
Chloride mg/l Cl	**596**				100	158	**659**	**409**	**149**	**>700**		30	Chloride associated with salinity	none
Chromium µg/l	<50				<50	<50	<50	<50	<50	<50		30	low in all groundwaters	none
Conductivity µS/cm	**17420**				921	1470	**48700**	4310	1096	**33 salinity**		1000	Conductivity associated with salinity	none
Copper µg/l	58.5				<50	<50	226	<50	<50	258		30	The apparent elevated level at RC4 are associated with high chloride/conductivity, indicative of saline interference in the test	none
Dissolved Oxygen % sat	58				93.9	9.1	97.8	16.8	13.7	32.2		no abnormal change	low DO in BH1/1, indicative of reducing conditions	none, given dilution available in receiving waters (>50,000)
Faecal Coliforms /100mls	0				**0**	0	0	**0**	**1**	0		0	Very low numbers present in some of boreholes. Presence most likely due to surface sources, such as wildlife.	none, levels in boreholes lower than background levels in surface waters
Iron µg/l	**<500**				**<500**	3849	**<500**	**<500**	**<500**	**1059**		200	Somewhat elevated iron at BH1/1. This may be associated with landfill leachate.	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Lead µg/l	<50				<50	<50	<50	<50	<50	<50		10	low at all sites	none
Magnesium mg/l	**209**				<50	<50	**890**	**57**	<50	**998**		10	Magnesium associated with salinity	none
Manganese µg/l	**<500**				**848**	**507**	<500	**<500**	**619**	**5392**		50	elevated at RC4. May be associated with landfill leachate	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Orthophosphate mg/l P	0.053				<0.006	0.22	0.076	0.006	0.006			0.03	low at all sites	none
pH	7.7				7.9	6.9	7.7	7.6	7.4	7.1		6.5 to 9.5	within normal range	none
Potassium mg/l	**70.9**				<50	<50	**291**	<50	<50	**309**		5	potassium associated with salinity	none
Sodium mg/l	**2854**				74.6	99.2	**8113**	**530**	105	**11969**		150	sodium associated with salinity	none
Temperature °C	11.5				11.4	10	11.3	11.9	12.7	13.2		25	within normal range	none
Total Coliforms /100 mls	**>2419**				**1**	**150**	**3106**	**1**	**4**	0		0	moderate numbers present in boreholes.	none, levels in boreholes close to background levels in surface waters
Total Organic Carbon mg/l C	16.6				2.5	nm	2.6	1.9	1.5	3.2			some variation between boreholes, but no extreme levels recorded.	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Total Oxidised Nitrogen mg/l N	0.5				nr	<0.1	1.1	0.2	0.1	<0.1		no abnormal change	Low values recorded.	none
Total Phenols	<0.01				<0.01	0.01	<0.01	0.02	0.02	<0.01			Low values recorded.	none
Zinc µg/l	<300				<300	<300	<300	<300	<50	<300		100	low at all sites	none

GW 2, GW3 and GW4 No sample-no footvalve/tubing

Unable to access RC5. BH10 discontinued. BH2 under construction

Table 2.3 Tramore Landfill Groundwater monitoring Q3 2008

GROUNDWATER - samples taken June 2008

Test	GW 02	GW 05	BH2	BH 5	BH 8	BH 9	RC 4	RC 5	Comment	Environmental significance
Aluminium ug/l	**<250**	**296**	**<250**	-2500	547	**496**	**-2500**	**-2500**	low to moderate levels	none
Ammonia mg/l N	1.9	0.63	150	0.38	0.077	0.29	**5.1**	**33**	elevated BH2, RC4, leachate likely source. Also elevated RC5, unknown source, leachate unlikely	none, given dilution available in backstrand
Antimony ug/l	**<10**	<1	**<10**	**-100**	**-1**	**-1**	**-100**	**-100**	low levels	none
Arsenic µg/l	**30.6**	1.9	**27.2**	**-100**	3.5	-1	**-100**	-100	slightly elevated GW2, BH2, likely saline interference	none
Barium ug/l	122	45.7	631	-600	69.4	48.2	-600	-600	reflects salinity	none
Beryllium ug/l	<10	<1	<10	-100	-1	-1	-100	**-100**	low levels	none
Boron µg/l	1846	56.3	2117	3675	135	69.1	4852	1475	reflects salinity	none
Cadmium µg/l	<10	<1	<10	-100	-1	-1	**-100**	-100	low to moderate levels	none
Calcium mg/l	28.6	87.3	2123	357	133	54.8	532	647	moderate levels	none
Chloride mg/l Cl	**592**	104	456	**660**	374	117	**nr**	**nr**	reflects salinity	none
Chromium µg/l	14.1	1.7	10.5	-100	2.3	1.1	-100	-100	low levels	none
Cobalt ug/l	<10	1.4	-10	-100	1.1	-1	-100	-100	low levels	none
ConductivityµS/cm	**1160**	**937**	**8230**	**nm**	**3290**	**943**	**nm**	**nm**	reflects salinity	none
Copper µg/l	43.8	2	16.8	-100	7.9	2.8	126	-100	generally low, salinity interference likely RC4	none
Dissolved Oxygen % sat	**16.7**	13.1	**4.2**	**99.7**	**102.9**	14.8	**21.8**	**25.8**	reflects aeration	none
Faecal Coliforms /100mls	**0**	**0**	**0**	0	**0**	**0**	**0**	**0**	low	none
Fluoride mg/l	3.5	0.13	1.57	4.75	0.82	0.14	3.4	3.2	reflects salinity	none
Iron µg/l	**1127**	461	**2962**	**-1000**	1023	723	**-1000**	**6395**	elevated BH2, leachate likely source. Also elevated RC5, unknown source, leachate unlikely	none
Lead µg/l	**<10**	<1	**-10**	**-100**	**1.4**	-1	**-100**	**-100**	low	none
List I/II Organic substances	<0.5	<0.5	<0.5	Xylene 0.6 ug/l 1.3 Toluene <0.5 others	<0.5	<0.5	<0.5	<0.5	low or not detected	none
Magnesium mg/l	303	17.9	184	938	54.7	23.4	1263	1038	reflects salinity	none
Manganese µg/l	503	1173	1161	-1000	509	955	-1000	-1000	elevated GW05, likely source is leachate	none
Mercury ug/l	<5	<5	-5	-5	-5	-5	-5	-5	low	none
Molybdenum ug/l	**<10**	**<1**	**-10**	-100	**-1**	**-1**	-100	**-100**	low	none
Nickel ug/l	**<10**	**2.7**	**-10**	**-100**	**3.2**	**1.7**	-100	**-100**	low	none
Nitrite as N	<0.001	<0.001	-0.001	0.01	-0.001	0.01	-0.001	-0.001	low	none
Orthophosphate mg/l P	0.025	<0.006	-0.006	0.11	-0.006	-0.006	-0.006	0.16	low	none
pH	7.6	7.8	7.3	7.8	8	7.5	7.4	7.2	normal range	none
Potassium mg/l	11.5	1.2	171	293	8.2	4.7	386	193	reflects salinity	none
Salinity o/oo	9.7	nm	4.5	31.2	1.7	nm	33	30.9	BH5, RC4 and RC5 highly saline	none
Selenium ug/l	47.9	1.9	21.9	147	9.2	1.6	185	142	low, except where saline interference likely	none
Silver ug/l	<10	<1	-10	-100	-1	-1	-100	-100	low	none
Sodium mg/l	3055	89.7	1104	8349	443	111	10831	9307	reflects salinity	none
Sulphate mg/l SO_4	720.7	66.5	72.3	2492	141.5	26.9	1442.1	1750	reflects salinity	none
Temperature °c	13.3	13.1	15.6	13.2	15.6	13.4	15.3	13	normal range	none
Thallium ug/l	<10	<1	-10	-100	-1	-1	-100	-100	low	none
Tin ug/l	<20	<2	-20	-200	-2	-2	-200	-200	low	none
Total Coliforms /100 mls	>2419	0	>2419	194	0	0	0	0	elevated at GW02, BH2, reflects mocrobiological activity associated with biodegradation	none
Total Cyanide mg/l	<0.05	<0.05	<0.05	nm	<0.05	-0.05	<0.05	-0.05	low	none
Total Organic Carbon mg/l C	12.7	2.1	33	2.2	1.5	0.6	3.9	4	relatively low	none
Total Oxidised Nitrogen mg/l N	<0.1	<0.1	-0.1	-0.1	0.2	0.1	-0.1	-0.1	low	none
Total Phenols	<0.01	<0.01	<0.01	nm	-0.01	0.01	-0.01	-0.01	low	none
Uranium ug/l	<10	1.4	-10	-100	2.9	-1	-100	-100	low	none
Vanadium ug/l	33.9	1.7	12	-100	3.6	1.5	-100	-100	low, except where saline interference likely	none
Zinc µg/l	<60	11.5	-60	-600	57.3	11.8	-600	-600	low	none

GW 1, GW3 and GW4 No sample-no footvalve/tubing BH10 discontinued.

Table 2.4 Tramore Landfill Groundwater monitoring Q4 2008

GROUNDWATER samples taken June 2008	GW 02	GW 05	BH2	BH 5	BH 8	BH 9	RC 4	RC 5	IGV	Comment	Environmental significance
Aluminium ug/l	45	74	<250	<250	<250	<250	<250	<250		none	none
Ammonia mg/l N	0.18	0.09	87	<0.01	<0.01	0.58	nr	0.19	0.15	Elevated BH1/1 (19 mg/l), BH2 (150 mg/l), Probable source landfill leachate. RC5(33 mg/l) unknown cause	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Antimony ug/l	<5	<5	<5	<5	<5	<5	5.4	<5		none	none
Arsenic µg/l	15	<5	<5	nr	<5	<5	38.5	40	10	The apparent elevated level at BH2 associated with high chloride/conductivity, indicative of saline interference in the test	none
Barium ug/l	120	93	320	99	100	102	100	110		Elevated Barium levels associated with salinity	none
Beryllium ug/l	<5	<5	<5	<5	<5	<5	<5	<5		none	none
Boron µg/l	1100	<50	1300	3400	<50	<50	3510	980	1000	Elevated boron levels associated with salinity	none
Cadmium µg/l	<5	<5	<5	<5	<5	<5	<5	<5	5	low in all groundwaters	none
Calcium mg/l	220	98	190	490	120	67.2	555	550	200	elevated calcium associated with salinity	none
Chloride mg/l Cl	>1839	87	>79	>1006	>363	182	>4912	>1490		Chloride associated with salinity	none
Chromium µg/l	<10	<10	29	120	<10	6.1	41.8	26	30	Slightly elevated results linked to salinity interference	none
Cobalt ug/l	<5	<5	<0.5	<5	<5	<5	5.5	<5		none	none
ConductivityµS/cm	11970	937	4150	nm	2860	930	51000	nm	1000	Conductivity associated with salinity	none
Copper µg/l	<30	<30	<30	190	<30	<50	223	200	30	The apparent elevated levels at GW2, RC4 and RC5 indicative of saline interference in the test	none
Dissolved Oxygen % sat	3	93.8	6.8	73.3	30.8	16.9	28.6	26.5		Low DO in BH1/1, BH2, BH(indicative of reducing conditions	none, given dilution available in receiving waters (>50,000) of backstrand
Faecal Coliforms /100mls	nm	<1	<1	<1	<1	<2	<2	<1	0	Not detected or very low numbers present in some of boreholes. Presence most likely due to surface sources, such as wildlife.	none, levels in boreholes lower than background levels in surface waters
Fluoride mg/l	nm	nm	nm	nm	nm	nm	nm	nm		Elevated Fluoride in BH5 and RC5 associated with salinity	none
Iron µg/l	550	170	2400	4300	230	475	3450	5300	200	Elevated iron at BH1/1, BH2. This may be associated with landfill leachate. Elevated at RC5 unknown cause. Distance from landfill	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Lead µg/l	<5	<5	<5	<5	<5	<5	<5	<5	10	low at all sites	none
List I/II Organic substances	nm	nm	nm	nm	nm	nm	nm	nm			
Magnesium mg/l	250	30	130	1400	57	35.4	1200	1300		Magnesium associated with salinity	none
Manganese µg/l	410	890	960	1000	620	1040	7290	1100	50	elevated at RC4. May be associated with landfill leachate	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Mercury ug/l	nm	nm	nm	nm	nm	nm	nm	nm			
Molybdenum ug/l	20	<5	<5	<5	<5	6	13.4	<5			
Nickel ug/l	<5	<5	<5	<5	<5	<5	<5	<5			
Nitrite as N	nm	nm	nm	nm	nm	nm	nm	nm			
Orthophosphate mg/l P	nm	nm	nm	nm	nm	nm	nm	nm		low at all sites	none
pH	7.6	7.8	7.2	7.6	7.6	7.4	7.5	7		within normal range	none
Potassium mg/l	160	<5	180	420	11	7.3	425	240	5	potassium associated with salinity	none
Salinity o/oo	nm	nm	nm	31.1	nm	nm	nm	30.2			
Selenium ug/l	<5	<5	<5	180	<5	<5	167	170		selenium associated with salinity - possible interference	
Silver ug/l	nm	nm	nm	nm	nm	nm	nm	nm			
Sodium mg/l	4300	220	570	13000	440	210	10400	12000	150	sodium associated with salinity	none
Sulphate mg/l SO4	nm	nm	nm	nm	nm	nm	nm	nm			
Temperature °c	12.9	13	14	13.6	12.6	13.2	13.3	12.4		within normal range	none
Thallium ug/l	<5	<5	<5	<5	<5	<5	<5	<5			
Tin ug/l	<10	<10	<10	<10	<10	106	107	<10		tin associated with salinity - possible interference	
Total Coliforms /100 mls	nm	2	54	<1	<1	<2	<2	<1	0	moderate numbers present in boreholes.	none, levels in boreholes close to background levels in surface waters
Total Cyanide mg/l	nm	nm	nm	nm	nm	nm	nm	nm		n/a	n/a
Total Organic Carbon mg/l C	nm	nm	nm	nm	nm	nm	nm	nm		n/a	n/a
Total Oxidised Nitrogen mg/l N	0.2	0.1	0.1	<0.1	0.2	0.1	0.2	<0.1		Low values recorded.	none
Total Phenols mg/l	0.02	0.03	0.03	0.02	0.02	0.04	0.02	0.01		Low values recorded.	none
Uranium ug/l	<5	<5	<5	<5	<5	<5	15.5	<5		Relatively low values recorded	none
Vanadium ug/l	<5	<5	<5	40	<5	13	689	38		vanadium associated with salinity - possible interference	none
Zinc µg/l	<100	<100	<100	<100	79	<100	<100	<100		low at all sites	none

GW1, GW3, GW4 no tubing due to site works

7.3 LEACHATE

7.3.1 INTRODUCTION

Leachate boreholes, BH1, BH 7 and RC6 have been routinely sampled since Sept 2001. Supplementary boreholes LT 1-5 were constructed in late 2001, and sampled since 2002.

Borehole locations are shown on appendix 1. Drilling records, where available, for groundwater boreholes are shown on table .

Table 5. Leachate borehole drilling records

Name	BH1/1	BH7A	LT1	LT2	LT3a	LT4a	LT5a	RC6A
Nominal Type	GW + L	leachate	L	L	L	L	L	L
Total Depth (m)	4.5	6	8.4	4.8	6	6	6	9
Strata (m)	Made ground: fill/clay with traces of rubble (0-1.7) Made ground; domestic refuse (1.7-3.7) Made ground: firm brown clay with traces of rubbish (3.7-4.2) Firm brown sandy gravelly clay: (4.2-4.5)	Made ground; clay with cobbles (0-0.6) Made ground:waste, bricks and metal (0.6-6)	Made ground rubble and clay (0-2.3) Made ground: domestic refuse (2.3 - 3.3) Made ground black domestic refuse (3.3 - 7.2) Made ground; mixture of rubbish and black silty sand (7.2 - 7.8) Loose grey silty sand with shells (7.8 - 8.4)	Made ground clay with occasional cobbles (0-1.2) Made ground: domestic refuse (1.2 - 4.5) Made ground silty refuse (domestic) (4.5 - 4.8)	Clay with cobbles (0-6)	Made ground clay occasional cobbles (0-0.7) Made ground: clay/waste (0.7 - 6)	Made ground:clay with gravel and boulder obs (0-2) Made ground: clay (2 - 3) Made ground clay with traces of refuse (3 - 3.8) Made ground; domestic refuse (3.8 - 7.8) Made ground: mixture of	Made ground light brown clay with gravel, cobbles and concrete (0-1) Made ground: black silty clay with gravel and plastic (1-3.2) Firm light brown grey gravelly clay with cobbles (3.2-7) Light brown clay with gravel and abundant cobbles (7-8.3) Light brown clay with gravel and large cobbles (8.3-9)
Response zone (m)	0.80m to 4.0m	3.5m to 6.0m	1.8 to 7.2	1.3 to 4.6	1.5 to 5.6	1.5 to 5.2	2.8 to 6.35	3 to 9
Designation based on drill record	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate

Results of analysis are presented in tables 3.1 to 3.4, and appendix E, and are compared with the median of "typical" landfill leachate, as published in the EPA document "*Landfill Operational Practices*", 1998.

7.3.2 RESULTS

Saline intrusion is evident in many of the leachate boreholes, reflected in the high concentrations of ions associated with seawater, such as *chloride, sodium, magnesium calcium and boron,* and subsequent interference in some of the tests normally used to characterise landfill leachate, as discussed in the introduction.

Heavy metal concentrations (c*admium, lead*) are generally low, being at about drinking water standard levels. There is a strong relationship between salinity and measured levels of zinc, copper, chromium and arsenic, which strongly indicate interference in tests due to salinity – see introduction.

Key Parameter – Ammonia

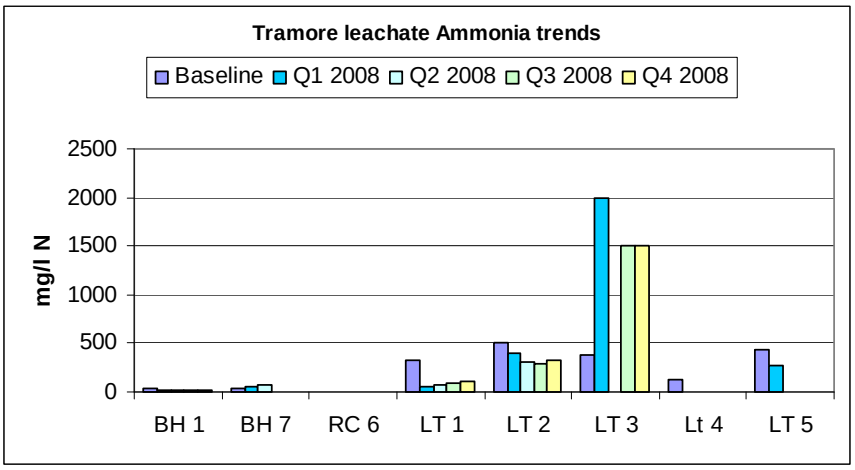


Fig 3.1 Leachate ammonia levels 2008

Ammonia concentrations were elevated at Sites LT1 to LT5, and relatively low at BH1, BH7 and RC6. This variation appears to indicate different stages of biodegradation within the landfill.

Key Parameter – COD

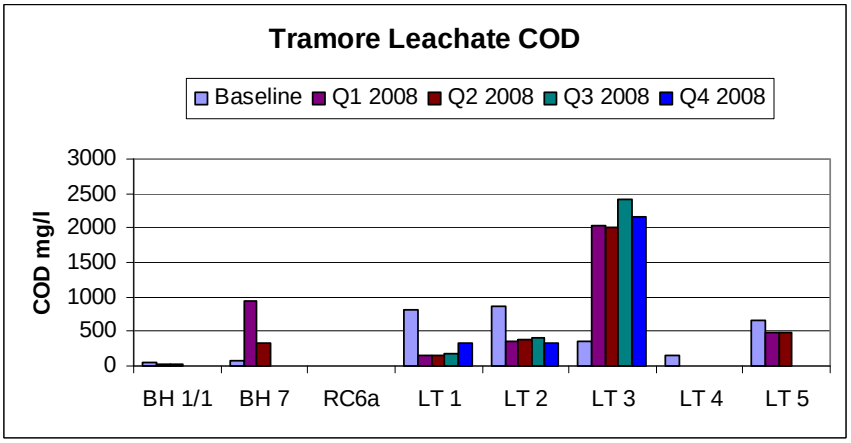


Fig 3.2 leachate COD levels 2008

The COD test measures the organic matter in a sample that is amenable to chemical oxidation. The COD test is usually applied to polluted waters and waste-waters.

7.3.3 Discussion

There were relatively low COD at BH1/1and BH7, indicating low waste-decomposition activity at these sites. In contrast, levels for these parameters were quite high at sites LT 1-5, indicating active waste-decomposition at these sites.

Table 3.1 Tramore Landfill Leachate Monitoring Q1 2008

Test	BH 1/1	BH 7	RC 6a	LT 1	LT 2	LT 3	LT 4	LT 5	Typical Leachate Analysis (EPA, 1997)	Comment	Environmental significance
Ammonia mg/l N	>10	52	0.49	59	390	**2000**	-	270	453	Levels were within the range expected for municipal landfill leachate. LT3 was highest.	Some local enrichment of ammonia levels in adjacent groundwaters possible, but given the volume of leachate produced and the dilution available in the wider environment (>50,000), no environmental effect is expected
Chloride mg/l Cl	142	31	114	213	657	3374	-	41	-	Chloride elevated at LT3. May be due to saline intrusion effects. Result for LT5 is low relative to conductivity and may be an error.	none given the saline receiving environment.
Conductivity µs/cm	1576	2000	1075	2800	5500	**25000**	-	7000	7180	Conductivity levels mirror chloride levels. Elevated level at LT3 may be due to saline intrusion effects.	none given the saline receiving environment.
pH	6.8	6.9	**7.4**	6.7	7	**7.6**	-	7.1	7.1	results within normal range	none
BOD mg/l O_2	1	**>410**	1	16.8	20	130	-	22.5	270	Somewhat elevated at BH7	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
COD mg/l O_2	19	943	8	140	353	**2030**	-	482	954	COD at BH7 mirrors elevated BOD result. High result for LT3 may be due to interference due to salinity.	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Temperature °c	9.9	13	11	11	13	15	-	13	-	results within normal range	none
Total Organic Nitrogen mg/l N	0.4	nm	nm	nm	nm	nm	-	nm	-	low at BH1/1	none
Orthophosphate mg/l P	0.046	-	<0.006	-	-	-	-	-	1.1	low where measured	none
Cadmium µg/l	<5	<5	<5	<5	<5	<5	-	<5	<10	results low	none
Calcium mg/l	102	**188**	51.5	**230**	116	34.1	-	113	155	results as expected for municipal leachate	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Chromium µg/l	18.8	39	13.3	16	19.4	**408**	-	**50.7**	50	Apparently elevated chromium at LT3 and LT5 linked to salinity interference in test	none
Arsenic µg/l	<5	**90.9**	<5	**8.1**	**20.1**	**40**	-	**13.1**	7	Apparently elevated arsenic at BH7, LT3 and LT5 linked to salinity interference in test.	none
Copper µg/l	12.1	15.5	10.1	7.96	8.08	37.1	-	12	40	relatively low results at all sites measured	none
Iron µg/l	**13100**	**57200**	1340	**27200**	6120	5970	-	10300	12100	Elevated at BH1/1, BH7 and LT1. Results typical of municipal leachate	Some local enrichment of iron levels in adjacent groundwaters and sediment possible, but given the volume of leachate produced and the dilution available in the wider environment (>50,000), no environmental effect is expected
Lead µg/l	<5	5.56	<5	<5	<5	10.5	-	9.06	90	low at all sites examined	none
Magnesium mg/l	22.6	59.6	23.3	31.6	86.6	**300**	-	**130**	125	Elevated magnesium linked to salinity at LT3 and LT5	none
Manganese µg/l	**646**	**11000**	**866**	**4870**	**2210**	172	-	**995**	500	Elevated at BH1/1, BH7, LT1, LT2 and LT5. Results typical of municipal leachate	Some local enrichment of manganese levels in adjacent groundwaters and sediment possible, but given the volume of leachate produced and the dilution available in the wider environment (>50,000), no environmental effect is expected
Potassium mg/l	14.1	35.7	3.6	39	164	**883**	-	217	492	elevated potassium at LT3 linked to salinity	none
Sodium mg/l	70.1	193	82.2	89.5	282	**2210**	-	515	688	elevated sodium at LT3 linked to salinity	none
Boran ug/l	314	279	93.3	521	945	5700	-	1950	-	elevated boron at LT3 linked to salinity	none
Nickel ug/l	10.8	30.9	8.76	6.24	15.8	273	-	32.9	-	elevated nickel at LT3 may be linked to salinity. Further testing needed to confirm this.	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Zinc µg/l	33	47.4	55.6	63.5	38.3	**235**	-	136	160	elevated zinc at LT3 linked to salininity	none
Faecal Coliforms /100mls	**<2**		**<2**				-		0	less than 2 detected at BH1/1 and RC6a	none
Total Coliforms / 100mls	**10**		**2**				-		0	low levels detected at BH1/1 and RC6a	none

nm - not monitored
LT 4 No sample, Dry

Table 3.2 Tramore Landfill Leachate Monitoring Q2 2008

Test	BH 1/1	BH 7	RC 6a	LT 1	LT 2	LT 3a	LT 4	LT 5	Typical Leachate Analysis (EPA, 1997)	Comment	Environmental significance
Ammonia mg/l N	18	64	0.5	72	300	**<0.003**		<0.003	453	Levels were within the range expected for municipal landfill leachate. BH7 was highest.	Some local enrichment of ammonia levels in adjacent groundwaters possible, but given the volume of leachate produced and the dilution available in the wider environment (>50,000), no environmental effect is expected
Arsenic µg/l	<50	**<50**	<50	**<50**	**<50**	**<50**		**<50**	7	low at all sites examined	none
BOD mg/l O_2	0.9	**6**		16.9	14				270	low at all sites examined	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Boron ug/l	<500	<500	<500	524	1015	3672		1748	-	elevated boron at LT3 linked to salinity	none
Cadmium µg/l	<50	<50	<50	<50	<50	<50		<50	<10	results low	none
Calcium mg/l	112	**196**	58.6	**251**	137	38		140	155	results as expected for municipal leachate	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Chloride mg/l Cl	158	195	119	181	331	550		386	-	Chloride elevated at LT3. May be due to saline intrusion effects.	none given the saline receiving environment.
Chromium µg/l	<50	<50	<50	<50	<50	**107**		**<50**	50	Apparently elevated chromium at LT3a linked to salinity interference in test	none
COD mg/l O_2	30	326		162	372	**2010**		495	954	High result for LT3 most likely due to interference due to salinity.	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
ConductivityµS/cm	1470	3110	1087	3300	6210	**24500**		7990	7180	Conductivity levels mirror chloride levels. Elevated level at LT3 may be due to saline intrusion effects.	none given the saline receiving environment.
Copper µg/l	<50	<50	<50	<50	<50	81.8		<50	40	relatively low results at all sites measured. Slightly elevated at LT3a most likely due to salinity interference.	none
Faecal Coliforms /100mls	**0**		**0**						0	none detected at BH1/1 or RC6a	none
Iron µg/l	**3849**	**2199**	<500	**22119**	3094	7903		6255	12100	Elevated at BH 1/1, BH7 and LT1. Results typical of municipal leachate	Some local enrichment of iron levels in adjacent groundwaters and sediment possible, but given the volume of leachate produced and the dilution available in the wider environment (>50,000), no environmental effect is expected
Lead µg/l	<50	<50	<50	<50	<50	<50		<50	90	low at all sites examined	none
Magnesium mg/l	<50	55.3	<50	<50	92.6	**259**		**142**	125	Elevated magnesium linked to salinity at LT3 and LT5	none
Manganese µg/l	**507**	**5773**	**<50**	**4133**	**1696**	<500		**796**	500	Elevated at BH1/1, BH7, LT1, LT2 and LT5. Results typical of municipal leachate	Some local enrichment of manganese levels in adjacent groundwaters and sediment possible, but given the volume of leachate produced and the dilution available in the wider environment (>50,000), no environmental effect is expected
Nickel ug/l	<50	60.4	<50	<50	<50	270		<50	-	elevated nickel at LT3a may be linked to salinity. Further testing needed to confirm this.	given the volume of leachate produced and the dilution available (>50,000), no environmental effect is expected
Orthophosphate mg/l P	0.22	<0.006	0.012	<0.006	0.16	6.2		0.13	1.1	relatively low	none
pH	6.9	7.2	**7.7**	6.8	7.3	**7.7**		7	7.1	results within normal range	none
Potassium mg/l	<50	<50	<50	6.8	192	**884**		241	492	elevated potassium at LT3 linked to salinity	none
Sodium mg/l	99.2	143	100	50	362	**1901**		574	688	elevated sodium at LT3 linked to salinity	none
Temperature °c	10	14	11.7	12	13			13	-	results within normal range	none
Total Coliforms / 100mls	**150**		**0**						0	low levels detected at BH1/1 and RC6a	none
Total Organic Nitrogen mg/l N	<0.1	NR	0.1	NR	NR	0.3		<0.1	-	low at BH1/1 and RC6a	none
Total Phenols	0.01		<0.01							low at BH1/1 and RC6a	none
Zinc µg/l	<300	<300	<300	<300	<300	**<300**		<300	160	low at all sites examined	none

nr - not reported
nm - not monitored
LT 4 No sample, Dry

Table 3.3 Tramore Landfill Leachate Monitoring Q3 2008

LEACHATES	BH 1/1	RC 6a	LT 1	LT 2	LT 3a	Typical Leachate Analysis (EPA, 1997)	Comment	Environmental significance
Test								
Aluminium ug/l	**-250**	**781**	**-250**	**230**	**-250**		low to moderate levels	none
Ammonia mg/l N	19	**0.49**	84	290	1500	453	elevated levels typical of leachate	may influence adjacent groundwater, but not expected to affect the wider environment, given the dilution available (>1/50,000).
Antimony ug/l	-10	**-10**	-10	-1	-10		low levels	none
Arsenic µg/l	-10	-10	-10	23.1	42.8	7	elevated level at LT3 linked to salinity interference	none
Barium ug/l	265	-60	**224**	185	102		moderately elevated, linked to salinity	none
Beryllium ug/l	-10	**-10**	-10	-1	-10		low levels	none
Boron µg/l	462	94.3	845	1427	**7185**		reflects salinity	none
Cadmium µg/l	-10	-10	-10	-1	**-10**		low levels	none
Calcium mg/l	141	75.3	372	198	**54.2**		moderately elevated	none
BOD mg/l			17.8	10.5	**320**	270	elevated at LT3, other locations low	none, given dilution available (>1/50,000)
Chloride mg/l Cl	nr	**120**	184	344	nr		moderate levels	none in saline environment
Chromium µg/l	-10	-10	-10	**13.4**	329		low LT1 and 2, elevated levels LT3 indicative of interference in test due to salinity	none
Cobalt ug/l	-10	-10	**-10**	3.6	51		low LT1 and 2, elevated levels LT3 indicative of interference in test due to salinity	none
COD mg/l			**183**	404	2406	954	moderate levels, typical of leachate, possible saline interference LT3	none
ConductivityµS/cm	**1500**	**1083**	3400	6440	24500	7180	reflects salinity	none
Copper µg/l	-10	-10	-10	8.2	**36.8**		low LT1 and 2, elevated levels LT3 indicative of interference in test due to salinity	none
Dissolved Oxygen % sat	13.1	**58.5**	**nm**	**nm**	nm		reflects aeration	none
Faecal Coliforms /100mls	**0**	**0**	-2	-2	0		low	none
Fluoride mg/l	0.83	0.15	1.43	1.9	57.4		generally low, reflects salinity	none in saline environment
Iron µg/l	9367	**1491**	28987	2411	**9034**	12100	elevated across leachate boreholes, typical of landfill leachate	may influence adjacent groundwater, but not expected to affect the wider environment, given the dilution available (>1/50,000).
Lead µg/l	-10	**-10**	-10	1.3	**-10**	90	low	none
List I/II Organic substances	Xylene 0.8 ug/l Trimethylbenzene 1.4 ug/l <0.5 others	<0.5	nm	nm	**nm**		low in sites tested	
Magnesium mg/l	27	28.4	51.5	126	373	125	reflects salinity	none
Manganese µg/l	660	960	**5706**	**1799**	**-500**	500	elevated LT1 and 2, typical of leachate	may influence adjacent groundwater, but not expected to affect the wider environment, given the dilution available (>1/50,000).
Mercury ug/l	-5	-5	-5	-5	-5		low	none
Molybdenum ug/l	**-10**	**-10**	-10	-1	-10		low	none
Nickel ug/l	**-10**	**-10**	18.4	11.9	**292**		generally low, somewhat elevated LT3	none, given dilution available (>1/50,000)
Nitrite as N	-0.001	0.001	-0.001	0.022	**-0.001**		low	none
Orthophosphate mg/l P	0.076	-0.006	-0.006	0.18	4.5		elevated LT3, otherwise low.	none, given dilution available (>1/50,000)
pH	7.1	7.6	6.9	7.6	7.8		normal range	none
Potassium mg/l	20.8	-10	84.2	282	1209	492	reflects salinity	none
Salinity o/oo	0.5	0.3	nm	nm	nm		nm	
Selenium ug/l	-10	-10	-10	14.5	31.1		generally low, elevated level at LT3 probably due to saline interference	none
Silver ug/l	-10	-10	-10	-1	-10		low	none
Sodium mg/l	87.2	107	158	438	2565	688	reflects salinity	none
Sulphate mg/l SO4	2	30.3	20	46.8	18.1		low	none
Temperature °c	13.8	13.4	12	14	15		normal range	none
Thallium ug/l	-10	-10	-10	-1	-10		low	none
Tin ug/l	-20	-20	-20	-2	22.1		low	none
Total Coliforms /100 mls	0	0	-2	-2	>9677		generally low, somewhat elevated at LT3, reflects higher microbial activity at this site	none
Total Cyanide mg/l	<0.05	<0.05	<0.05	<0.05	<0.05		low	none
Total Organic Carbon mg/l C	nm	nm	nm	nm	nm		nm	
Total Oxidised Nitrogen mg/l N	-0.1	0.1	-0.1	-0.1	nr		low	none
Total Phenols	-0.01	-0.01	nm	nm	nm		nm	
Uranium ug/l	-10	-10	-10	-1	-10		low	none
Vanadium ug/l	-10	-10	-10	5.3	67.8		generally low, elevated level at LT3 probably due to saline interference	none
Zinc µg/l	-60	-60	-60	21.3	140	160	low	none

BH7 no sample L4 dry L5 no tubing

Table 3.4 Tramore Landfill Leachate Monitoring Q4 2008

LEACHATES	BH 1/1	RC 6a	LT 1	LT 2	LT 3a	Typical Leachate Analysis (EPA, 1997)	Comment	Environmental significance
Test								
Aluminium ug/l	-250	-250	nm	-25	-250		low levels	none
Ammonia mg/l N	22	1.2	110	330	1500	453	elevated levels typical of leachate	may influence adjacent groundwater, but not expected to affect the wider environment, given the dilution available (>1/50,000).
Antimony ug/l	-5	-5	nm	5.5	9.9		low levels	none
Arsenic µg/l	-5	-5	nm	-0.5	27	7	elevated level at LT3 linked to salinity interference	none
Barium ug/l	270	240	nm	170	150		moderately elevated, linked to salinity	none
Beryllium ug/l	-5	-5	nm	-0.5	-5		low levels	none
Boron µg/l	320	270	nm	1100	6500		reflects salinity	none
Cadmium µg/l	-5	-5	nm	-0.5	-5		low levels	none
Calcium mg/l	180	160	nm	170	56		moderately elevated	none
BOD mg/l	nm	nm	19	14	200	270	elevated at LT3, other locations low	none, given dilution available (>1/50,000)
Chloride mg/l Cl	167	186	282	712	>1936		linked to salinity	none in saline environment
Chromium µg/l	22	22	nm	39	380		low LT1 and 2, elevated levels LT3 indicative of interference in test due to salinity	none
Cobalt ug/l	-5	-5	nm	-0.5	57		low LT1 and 2, elevated levels LT3 indicative of interference in test due to salinity	none
COD mg/l	nm	nm	320	330	2165	954	moderate levels, typical of leachate, possible saline interference LT3	none
ConductivityµS/cm	1652	1083	3790	4990	25300	7180	reflects salinity	none
Copper µg/l	-50	-50	nm	-3	41		elevated levels LT3 indicative of interference in test due to salinity	none
Dissolved Oxygen % sat	16.7	79.3	nm	nm	nm		reflects aeration	none
Faecal Coliforms /100mls	-2	-2	nm	nm	nm		low	none
Fluoride mg/l	nm	nm	nn	nm	nm		n/a	n/a
Iron µg/l	15000	13000	nm	3200	7400	12100	elevated across leachate boreholes, typical of landfill leachate	may influence adjacent groundwater, but not expected to affect the wider environment, given the dilution available (>1/50,000).
Lead µg/l	-5	-5	nm	-0.5	-5	90	low	none
List I/II Organic substances	nm	nm	nm	nm	nm		n/a	n/a
Magnesium mg/l	42	38	nm	100	340	125	reflects salinity	none
Manganese µg/l	870	740	nm	2000	-250	500	elevated LT2, typical of leachate	may influence adjacent groundwater, but not expected to affect the wider environment, given the dilution available (>1/50,000).
Mercury ug/l	nm	nm	nm	nm	nm		n/a	n/a
Molybdenum ug/l	6	5.9	nm	6.6	7.3		low	none
Nickel ug/l	7.7	-5	nm	-0.5	320		generally low, somewhat elevated LT3	none, given dilution available (>1/50,000)
Nitrite as N	nm	nm	nm	nm	nm		n/a	n/a
Orthophosphate mg/l P	nm	nm	nm	nm	nm		n/a	n/a
pH	7	7.8	6.9	7.6	7.7		normal range	none
Potassium mg/l	41	36	nm	240	1300	492	reflects salinity	none
Salinity o/oo	nm	nm	nm	nm	nm		nm	
Selenium ug/l	-5	-5	nm	-0.5	-5		low	none
Silver ug/l	nm	nm	nm	nm	nm		nm	none
Sodium mg/l	210	180	nm	370	2600	688	reflects salinity	none
Sulphate mg/l SO4	nm	nm	nm	nm	nm		nm	none
Temperature °c	14.1	14.2	13	14	15		normal range	none
Thallium ug/l	-5	-5	nm	-0.5	-5		low	none
Tin ug/l	110	110	nm	110	130		Tin levels associated with salinity - possible saline interference	none
Total Coliforms /100 mls	32	143	nm	nm	nm		generally low	none
Total Cyanide mg/l	nm	nm	nm	nm	nm		nm	n/a
Total Organic Carbon mg/l C	nm	nm	nm	nm	nm		nm	
Total Oxidised Nitrogen mg/l N	-0.1	0.1	0.1	0.2	0.5		low	none
Total Phenols	0.04	0.02	nm	nm	nm		low	
Uranium ug/l	-5	-5	nm	-0.5	-5		low	none
Vanadium ug/l	16	14	nm	20	94		generally low, elevated level at LT3 probably due to saline interference	none
Zinc µg/l	-100	-100	nm	-10	-5	160	low	none

BH7 no access L4 dry L5 no tubing

7.4. Leachate Levels

7.4.1 Introduction

Leachate levels are determined weekly, by dip meter, at boreholes BH1/1, BH7, RC6, LT1, LT2, LT3, LT4, and LT5.

7.4.2 Results

Results of monitoring are presented in tables 4.1 to 4.4. There were fluctuations in levels in BH7, LT1, LT2 and LT5.

7.4.3 Discussion

The variation in groundwater and leachate levels may be due to air pressure, changes in landfill water balance or tidal effects.

Tidal intrusion into the landfill boreholes was the subject of special reports in 2002 and 2006; Waterford County Council, *Investigation into the Occurrence of Salinity Intrusion at Tramore Landfill Site*, MCOS, 2002 and *Investigation into the possible occurrence of salinity intrusion at Tramore Landfill*, RPS 2006.

Table 4.1 Tramore Landfill Leachate & Groundwater Levels Q1 2008

Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7a	BH 8	BH 9	RC 4	RC 5	RC 6a	LT 1	LT 2	LT 3a	LT 4a	LT 5	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8
1	04/01/2008	TL	2.2	-	-	-	1.9	-	-	-	-	2.2	4.3	3.3	4.7	0.1	3.6	-	-	-	-	-	-	-	-
2	09/01/2008	TL	2.2	-	-	-	1.8	-	-	-	-	2.2	4.2	3.3	4.7	0.1	3.7	-	-	-	-	-	-	-	-
3	15/01/2008	TL	2.4	1.8	-	1.9	1.9	1.6	2.2	1.1	1.2	2.4	4.3	3.3	4.9	0.2	3.7	-	-	-	-	-	-	-	-
4	25/01/2008	TL	2.3	-	-	-	1.9	-	-	-	-	2.2	4.2	3.4	4.7	0.1	3.7	-	-	-	-	-	-	-	-
5	01/02/2008	TL	2.3	-	-	-	2.1	-	-	-	-	2.1	4.2	3.3	4.7	0.2	3.4	-	-	-	-	-	-	-	-
6	07/02/2008	TL	2	1.7	-	1.9	1.7	1.5	2.1	1	1.2	2.3	4.1	3.2	4.3	0.1	3.5	-	-	-	-	-	-	-	-
7	13/02/2008	TL	2.1	-	-	-	1.6	-	-	-	-	2.1	3.9	3.1	4.5	3.4	3.4	-	-	-	-	-	-	-	-
8	19/02/2008	TL	2.2	-	-	-	1.7	-	-	-	-	2.1	4	3.1	4.5	0.2	3.5	-	-	-	-	-	-	-	-
9	28/02/2008	TL	2.1	-	-	-	1.6	-	-	-	-	2.2	3.9	3	4.5	0.2	3.4	-	-	-	-	-	-	-	-
10	07/03/2008	TL	0.6	-	-	-	1.3	-	-	-	-	1.1	1.1	1.7	3.1	DRY	0.8	-	-	-	-	-	-	-	-
11	13/03/2008	TL	0.7	-	-	-	1.1	-	-	-	-	1.2	1.1	1.7	3.2	DRY	0.8	-	-	-	-	-	-	-	-
12	21/03/2008	TL	0.6	-	-	-	1.2	-	-	-	-	1.2	1.8	3.2	2.8	DRY	0.9	-	-	-	-	-	-	-	-
13	28/03/2008	TL	0.5	1.3	-	0.7	1.2	1.5	1.9	0.9	0.2	1.1	1.1	1.6	3.1	DRY	0.8	0.3	0.8	0.1	1.3	0.1	0.6	0.1	0.2

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Heights of monitoring wells were adjusted from 07/03/08 onwards due to updated GPS locations

Table 4.2 Tramore Landfill Leachate &Groundwater Levels Q2 2008

Date	18/04/2008	15/05/2008	13/06/2008	16/06/2008
	Level m	Level m	Level m	Level m
BH 1/1	0.5	0.7	0.5	0.4
BH2	1	1.1	1.3	1.1
BH4A				
BH5	0.7	0.7	0.7	0.7
BH7B	1	1.4	1.2	1.4
BH8	1.5	1.6	1.5	1.4
BH9	1.9	1.9	1.9	1.9
RC4	0.9	1	0.9	1
RC5	0.2	0.2	0.2	0.1
RC6A	1	1.1	1.1	1.1
LT1	1	1	1.1	1
LT2	1.5	1.7	1.6	1.6
LT3A	3	3.5	3.1	3.2
LT4B				
LT5	0.8	1.1	0.8	0.6
GW1	0.2	0.2	0.3	0.4
GW2	0.7	0.7	0.8	0.5
GW3	0.1	0.1	0.1	0.1

Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7a	BH 8	BH 9	RC 4	RC 5	RC 6a	LT 1	LT 2	LT 3a	LT 4a	LT 5	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8
14	03/04/2008	TL	0.6	-	-	-	1.3	-	-	-	-	1.1	1.3	2	3.2	Dry	0.8	-	-	-	-	-	-	-	-
15	09/04/2008	TL	0.7	-	-	-	1.3	-	-	-	-	1.2	1.3	2.1	3.2	Dry	0.8	-	-	-	-	-	-	-	-
16	17/04/2008	TL	0.6		-		1.3					1	1.3	2	3.2	Dry	0.9	-	-	-	-	-	-	-	-
17	18/04/2008	TL	0.5	1	-	0.7	1	1.5	1.9	0.9	0.2	1	1	1.5	3	Dry	0.8	-	-	-	-	-	-	-	-
18	21/04/2008	TL	0.5	-	-	-	1.1	-	-	-	-	1.1	1	1.9	3.1	Dry	0.8	-	-	-	-	-	-	-	-
19	02/05/2008	DR	0.7		-		1.2					1	0.8	1.9	3	Dry	0.9	-	-	-	-	-	-	-	-
20	06/05/2008	DR	0.7	-	-	-	1.1	-	-	-	-	1.1	1	1.9	2.9	Dry	1	-	-	-	-	-	-	-	-
21	15/05/2008	DR	0.7	1.1	-	0.7	1.4	1.6	1.9	1	0.2	1.1	1	1.7	3.5	Dry	1.1	-	-	-	-	-	1.1	-	-
22	23/05/2008	DR	0.8	-	-	-	0.9	-	-	-	-	1.1	1.1	2	2.9	Dry	1.1	-	-	-	-	-	-	-	-
23	06/06/2008	DR	0.7	-	-	-	1	-	-	-	-	1	1	2.2	3	Dry	1.1	-	-	-	-	-	-	-	-
24	12/06/2008	DR	0.6	-	-	-	1.3	-	-	-	-	1	1.1	2	2.9	Dry	1.2	-	-	-	-	-	-	-	-
25	16/06/2008	DR	0.4	1.1	-	0.7	1.4	1.4	1.9	1	0.1	1.1	1	1.4	2.8	Dry	0.6	0.4	0.5	0.1	-	-	-	-	-
26	26/06/2008	DR	0.7		-		1.3					1.1	1.2	2.2	3	Dry	1.3								

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Heights of monitoring wells were adjusted from 07/03/08 onwards due to updated GPS locations

Table 4.3 Tramore Landfill Leachate & Groundwater Levels Q3 2008

Date	16/07/2008	18/08/2008	29/09/2008
Bore	Level	Level	Level
BH 1/1	0.5	0.8	0.9
BH2	1.1	1.1	1
BH4A			
BH5	0.7	0.9	0.7
BH7B	1.2	0.9	1.1
BH8	1.5	1.3	1.6
BH9	1	1.7	1.9
RC4	0.8	1	0.8
RC5	0.3	0.4	0.3
RC6A	1.1	1.2	1.2
LT1	1	1.4	1.1
LT2	1.6	1.8	1.3
LT3A	3.1	2.9	2.9
LT4B			
LT5	0.8	0.9	0.8
GW1	0.1	0.2	0.2
GW2	0.7	1	1
GW3	0.3	0.1	0.3

Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7a	BH 8	BH 9	RC 4	RC 5	RC 6a	LT 1	LT 2	LT 3a	LT 4a	LT 5	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8
27	03/07/2008	DR	0.8	-	-	-	1.4	-	-	-	-	1.2	1.4	2.3	3.3	Dry	1.4	-	-	-	-	-	-	-	-
28	11/07/2008	DR	0.6	-	-	-	1.1	-	-	-	-	1.1	1.3	2.1	3	Dry	1.2	-	-	-	-	-	-	-	-
29	16/07/2008	DR	0.5	1.1	-	0.7	1.2	1.5	1	0.8	0.3	1.1	1	1.6	3.1	Dry	0.8	0.1	0.7	0.3	-	-	-	-	-
30	22/07/2008	DR	0.5		-		1.1					1	1.1	1.8	2.9	Dry	0.9	-	-	-	-	-	-	-	-
31	31/07/2008	DR	0.8	-	-	-	1.5	-	-	-	-	1.2	1.3	2.1	3.1	Dry	1.1	-	-	-	-	-	-	-	-
32	07/08/2008	DR	0.9		-		1.3					1.2	1.4	2.1	3	Dry	1	-	-	-	-	-	-	-	-
33	14/08/2008	DR	1	-	-	-	1.2	-	-	-	-	1.3	1.4	2.2	3.1	Dry	1.1	-	-	-	-	-	-	-	-
34	18/08/2008	DR	0.8	1.1	-	0.9	0.9	1.3	1.7	1	0.4	1.2	1.4	1.8	2.9	Dry	0.9	0.2	1	0.1	-	-		-	-
35	28/08/2008	DR	0.8	-	-	-	1	-	-	-	-	1.2	1.5	2.3	3.2	Dry	1.3	-	-	-	-	-	-	-	-
36	02/09/2008	DR	0.9	-	-	-	1	-	-	-	-	1.3	1.6	2.3	3.2	Dry	1.4	-	-	-	-	-	-	-	-
37	12/09/2008	DR	0.8	-	-	-	1	-	-	-	-	1.3	1.5	2.3	3.1	Dry	1.4	-	-	-	-	-	-	-	-
38	19/09/2008	DR	0.7		-		1.2					1.2	1.3	2	2.8	Dry	1.3				-	-	-	-	-
39	29/09/2008	DR	0.9	1	-	0.7	1.1	1.6	1.9	0.8		1.2	1.1	1.3	2.9	Dry	0.8	0.2	1	0.3					

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Heights of monitoring wells were adjusted from 07/03/08 onwards due to updated GPS locations

Table 4.4 Tramore Landfill Leachate & Groundwater Levels Q4 2008

Date	24/10/2008	14/11/2008	30/12/2008
Bore	Level	Level	Level
BH 1/1	0.7	0.5	0.5
BH2	1.2	1.1	1.2
BH4A			
BH5	0.8	0.9	0.9
BH7B	0.8	1.1	1.1
BH8	1.4	1.5	1.3
BH9	1.8	1.5	1.4
RC4	0.9	0.9	0.8
RC5	0.4	0.3	0.2
RC6A	1.2	1.1	1
LT1	1.3	1.2	1
LT2	1.7	1.5	1.5
LT3A	2.8	3.1	2.9
LT4B			
LT5	0.8	0.4	0.9
GW1	0.1	0.2	0.3
GW2	1	0.9	1
GW3	0.2	0.2	0.1

Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7a	BH 8	BH 9	RC 4	RC 5	RC 6a	LT 1	LT 2	LT 3a	LT 4a	LT 5	GW 1	GW 2	GW 3	GW 4	GW 5	GW 6	GW 7	GW 8
40	07/10/2008	DR	0.9	-	-	-	1.1	-	-	-	-	1.3	1.2	1.9	2.7	Dry	1.2	-	-	-	-	-	-	-	-
41	13/10/2008	DR	0.9	-	-	-	1.1	-	-	-	-	1.2	1.2	1.9	2.6	Dry	1.1	-	-	-	-	-	-	-	-
42	24/10/2008	DR	0.7	1.2	-	0.8	0.8	1.4	1.8	0.9	0.4	1.2	1.3	1.7	2.8	Dry	0.8	0.1	1	0.2	-	-	-	-	-
43	27/10/2008	DR	0.8		-		0.9					1	1.1	1.8	2.6	Dry	1.1	-	-	-	-	-	-	-	-
44	09/11/2008	DR	1	-	-	-	1.1	-	-	-	-	1.2	1.2	1.9	2.8	Dry	1.2	-	-	-	-	-	-	-	-
45	14/11/2008	DR	0.5	1.1	-	0.9	1.1	1.5	1.5	0.9	0.3	1.1	1.2	1.5	3.1	Dry	0.4	0.2	0.9	0.2	-	-	-	-	-
46	19/11/2008	DR	0.9	-	-	-	1	-	-	-	-	1	1	1.9	2.6	Dry	1.1	-	-	-	-	-	-	-	-
47	27/11/2008	DR	0.8		-		1					1	0.9	1.9	2.6	Dry	1.1				-	-		-	-
48	05/12/2008	DR	0.8	-	-	-	0.9	-	-	-	-	0.9	0.9	2	2.6	Dry	1	-	-	-	-	-	-	-	-
49	09/12/2008	DR	0.8	-	-	-	1	-	-	-	-	1.3	1.6	2.3	3.2	Dry	1.4	-	-	-	-	-	-	-	-
50	17/12/2008	DR	0.8	-	-	-	1	-	-	-	-	0.9	0.9	2.1	2.7	Dry	1	-	-	-	-	-	-	-	-
51	22/12/2008	DR	0.5		-		0.8					0.8	0.6	1.9	2.5	Dry	0.9				-	-	-	-	-
52	30/12/2008	DR	0.5	1.2	-	0.9	1.1	1.3	1.4	0.8	0.2	1	1	1.5	2.9	Dry	0.9	0.3	1	0.1					

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Heights of monitoring wells were adjusted from 07/03/08 onwards due to updated GPS locations

7.5. Landfill Gas

7.5.1 Introduction

The main landfill gases, Methane and Carbon dioxide, as well as Oxygen, were measured in monitoring boreholes within [BH1/1, BH2, BH7, BH10, RC4, L1, L2, L3, L4, L5] and outside [BH8, BH9, RC5] the landfill area, and in the site hut.

7.5.2 Results

Results are presented in tables 5.1 to 5.4

Key parameter – methane

Methane is a product of the breakdown of biodegradable material in the landfill.

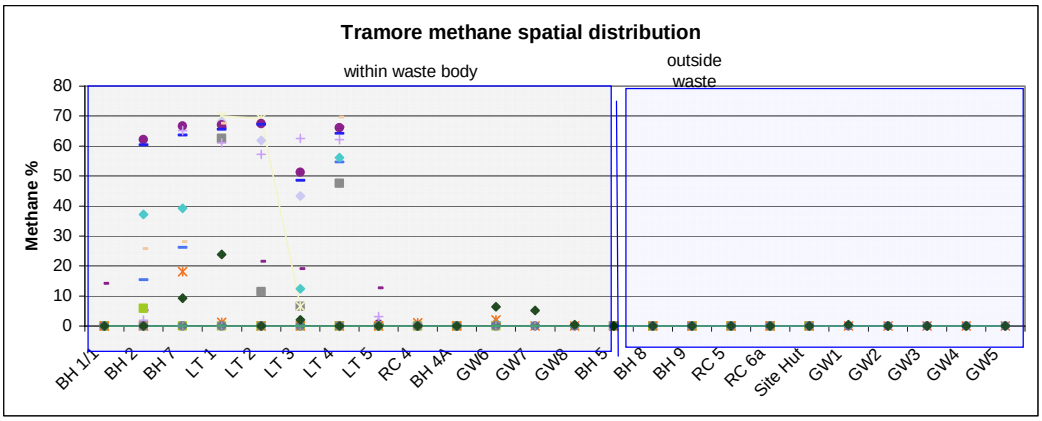


Fig 5.1 Methane spatial distribution

7.5.3 Discussion

There was no landfill gas detected in the site building.

Relatively high levels of methane, consistent with the breakdown or organic waste, were present at boreholes BH1/1, BH2, LT1, LT2, LT3, and LT4, within the landfill area. Other monitoring sites within the landfill area, BH7, BH10 and LT5 had none or only trace levels of methane and carbon dioxide (<1%).

No landfill gases were detected at monitoring sites BH8, BH9, RC4 and RC5, outside the landfill area. The amount of landfill gas being generated has been reduced significantly following the installation of the temporary flare in late May. A permanent flare has since been installed.

Table 5.1 Gas Levels Q1 2008

Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7A	BH 8	BH 9	RC 4	RC 5	RC 6A	LT 1	LT 2	LT 3A	LT 4A	LT 5	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
1	04/01/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 986	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	09/01/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	15/01/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 973	0 0 20.9 973	62.1 31.4 0.8 973	0 0 20.9 973	0 0 20.9 973	66.7 30.2 1.2 972	0 0 20.9 973	0 0 20.9 973	0 0 20.9 973	0 0 20.9 973	0 0 20.9 973	67.1 37.3 1.4 972	67.5 27.4 2.1 972	51.2 40.7 4.4 972	66.1 26.3 1.7 972	0.6 0.8 20.4 973	0 0 20.9 973	0 0 20.9 973	0 0 20.9 973	Not complete	0 0 20.9 973	-	-	-
4	25/01/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 1022	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
5	01/02/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 986	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
6	07/02/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 1020	0 0 20.9 1020	60.4 29.7 0.9 1020	0 0 20.9 1021	0 0 20.9 1020	63.6 32.2 1.9 1021	0 0 20.9 1021	0 0 20.9 1020	0 0 20.9 1020	0 0 20.9 1020	0 0 20.9 1021	65.6 34.8 1.7 1020	67.2 29.2 1.6 1021	48.5 36.7 4.9 1021	64.2 19.9 3.2 1021	0.4 0.4 20.6 1020	0 0 20.9 1020	0 0 20.9 1020	0 0 20.9 1021	Not complete	0 0 20.9 1020	-	-	-
7	13/02/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 1028	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
8	19/02/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 1014	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9	28/02/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 1012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
10	07/03/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 1001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11	13/03/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 991	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
12	21/03/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 995	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
13	28/03/2008	TL	CH_4 CO_2 O_2 Air Pressure	0 0 20.9 988	0 0 20.9 988	1.9 2.2 18.6 988	0 0 20.9 988	0 0 20.9 987	65.1 31.2 2.1 987	0 0 20.9 988	0 0 20.9 988	0 0 20.9 988	0 0 20.9 988	0 0 20.9 988	61.1 31.7 4.1 987	57.2 28.6 4.4 987	62.5 31.4 2.1 987	62.2 31.5 4.2 987	3.2 2.6 18.1 987	0 0 20.9 988	0 0 20.9 988	0 0 20.9 988	0 0 20.9 987	0 0 20.9 987	0 0 20.9 988	0 0 20.9 988	0 0 20.9 988

Table 5.2 Gas Levels Q2 2008

Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7A	BH 8	BH 9	RC 4	RC 5	RC 6A	LT 1	LT 2	LT 3A	LT 4A	LT 5	GW1	GW2	GW3	GW4
14	03/04/2008	TL	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 1028	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
15	09/04/2008	TL	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 1017	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
16	17/04/2008	TL	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 998																			
17	21/04/2008	TL	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 1027	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
18	01/02/2008	TL	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 998	2.8 0.6 19.3 996	9.9 3.7 16.3 995	0 0 20.9 995	0 0 20.9 995	62.1 34.1 1.1 984	0 0 20.9 995	0 0 20.9 996	65.5 30.1 6.1 996	0 0 20.9 996	0 6.0 20.9 996	64.0 35.1 3.0 994	68.0 32.4 15.0 994	60.1 30.3 6.0 996	65.4 33.7 0.6 996	15.6 12.2 4.1 984	0 0 20.9 994	0 0 20.9 994	0 0 20.9 994	0 0 20.9 994
19	02/05/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 993																			
20	06/05/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 982	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21	15/05/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 988	0 0 20.9 988	5.8 3.1 18.0 988	0 0 20.9 988	0 0 20.9 988	64.0 33.3 1.6 987	0 0 20.9 988	0 0 20.9 996	0 0 20.9 988	0 0 20.9 987	0 6.0 20.9 987	60.5 32.2 3.2 987	64.0 31.3 9.4 987	61.3 30.0 5.1 987	65.4 33.7 0.6 987	8.5 5.1 3.1 987	0 0 20.9 988	0 0 20.9 988	0 0 20.9 988	0 0 20.9 988
22	23/05/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 996	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
23	06/06/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 21.0 1015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
24	12/06/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 21.0 1015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
25	16/06/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 1009	0 0 20.9 1011	5.8 0 19.1 1009	0 0 20.9 1011	0 0 20.9 988	0 0 20.9 1010	0 0 20.9 1011	0 0 20.9 1011	0 0 20.9 1011	0 0 20.9 1011	0 0 20.9 1011	0 9.0 9.7 1011	0 2.7 9.7 1011	0 0 20.9 1010	0 0 20.9 1011	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1011
26	26/06/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 21.1 1010																			
Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7A	BH 8	BH 9	RC 4	RC 5	RC 6A	LT 1	LT 2	LT 3A	LT 4A	LT 5	GW1	GW2	GW3	GW4

Table 5.3 Gas Levels Q3 2008

Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7A	BH 8	BH 9	RC 4	RC 5	RC 6A	LT 1	LT 2	LT 3A	LT 4A	LT 5	GW1	GW2	GW3	GW4
27	03/07/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	11/07/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
29	16/07/2009	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 1023	0 0 20.9 1023	0 0 20.3 1023	0 0 20.9 1022	0 0 20.9 1022	18.1 12.1 1.3 1021	0 0 20.4 1021	0 0 20.9 1023	1.1 0.0 19.2 1023	0 0 20.9 1023	0 6.0 20.9 1022	1.2 11.2 4.3 1023	0 0 20.4 1022	0 0 20.6 1022	0 0 20.5 1023	0 0 20.4 1022	0 0 20.9 1023	0 0 20.9 1022	0 0 20.6 1022	0 0 20.4 1022
30	22/07/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 1010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
31	31/07/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.9 1016																			
32	07/08/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 20.6 1003																			
33	14/08/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 18.8 1003	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
34	18/08/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 18.4 1021	0 0 18.4 1021	0 0 18.5 1022	0 0 18.4 1022	0 0 18.4 1021	0 0 18.4 1021	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1021	0 0 18.5 1021	0 0 18.5 1022	0 0 18.5 1021
35	28/08/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 18.5 988	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
36	02/09/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 18.9 1012	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
37	12/09/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 18.4 1023	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
38	19/09/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 18.8 1000																			
39	29/09/2008	DR	CH_4, CO_2, O_2, Air Pressure	0 0 18.8 1020	0 0 18.7 1020	0 0 18.9 1021	0 0 18.4 1021	0 0 18.9 1021	0 0 19.2 1021	0 0 18.9 1020	0 0 18.7 1021	0 0 18.7 1020	0 0 18.6 1020	0 0 18.8 1021	0 0 18.9 1022	0 0 18.8 1022	0 0 18.6 1020	0 0 18.7 1022	0 0 18.6 1022	0 0 18.8 1021	0 0 18.9 1021	0 0 18.9 1021	0 0 18.7 1021
Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7A	BH 8	BH 9	RC 4	RC 5	RC 6A	LT 1	LT 2	LT 3A	LT 4A	LT 5	GW1	GW2	GW3	GW4

Table 5.4 Gas Levels Q4 2008

Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7A	BH 8	BH 9	RC 4	RC 5	RC 6A	LT 1	LT 2	LT 3A	LT 4A	LT 5	GW1	GW2	GW3	GW4
40	07/10/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.6 1015	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	13/10/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.6 1016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
42	24/10/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.8 1023	0 0 18.8 1023	0 0 18.9 1023	0 0 18.8 1023	0 0 18.9 1023	0 0 18.8 1023	0 0 18.9 1023	0 0 18.8 1023	0 0 18.8 1023	0 0 18.8 1023	0 0 18.8 1023	0 0 18.8 1023	0 0 18.9 1023	0 0 18.8 1023	0 0 18.9 1023	0 0 18.8 1023	0 0 18.8 1023	0 0 18.8 1023	0 0 18.9 1023	0 0 18.8 1023
43	27/10/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.8 1010	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
44	09/11/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.4 1002																			
45	14/11/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.2 1025	0 0 18.3 1025	0 0 18.2 1025	0 0 18.2 1025	0 0 18.1 1025	0 0 18.1 1025	0 0 18.1 1025	0 0 18.1 1025	0 0 18.2 1025	0 0 18.1 1025	0 0 18.1 1025	0 0 18.1 1025	0 0 17.9 1025	0 0 18.2 1025	0 0 18.2 1025	0 0 18.2 1025	0 0 18.2 1025	0 0 18.1 1025	0 0 18.1 1025	0 0 18.8 1025
46	19/11/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.8 998	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
47	27/11/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.8 1015	0 0 18.4 1021	0 0 18.5 1022	0 0 18.4 1022	0 0 18.4 1021	0 0 18.4 1021	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1022	0 0 18.5 1021	0 0 18.5 1021	0 0 18.5 1022	0 0 18.5 1021
48	05/12/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.3 1005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
49	09/12/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.5 1001	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
50	17/12/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.8 1016	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
51	22/12/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.5 1021																			
52	30/12/2008	DR	CH_4 CO_2 O_2 Air Pressure	0 0 18.1 1024	0 0.1 17.9 1024	0 0 18.1 1024	0 0.0 17.9 1024	0 0 18.0 1024	9.2 4.6 14.6 1024	0 0 17.9 1024	0 0 17.9 1024	0 0 18.3 1024	0 0 18.6 1020	0 0 18.0 1024	23.8 12.0 11.2 1024	0 0 18.2 1024	2.1 1.4 17.6 1024	0 0 18.2 1024	0 0.1 17.9 1024	0.4 0 18.0 1024	0 0 18.3 1024	0 0.5 18.1 1024	0 0 18.1 1024
Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7A	BH 8	BH 9	RC 4	RC 5	RC 6A	LT 1	LT 2	LT 3A	LT 4A	LT 5	GW1	GW2	GW3	GW4

7.6 NOISE

7.6.1 Introduction

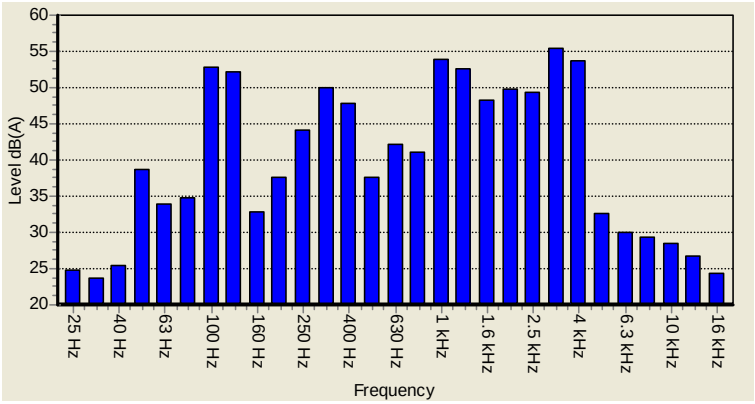
Daytime noise levels were recorded on 11/01/07 at two locations at Tramore Landfill Site, B1 and B2, as specified in the licence monitoring schedule D. These locations are shown in appendix 1. There are limits of 55 dB Leq(30) daytime, and 45 dB Leq(30) night-time imposed as a condition of the licence.
A Cirrus 800A Sound Level Meter was used. The meter was calibrated and checked with a 94 dB calibrator before and after each measurement. Broadband and Frequency Band analysis measurements were conducted at each location. A summary of results is presented in table 6.1, below.

7.6.2 Summary of Results / Discussion

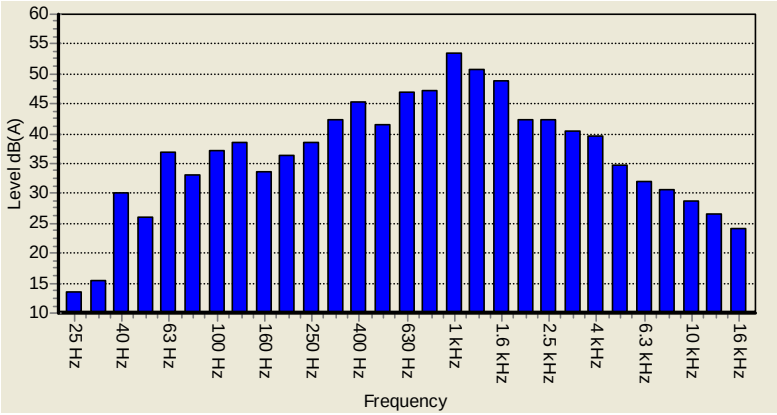
Site	*Date of Monitoring*	*Time of commencement of monitoring*	*L(A)eq[30mins] dB*	*$L(A)_{10}$ [30 mins]*	*$L(A)_{90}$ [30 mins]*
B1	15/4/2008	14.04	48.2	48.3	42.0
B2	15/4/08	15.08	49.8	53.8	44.0

Table 6.1 Summary of noise measurements at Tramore landfill 15/4/08.

Average noise levels, LAEQ(30), at sites B1 and B2 were within the daytime limits of 55dB. Night-time measurements were not made, as the landfill is not operational outside of daytime hours.



B1 1/3 Octave Noise Analysis, (A weighting) 15/4/08



B2 1/3 Octave Noise Analysis, (A weighting) 15/4/08

Frequency analysis at sites B1 and B2 indicated a broad range of frequencies, with no particular tonal emissions, consistent with a variety of noise sources, such as wind and machinery and traffic.

7.7 LEACHATE TOXICITY

7.7.1 Introduction / Methodology

Leachate toxicity tests were carried out at the Aquatic Toxicity Laboratory, Enterprise Ireland, Shannon.

A representative sample of leachate was obtained by compositing grab samples, taken in December 2008, from leachate boreholes..

Two test species were used, namely *Tisbe battagliai* (marine copepod), and *Skeletonema costatum* (marine alga).

The tests consisted of exposing populations of the tests species to various concentrations of the leachate sample, and noting the concentration at which the species exhibited a response (usually mortality or growth inhibition) for 50% of the population thus exposed. This concentration is termed the EC50 (Effective concentration for 50% of the exposed population). The EC50 can also be expressed as *Toxic Units*, which are calculated by dividing 100 by the EC50.

7.7.2 Results

SPECIES	***T. battaglia***	***S. costatum***
EC50	17.9% vol/vol 48 hr LC50	1.7 % vol/vol 72 hr IC50
TOXIC UNITS	5.6	58.8

Table 7.1 Summary of Tramore leachate toxicity tests December 2007

7.7.3 Discussion

The highest toxicity result of 58.8 Toxic units was obtained with *Skeletonema costatum*, the marine alga. The nature of algal testing is a growth rate inhibition measurement over 72 hours compared to a control. This is in effect akin to a chronic more than an acute test in that many replications of algal cells occur during 72 hours. A factor of 10 is normally used to relate acute to chronic toxicity, (J O'Neill, Shannon Toxicity Laboratory, *pers. Comm*). Therefore the acute toxicity of the leachate to *Skeletonema* would be approximately 5.8 TU.

Where a potentially toxic discharge is entering a waterbody, it is usually considered that 20 dilutions per Toxic Unit are required to protect the receiving environment from toxic effects.

In the case of the leachate sample tested, a dilution of 1176 would be required, taking the highest toxicity value obtained of 58.8 Toxic Units against the marine alga *Skeletonema costatum*.

The actual dilution available to leachate from Tramore Landfill is estimated to be at least 1/38,000*, therefore no toxic effect from the leachate is expected.

** Calculation of Dilution available:*

Estimated volume of leachate produced per tidal flush: 19.8 m^3, calculated using formula in accordance with the EPA Landfill Design Manual.

Tidal Flush Volume:

Assume conservative tidal range 1 metres X inner backstrand area 760,000 m^2 = 760,000 m^3 per tidal flush

Estimated Dilution available: = 19.8/760,000 = 1/38,000 approx.

7.8 CHEMICAL ANALYSIS OF ESTUARINE SEDIMENT AND BENTHIC MACROFAUNA

7.8.1 BENTHIC MACROFAUNA (SHELLFISH)

7.8.1.1 METHODS

Shellfish samples – cockles (*Ceracostaderma edule*) and mussels (*Mytilis edulis*) were taken from the backstrand, within 200 metres of the landfill, on17/12/08.

Approximately 50 individuals of each type were sampled along the sampling zone, figure 8.1. These individuals were mixed well and a subset of 10 individuals of each type was taken for processing and testing.

Shellfish were depurated overnight in clean aerated seawater, before de-shelling. The flesh was blotted dry, and dried at 60degC for 3 days. The dried flesh was ground to powder at Waterford County Council's laboratory and portions were analysed for metals at Environmental Services Laboratory, Cork. QC and reference materials were processed with the samples.

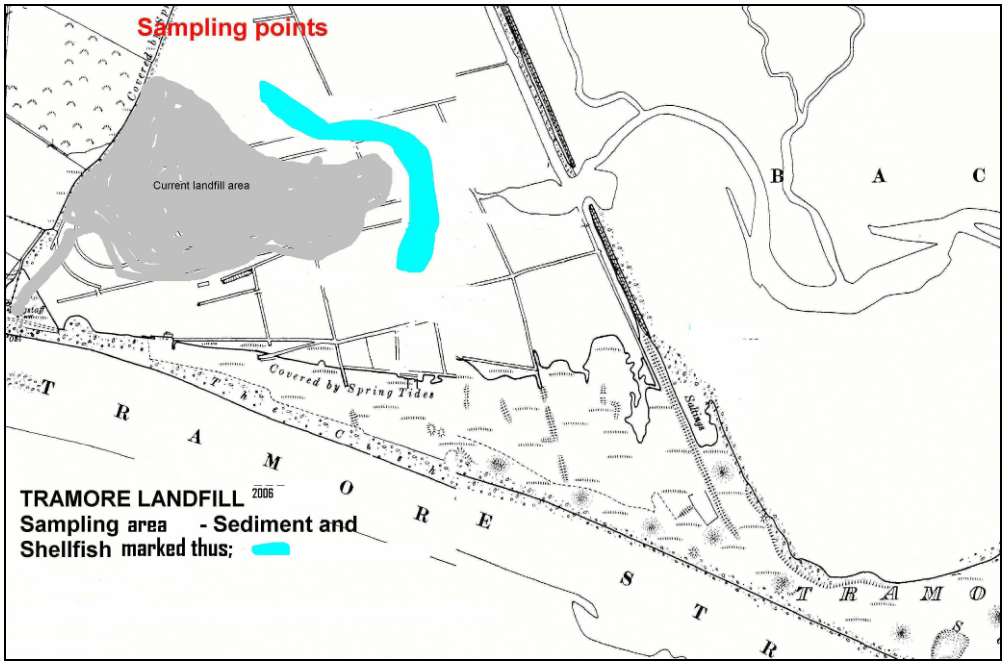


Fig 8.1. Tramore backstrand shellfish and sediment sampling areas

7.8.1.2 RESULTS

Results of analysis are presented in table 1.

Table 1. Trace metal concentrations in shellfish samples from Tramore inner backstrand, December 2008 mg/Kg wet weight

PARAMETER mg/Kg wet weight *	Cockle flesh *Cardium edule* December 2008	Mussel flesh *Mytilis edulis* December 2008	Shellfish Quality Standards *
Arsenic	1.96	4.64	
Cadmium	<0.1	0.26	1
Chromium	<1	<1	
Copper	<1	1.94	20
Iron	35.2	90.2	
Lead	<0.3	0.96	1.5
Manganese	<1	1.78	
Zinc	6.5	22.4	

7.8.1.3 COMPARISON WITH STANDARDS

*EU Commission Regulation 466/2001/EC (as amended by Regulation 221/2002/EC) came into effect on 5th April 2002. This set maximum levels for mercury, cadmium and lead in bivalve molluscs of 0.5mg kg^{-1}, 1mg kg^{-1}, and 1.5mg kg^{-1} wet weight respectively. In the absence of EU standards for other contaminants in shellfish, monitoring results have been compared to strictest guidance or standard values available in other OSPAR Convention contracting countries; hence the Spanish guideline for copper is applied.

Discussion

All mussel and cockle samples from Tramore backstrand complied with shellfish quality standards.

7.8.1.4 TRENDS AND COMPARISON WITH PREVIOUS RESULTS

The results obtained for mussels and cockles in the 2008 survey are presented in table 2 for comparison with previous results for this site.

Table 2(a) Trace metal concentrations in mussels in Tramore backstrand for years 2002, 2003, 2004, 2005, 2006 and 2008

Parameter mg/kg wet weight *	MUSSEL						
	July 2002	Jan 2003	Oct 2003 (average of 5 sampling sites)	Sept 2004	Aug 2005	Dec 2006	Dec 2008
Arsenic			3.18	2.57	3.5	3.35	4.64
Cadmium	0.24	0.15	0.22	0.16	0.16	0.26	0.26
Chromium			0.98		0.36	0.36	<1
Copper	1.88	1.39	1.72		1.05	0.95	1.94
Iron			101		71.9	55.66	90.2
Lead	1.21	0.73	0.68	0.8	0.52	0.56	0.96
Manganese			1.16		1.8	1.03	1.78
Zinc	23.38	24.8	14.0	14.15	12.98	22.64	22.4

Table 2(b) Trace metal concentrations in cockles from Tramore backstrand for years 2002, 2003, 2004, 2005, 2006 and 2008

Parameter mg/kg wet weight *	COCKLE					
	July 2002	Oct 2003 (average of 6 sampling sites)	Sept 2004	Aug 2005	December 2006	December 2008
Arsenic		2.47	2.77	2.71	2.04	1.94
Cadmium	0.04	0.038	0.04	0.03	0.03	<0.1
Chromium		0.95		0.82	0.36	<1
Copper	1.48	2.9		2.02	0.86	<1
Iron		137		129.3	42.12	35.2
Lead	0.296	0.26	0.16	0.53	0.03	<0.3
Manganese		1.55		2.55	0.96	<1
Zinc	11.86	7.85	6.9	7.68	6.04	6.5

7.8.1.5 Discussion

Results for December 2008 were similar to previous years. Some minor fluctuations from year to year are apparent, but there is no clear trend and the differences are likely due to natural variations.

7.8.1.6 COMPARISON WITH OTHER SITES

Trace metal concentrations in mussel samples from Tramore inner backstrand are compared in table 3 with levels found in the following surveys;

a) Marine Institute survey of 25 shellfish growing areas around the Irish coast, sampled 2004 and 2005.
b) EPA surveys of Waterford and Wexford Harbours, 2004 and 2005.

Table 3. Trace metal concentrations in mussels from Tramore backstrand, and at other estuarine and coastal sites

	Tramore inner backstrand	**Wexford Harbour,**	**Waterford Harbour**	**Metals levels in mussel samples from 25 locations on the Irish coast, Marine Institute Surveys 2004 - 2005 Refs 1 and 2**		
mg/kg wet weight		**EPA survey, Ref 3**	**EPA survey, Ref 3**			
		2004	**2005**			
	17 December 2008	**Mean of 4 samples**	**Mean of 4 samples**	**Mean**	**90%ile**	**Max**
Arsenic	4.64	3.6	**2.6**			
Cadmium	0.26	0.3	0.25	**0.15**	**0.2**	**0.35**
Chromium	<1	4	1.4	**0.18**	**0.33**	**0.66**
Copper	1.94	2.2	2.9	**1.39**	**1.57**	**1.97**
Iron	90.20					
Lead	0.96	1.3	2.1	**0.23**	**0.52**	**0.85**
Manganese	1.78					
Mercury				**0.027**	**0.03**	**0.04**
Zinc	22.40	15.6	25.4	**15.69**	**19.1**	**27**

7.8.1.7 Discussion

Metals levels recorded in Tramore backstrand mussels in December 2008 were similar to that found at other estuarine and coastal sites.

7.8.2. Sediment.

7.8.2.1 Introduction

A composite sample of sediment (approx 2 kg) was taken at ten sampling points along a sampling zone adjacent to Tramore landfill, see fig 8.1. This was hand mixed on-site, and a portion (approx 200g) taken for analysis. The composite sample was dried at 105 deg for two days, and pulverized with mortar and pestle in Waterford County Council's laboratory. Portions of the powdered samples were analysed for metals at Environmental Services Laboratory, Cork. QC and reference materials were processed with the samples.

7.8.2.2 Results

Parameter	Units	Tramore inner backstrand, December 2008	Sediment Quality Standards			
			Baseline *	Threshold **	ERL ***	Proposed Irish sediment guidance levels ****
Arsenic	mg/Kg dry wt.	6.1				
Cadmium	mg/Kg dry wt.	<0.5	0.5	1.5	5	1
Chromium	mg/Kg dry wt.	16.4	5	50	80	100
Copper	mg/Kg dry wt.	10.6	5	50	70	50
Iron	mg/Kg dry wt.	13094				
Lead	mg/Kg dry wt.	19.4				50
Manganese	mg/Kg dry wt.	242				
Zinc	mg/Kg dry wt.	52.6	20	100	120	400

Table 4. Trace metal concentrations in sediment from Tramore inner backstrand, and comparison with environmental standards

7.8.2.3 Comparison with Standards.

Based on field investigations and literature data, Jeffrey et al (1995) ref 4, established baseline and threshold values for organic matter and heavy metals in estuarine sediments.

* The baseline concentration is defined as "that of the natural unpolluted estuary and corresponds to the authors views of the pre-industrial situation for sediments".

** The threshold is "the pollutant concentration beyond which deleterious environmental change is observable".

*** The National Oceanic and Atmospheric administration in USA (Long and Man, 1995) also established sediment quality guidelines. The guidelines are based on a review of numerous studies of the correlation between the toxicity of sediments and the content of pollutants. The ERL limits shown represent the concentration above which there may be a risk of deleterious impacts on fauna.

**** Proposed new Irish sediment guidance levels. Cronin et al, *Guidelines for the assessment of dredge material for disposal in Irish waters.* Marine Institute, 2006

Discussion

Chromium, copper and Zinc at Tramore were above baseline levels. However, all values were below threshold and ERL limits, and proposed Irish standards for non-contaminated sediment, and were well below concentration where deleterious impacts on fauna can be expected.

7.8.2 .4 Comparison with previous surveys and other sites

Table 5. Trace metal concentration in sediment from Tramore inner backstrand and other estuarine and coastal sites

		Tramore Backstrand							Waterford Estuary ref 3	Wexford Hbr ref 3
Parameter	Units	**2008**	2006	2005	2004	2003	2002	1998	2001	2004
Arsenic	mg/kg dry wt	**6.1**	4.96	5.2	5.2	7.1	5.6		8	10
Cadmium	mg/kg dry wt	**<0.5**	0.063	0.1	<0.44	<0.04	0.123	0.42	0.04	0.3
Chromium	mg/kg dry wt	**16.4**	16.4	14.3				65.6	35	31
Copper	mg/kg dry wt	**10.6**	6.98	8.1	10.7	8.6	5.4	11	9.8	13
Iron	mg/kg dry wt	**13094**	12,880	9721	13106	14048	15500		17466	24689
Lead	mg/kg dry wt	**19.4**	9.6	11.3	14.5	11	15.1		26	20
Manganese	mg/kg dry wt	**242**	225	215	263	398	270		622	385
Zinc	mg/kg dry wt	**52.6**	41.2	34	48.5	35	51.4	55.3	141	83

7.8.2.5 Discussion

December 2008 Tramore backstrand sediment metal levels were similar to levels found at that site in previous years.

The majority of sediment metal levels at Tramore backstrand were lower than that found in samples from Waterford and Wexford Estuaries. Copper was slightly higher at Tramore in 2008 than found at wexford, but was lower than at the Waterford Estuary site.

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7.9 ECOLOGICAL SURVEY OF BACKSTRAND AND DUNES

7.9.1 INTRODUCTION AND SCOPE OF WORKS

Limosa Environmental was commissioned by Waterford County Council to conduct ecological surveys of Tramore Landfill and surrounding environment in fulfilment of the requirements of the Tramore Landfill waste licence (Environmental Protection Agency Reg No. 75-1, Condition 8.10.1).

The scope of works, executive summary and conclusions are reproduced below.

The scope of works as outlined in the tender request is as follows:

1. Habitat types at landfill, backstrand and dunes: Mapping of main habitat types as identified in previous surveys, including fixed dunes, salt marsh, muddy shore, muddy sand shore. Description of main flora and fauna present. Interpretation of findings with regard to previous surveys.

2. Faunal analysis of the backstrand: Sampling, identification and enumeration of fauna at sample sites along two transects as per previous survey. Interpretation of results with regard to previous surveys.

3. Interpretation and comment on bird count data – to be obtained from annual IWeBs counts by BirdWatch Ireland, and the landfill bird control contractor.

7.9.2 EXECUTIVE SUMMARY

Limosa Environmental was commissioned by Waterford County Council to conduct ecological surveys of Tramore Landfill and surrounding environment in fulfilment of the requirements of the Tramore Landfill waste licence. Tramore Landfill ceased accepting waste on 31st December 2005.

The scope of works included mapping the main habitat types and identification of flora and fauna within a pre-determined survey area, an intertidal survey of Tramore Backstrand and a review and assessment of waterbird data for Tramore Backstrand.

Habitats within the boundary of Tramore Landfill have undergone a process of steady change in recent years due to the capping and rehabilitation process. In 2008, the landfill was dominated by one habitat type – amenity grassland (GA2), as the majority of the site has recently been seeded.

As mentioned in previous annual reports, rehabilitation of the landfill site should consider not only the desired end-result habitat within the landfill site but also the ecological sensitivities of the habitats surrounding the site. The colonisation of invasive or non-native species (which could pose a threat to the surrounding semi-natural habitats) should therefore be monitored.

Habitats outside of the landfill site do not appear to have undergone significant change over recent years. As in previous annual reports we discuss several pressures upon these habitats, including the on-going encroachment of the mudflats by Common Cord-grass, erosion of the sand dunes by the frequent passage of walkers and the occurrence of the alien, invasive species, Japanese Knotweed.

The scarce plant Golden-samphire was recorded within the survey area in November 2008; it was undetected in 2005, 2006 and 2007 and its identification this year is welcomed.

The 2008 survey also confirmed the continued presence of the Otter, a highly protected mammal, within the survey area.

The macrofaunal community of Tramore Backstrand remains diverse, and abundances are in some cases, greater than in recent years. The long-term data-set available from annual landfill monitoring clearly shows the decline in the population of Common Cockles since 2000 and we speculate that this may be linked to mechanical cockle harvesting which was banned within Tramore Backstrand in 2007. Results of recent annual surveys suggest levels of organic enrichment across the inner Backstrand have decreased and overall, there is no evidence to suggest that the landfill site has had any deleterious effects on the macroinvertebrate fauna of the inner Backstrand.

Tramore Bay is recognised as being of international importance for Light-Bellied Brent Geese, which appear to have a relatively stable population at this site during winter. The site remains nationally important for a range of waterbird species. Overall waterbird numbers across the site are highly variable but decreases are apparent for two species: Teal and Dunlin, the latter consistent with national trends.

Overall, the 2008 survey reports that Tramore Backstrand and environs continues to support a rich and diverse flora and fauna.

Observations from the current survey confirm the continued presence of the highly protected mammal species Otter within the survey area.

The macrofaunal community of Tramore Backstrand remains diverse with a total 22 species recorded this year; the greatest diversity recorded during the seven-year monitoring period.

7.10 CONCLUSIONS – Impact of Tramore Landfill on Surrounding Environment

There is no indication of any effect from the landfill on the surface water sites SW1 to SW6.

The results of groundwater monitoring are in line with results from previous rounds of testing carried out since 1999. As indicated in previous reports, it appears that groundwater quality within the current working area is impacted by leachate from the landfill, however the naturally reducing conditions found in the area may be contributing to elevated iron and ammonia levels in groundwater. Groundwater outside the landfill site was generally satisfactory.
Leachate quality was as expected for a landfill accepting mainly domestic and inert waste. Based on toxicity tests carried out, and available dilution, no toxic effect from landfill leachate is expected.

No noise nuisance was indicated during the annual noise survey.

The metal concentrations in shellfish from Tramore inner backstrand complied with relevant shellfish quality standards and were similar to that found at other estuarine and coastal sites around the country.
Trace metal concentrations in sediment samples from the inner backstrand were well below the concentration where deleterious impacts on fauna can be expected and were lower than average levels from Waterford and Wexford Harbours.
Monitoring results indicate that the landfill is having no significant impact on adjacent sediment and shellfish.
The 2007 ecological survey showed that Tramore Backstrand and environs continues to support a rich and diverse flora and fauna.

The environmental monitoring carried out during 2008 indicates that the landfill has no detrimental impact on the surrounding environment.

7.11 Meteorological Data

Monthly meteorological data is attached in Appendix F.

7.12 Nuisance Monitoring

Nuisance Control is carried out in accordance with Condition 7 and 8.12 of the Waste Licence. The site is inspected weekly by the Landfill Manager and recorded on inspection sheets. The inspection sheet records environmental nuisances such as birds, loose litter, odour, dust, mud and vermin and also provides for the recording of description works. The inspection sheet also provides for the recording of nuisances as well as site security, infrastructure and housekeeping. A road sweeper cleans site access roads as required.

Dust control was carried out in accordance with 7.4 of the Waste Licence. A slight – moderate nuisance was observed during the monitoring period particularly in dry weather conditions however site roads and any other areas used by vehicles are sprayed with water as and when required. Prior to exiting the facility all vehicles enter the wheel wash so as to minimise airborne dust nuisance.

Vermin and Fly control was carried out in accordance with Condition 11.5 of the waste licence. Vermin and fly activity was very low for the reporting period due implementation of a good eradication programme.

Litter control was carried out in accordance with Condition 7.3 and 11.4.2 of the Waste Licence.
As the landfill is no long active, litter control only applies to the Civic Amenity area of the site. The caretaker collects any loose material which may have been caught by the wind and returns it to the appropriate receptacle. In the event of an extremely windy day a litter picker would be employed to pick the area around the Civic Amenity site.

A slight nuisance was caused by mud in wet weather conditions around the facility during the reporting period. A metre of clay has to be placed on top of the LLDPE liner to complete the capping works, this equates to 200,000 tonnes of clay. Some mud was transported from the landfill to the entrance road due to the high volume of vehicles entering and exiting the facility In accordance with Condition 7.5 of the Waste Licence prior to exiting the facility all vehicles use the wheel wash so as to minimise mud in the Civic Amenity Area and adjacent entrance road. Bowsers and road sweepers are also used to clean this area.

7.13 Ambient Monitoring

It is proposed that a monthly Odour Monitoring Survey be incorporated into the monthly monitoring program. This would involve visiting each of the 37 gas extraction wells and checking for releases of any odour. A Leak Detection Survey would also be conducted on an annual basis. No composting occurred on site in 2008.

8 Topographic survey

A topographic survey is included in this report. This is attached in Appendix G

9 Borehole Summary

Due to the remediation works being carried out at the Tramore Landfill, many of the boreholes on site had to be refurbished during 2007. In addition a further eight groundwater wells were installed at the request of the Agency. A borehole review is included in Appendix I. This review was conducted between the end of 2007 and the start of 2008 and includes the location and designation of each borehole. During the current reporting period further works were carried on, principally with the erection of additional protective barriers at BH1/1, BH8, RC4 and BH2. 2 boreholes were decommissioned, one adjacent to the site hut and another on the northern boundary of the adjoining caravan park close to where the new Tramore Relief Road is being constructed.

10. Proposed development of the facility and timescales of such development

a) Landfill Capping and Restoration

A Closure Restoration and Aftercare Plan was sent to the EPA during 2007 and capping was completed in 2008.

b) Landfill Gas Management

Under condition 3.12.1 of the Waste Licence "infrastructure for the active collection and flaring of landfill gas shall be installed at the facility. The flare shall be of an enclosed type design". The gas collection system was installed in tandem with the final capping of the landfill. Gas wells were bored in 2006 and the quantity of gas in these boreholes was recorded. A temporary flare was installed in May 2008. The permanent flare is now operational and landfill gas emissions are now minimal.

11. Volume of leachate produced and volume of leachate transported / discharged offsite.

The annual volume of leachate generated was estimated for the Waste Licence Application in 1998 to be in the order of 14087m^3. A saline intrusion study was conducted on the Landfill in 2005 and submitted to the Agency. A leachate extraction system has been installed in tandem with the final capping of the landfill. Leachate extraction wells were bored in 2006 and wells were monitored. The leachate collection tank has been installed but unfortunately there has been a delay in the commencement of pumping. It is expected that pumping of leachate will commence in May 2009. Leachate will then be tankered from the site. A final destination for the leachate will be indentified with the most likely destination being the Tramore Waste Water Treatment Plant. Leachate levels are expected to reduce due to the capping works, which will keep rainwater from entering the landfill, also the pumping of the leachate wells will reduce the leachate head. It is proposed that this leachate be brought to the Tramore Waste Water Treatment plant. To date no leachate has been removed from the site. This work will be carried out in conjunction with the Closure Restoration and Aftercare Plan.

12. Report on Development works undertaken during the Reporting Period

Remediation of Landfill

Landfill Capping Works

The capping contractor, FLI, mobilised to site on 7th November 2006 and commenced lining on the 9th November. However poor weather conditions and related programming difficulties with other onsite works (particularly unavailability of suitable capping soil) resulted in multiple mobilisations and demobilisations, significantly extending the duration of works. The lining works were substantially completed on 28th January 2008.

The following summarises progress in 2008:

January: lining works substantially completed by FLI

February: finalising capping earthworks

March: finalising capping earthworks

April: Plant installed the surface water drainage system along the southern boundary of the site.

May: Farm Relief Services repaired the boundary fence on the southern boundary of the site. Other plant on hire was assisting Lining Technology with the gas and leachate pipework.

June: Clay was imported to regrade any low points that existed on the flat surface of the landfill. The surface water drainage outfalls were also installed and the placing of the rock armour continued.

July: The rock armour on the southern slope was completed. Clay was imported to grade around the wellheads. The surface water drainage up to the location of the flare and also on the North Western boundary was completed.

August: Three weeks of bad weather beginning at the start of the month prevented any soil importation throughout the month of August.

September: Acceptance of clay began in mid September from three sources. Material accepted was mainly a very good subsoil material. 1NO. Dozer was on site to spread out this material.

October to December: No works onsite

Landfill Gas / Leachate Extraction System

Lining Technology, contractor for the Gas / Leachate Extraction System, mobilised to site the week commencing 4th December 2006 to install all 37 No. extraction well boreholes. Following installation of temporary pipework from the extraction wells to the location of the temporary flare in

January 2007 they demobilised from the site. They undertook a leachate investigation between February and April 2007, but as the results were inconclusive RPS carried out their own analysis.

The following works have been carried out in 2008:
January: no works on this element
February: ESB connected the new three phase power supply
March: Lining Technology remobilised to site and commenced excavating the trenches for the gas and leachate extraction pipework
April: The gas and leachate pipework was installed and tested. Knockout pots were also installed.
May: The temporary flare was commissioned and the pumping trials commenced towards the end of the month of May.
June: Pumping trial was ongoing. The possibility of gas utilisation was also being looked into while the pumping trials were being carried out.
July: Ground improvement works for the leachate tank were carried out.
August: Irish Industrial Tanks ltd. arrived on site to install the leachate tank.
October to December: No works onsite

Erosion Protection Works

The EPA and the National Parks and Wildlife Service approved the erosion protection works proposal submitted by RPS. The erosion protection is on a section of the northern slope and continues around the eastern point and along the southern side of the eastern peninsula. Suitable rock had to be selected from Roadstone's quarry in Kilmacow and brought to site by trucks on hire to Waterford County Council during November and December 2007.
The rock armour was completed in July with the last section being placed on the southern boundary.

13. Annual Water Balance Calculation and Interpretation

The annual water balance could not be determined as the site is subject to saline intrusion. Meteorological data from Rosslare weather station is collected for the facility on a daily basis. (Appendix F).

14. Report on the progress towards achievement of the Environmental Objectives and Targets contained in the previous year's report. (*Pleases refer to the AER 2006 for the previous years Objectives and Targets)*

1. Under Condition 2.3.1 an Environmental Management System was compiled for the facility and was submitted to the Agency in March 2003.
1. All site infrastructures have been maintained to the standards outlined in Condition 3 of the Waste Licence.
2. The effect of environmental nuisances was kept to a minimum during the reporting period. On occasions there was some dust was prevalent around the site particularly during the Summer months when the weather was very dry but this was kept under control by having a water sprinkler come on site at various times throughout the days. Likewise, when extremely wet conditions were experienced, problems with mud occurred. This problem was resolved by the hiring of extra road sweepers and water bowsers.
4. In the first quarter relatively high levels of methane, consistent with the breakdown or organic waste, were present at boreholes BH7, LT1, LT2, LT3, LT4 and LT5, within the landfill area. Other monitoring sites within the landfill area, BH10 and LT5 had none or only trace levels of methane and carbon dioxide (<1%). However methane levels have been significantly reduced following the initial installation of the temporary flare and subsequent installation of the permanent flare.

5. The Monitoring Programme as outlined under condition 8 and Schedule D of the Waste Licence has been maintained during the reporting period and all reports have been submitted to the Agency. There have been times that reports were submitted late as samples being analysed by the EPA Regional Laboratory in Kilkenny were slow to arrive.
6. The Facility Office has a comprehensive set of records for 2003, 2004, 2005, 2006, 2007 and 2008.
7. No emergency or complaint occurred on site during the reporting period
8. A Closure Restoration and Aftercare plan has been approved by the Agency. Outstanding works have been identified in the Schedule of Environmental Objectives and Targets for the forthcoming year.

16. Schedule of Environmental Objectives and Targets for the forthcoming year

Objective 1 – To maintain site infrastructure to the standards outlined in Condition 3 of the Waste Licence

Target 1.1 - Any defect to the existing infrastructure will be repaired / replaced as quickly as possible on an on going basis.

Objective 2 – To minimise the effect of environmental nuisances

Target 2.1 – To implement the procedures outlined in Condition 7 of the Waste Licence on an ongoing basis throughout the year. Waterford County Council have endeavoured to achieve compliance with this condition and have to date been successful.

Objective 3 – That no specified emissions from the facility, shall exceed the limit values, set out in Condition 6 and Schedule C of the Waste Licence.

Objective 4 – To maintain the Monitoring Programme as outlined in Condition 8 and Schedule D of the Waste Licence.

Target 4.1 – To carry out the monitoring programme as outlined in Condition 8 and Schedule D of the Waste Licence.

Target 4.2 – To submit Monitoring Reports to the Agency within the timescale as outlined in Schedule E of the Waste Licence.

Objective 5 – To establish good record keeping and that all records are held at the facility office to comply with Condition 10 of the Waste Licence.

Objective 6 – That no emergency situation occurs on the site.

Target 6.1 – Ensure the contingency arrangements as outlined in Condition 9 of the Waste Licence are implemented throughout the year and to follow the procedure set out in the Emergency Response Procedures.

Objective 7 – Ensure the there is sufficient funds available to comply with Condition 12 of the Waste Licence.

The gate fee was the only avenue available to Waterford County Council to raise funds to ensure financial stability of the facility. When the landfill closed other options to increase revenue had to be explored. Fee increases were necessary during the past year to maintain the high standards and to continue with the development programme.

Objective 8 – To restore the landfill in accordance with the Plan agreed with the Agency and in such a way that final works have a minimal impact on the surrounding environment.

Target 8.1 – Completion of all required landscaping including removal of stones from landfill cap and any necessary replanting.

Target 8.2 – Completion of Surface Water Drainage system including inspection manholes at outfalls.

Target 8.3 – Completion of Gas Collection Infrastructure and Leachate Management system including identification of final destination for leachate that is removed off site. Proposals in this regard to be approved by the Agency.

16 Reported Incidents and Complaints Summary

16.1 Incidents

No incident occurred during the reporting period.

17.1 Complaints

No complaint in relation to the operation of the Facility was received during the reporting period.

18. Reports on Financial Provisions

Waterford County Council is responsible for providing annual fees to the Agency for monitoring and inspection of the site. The annual fee for 2008 for monitoring was €23,011 and €19,831 for the licence.

19. Management and Staffing Structure of the Facility

This can be viewed in Appendix J – Management Structure of Waterford County Council.

20. Programme for Public Information

A record of all monitoring results and reports are maintained both at the facility office and within the Environment Section of Waterford County Council at the Civic Offices in Dungarvan Co. Waterford.

21. Reports on Training of Staff

Both the Facility Manager and Deputy Manager have completed the Fás Waste Management Training Course. Site personnel have attended the Fás Safe Pass program, Waste Facility Operative Course and site operatives attended a course in the handling, storage and removal of Waste from the Civic Amenity Site. A Fire Handling and Evacuation Training course was also attended by site caretakers. Courses for 2008 will include manual handling training, Waste Facility Operative Course, and a First Aid Course.

22. Construction and Demolition Waste used in Remediation

Type	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	
Clay on Purchase	0	0	0	0	3446.00	2693.32	
Rock Armour	0.00	0.00	0.00	0.00	0.00	342.10	
Type	**Jul-08**	**Aug-08**	**Sep-08**	**Oct-08**	**Nov-08**	**Dec-08**	**Total**
Clay on Purchase	27713.90	444.34	14951.89	0	0	0	24308.74
Rock Armour	856.90	0	0	0	0	0	1199.00

23. Maintenance Program

Waterford County Council commissioned an electronic Preventative Maintenance Program (PEMAC) which was completed by MJM Technologies Ltd. This Program covers all aspects of site maintenance and include monitoring and reporting, health and safety, maintenance and all training.

APPENDIX A

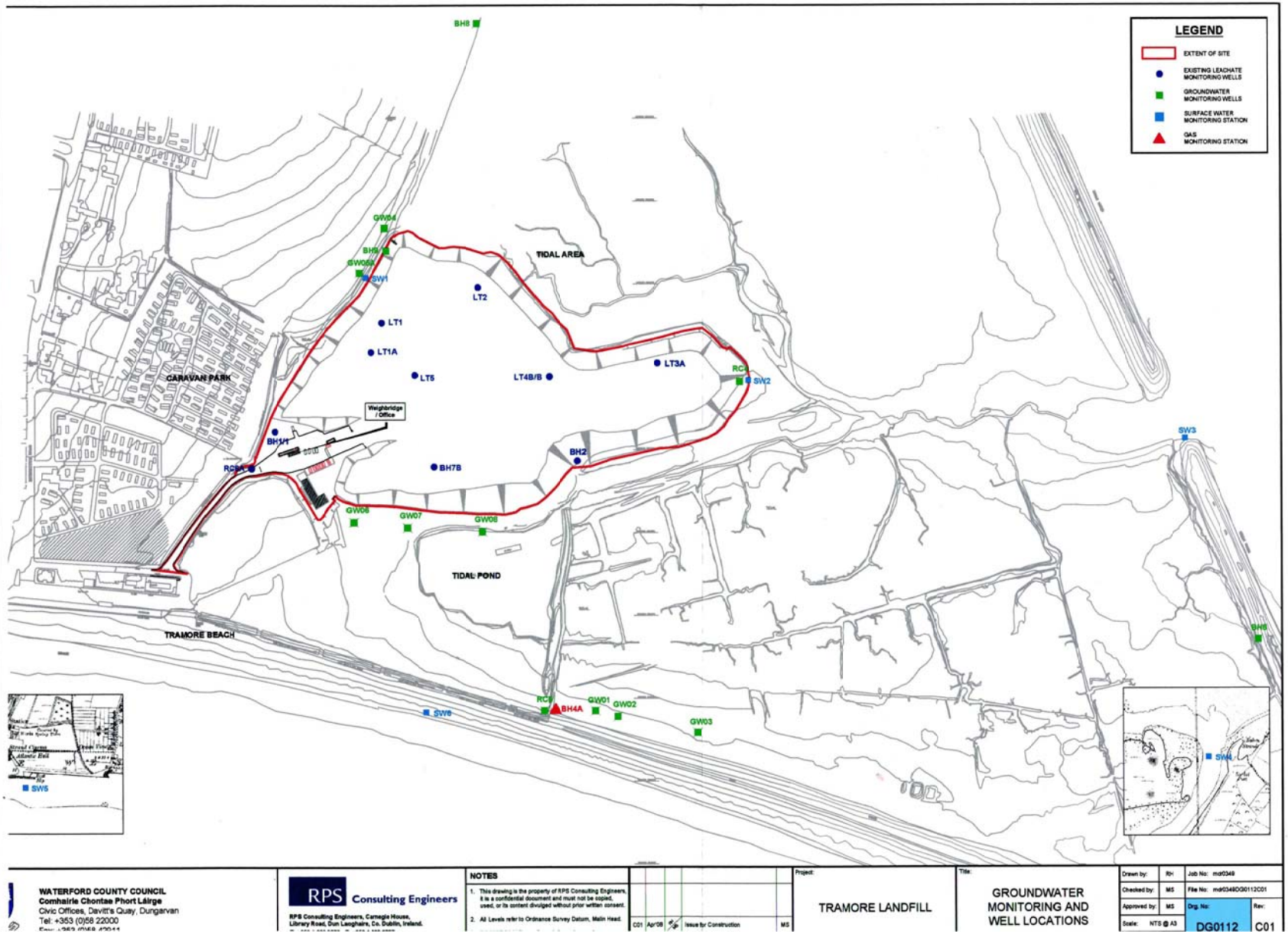
Quantity & Composition of Waste Received, Disposed of & Recovered during the reporting period.

		Tramore Landfill Tonnages 1st Jan 08 - 31 st Dec 08												
Type	EWC Code	Jan-08	Feb-08	Mar-08	Apr-08	May-08	Jun-08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Dec-08	Total
Dry Materials	15 01 01	10.34	5.82	6.82	5.24	4.88	7.08	5.26	4.90	3.60	16.50	4.92	1.12	76.48
Textiles	04 02 22	0.00	0.46	0.64	0.00	0.00	0.12	0.00	0.00	0.10	0.10	0.40	0.06	1.88
Oil	13 02 06	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.00	0.78	0.00	0.00	1.12
weee	16 02 13	3.44	2.20	1.98	0.00	3.78	0.00	3.24	7.86	2.84	2.70	0.00	0.00	28.04
Fridges	16 02 11	0.00	2.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.14
Small Household	16 02 13	0.00	0.00	0.00	0.00	3.22	3.42	0.00	0.00	0.00	0.00	0.00	0.00	6.64
Large Household	16 02 13	4.40	0.00	5.12	0.00	3.90	0.00	0.00	0.00	4.12	0.00	4.00	0.00	21.54
TVs Monitors	16 02 09	0.00	1.50	0.00	3.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.54
Polluted Appliances	16 02 09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Scrap metal	17 04 07	1.64	0.00	3.04	1.82	3.50	1.04	2.74	2.46	1.44	0.00	1.68	0.00	19.36
Domestic Bulky Co Co	20 03 01	7.90	9.54	5.54	8.60	9.24	8.66	8.56	8.30	7.34	7.28	5.30	2.10	88.36
Civic Skip	20 03 99	9.12	4.40	5.36	7.50	7.86	5.20	6.72	5.40	3.52	2.16	3.28	1.34	61.86
Clay		0.00	0.00	0.00	0.00	86.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	86.42
Clay on Purchase		0.00	0.00	0.00	0.00	3446.00	2693.32	2773.19	444.34	14951.89	0.00	0.00	0.00	24308.74
Rubble	17 01 07	0.00	5.94	0.00	10.60	10.72	0.00	10.28	0.00	0.00	0.00	0.00	0.00	37.54
Rock Armour		0.00	0.00	0.00	0.00	0.00	342.10	856.90	0.00	0.00	0.00	0.00	0.00	1199.00
Garden Waste to Dvan	02 01 07	2.38	2.52	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.88	17.78
Timber	17 02 01	5.18	2.56	2.50	4.56	3.22	4.78	3.24	5.38	0.92	2.02	2.76	1.48	38.60
Flat Glass	17 02 02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.28	0.00	0.00	0.00	0.00	3.28
Paint	08 01 21	0.00	0.00	0.00	0.54	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28
Batteries	16 06 01	0.00	0.00	0.00	0.00	0.00	0.00	0.16	0.00	0.00	0.00	0.00	0.00	0.16
Obsolete Medicines		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aerosols	16 05 04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.10
Fluorescent Lamps	16 02 11	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Total Accepted		**44.40**	**37.08**	**31.00**	**42.00**	**3583.48**	**3065.72**	**3670.63**	**481.92**	**14975.77**	**31.64**	**22.34**	**18.98**	**26004.96**

Waste Transfered														
Flat Glass	17 02 02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.28	0.00	0.00	0.00	0.00	3.28
Garden Waste to Dvan	02 01 07	2.40	2.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.88	17.78
Fridges	16 02 11	0.00	2.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.16
Dry Materials	15 01 01	10.42	5.70	6.82	5.26	5.66	6.60	0.00	0.00	4.40	6.38	4.88	1.02	57.14
Textiles	04 02 22	0.00	0.46	0.64	0.00	0.00	0.12	0.00	0.00	0.10	0.10	0.20	0.08	1.70
weee	16 02 13	3.40	2.22	1.98	0.00	3.76	0.00	0.00	0.00	2.84	2.70	0.00	0.00	16.90
Small Household	16 02 13	0.00	0.00	0.00	0.00	3.18	3.30	0.00	0.00	0.00	0.00	0.00	0.00	6.48
Large Household	16 02 13	4.28	0.00	5.12	0.00	3.88	4.34	0.00	0.00	4.12	0.00	4.02	0.00	25.76
TVs Monitors	16 02 09	0.00	1.50	0.00	3.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.54
Domestic Bulky Co Co	20 03 01	7.76	9.52	5.54	8.08	12.10	8.64	0.00	0.00	7.34	7.34	5.32	1.18	72.82
Civic Skip	20 03 99	9.16	4.28	5.36	7.50	6.06	5.10	0.00	0.00	9.62	2.14	3.30	1.34	53.86
Polluted Appliances	16 02 09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Scrapmetal	17 04 07	1.56	0.00	3.04	1.82	3.50	1.14	0.00	0.00	1.46	0.00	1.70	0.00	14.22
Timber	17 02 01	5.20	2.56	2.50	4.48	3.12	4.78	0.00	0.00	0.92	2.02	2.76	1.48	29.82
Rubble	17 01 07	0.00	5.96	0.00	10.60	10.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	27.28
Oil	13 02 06	0.00	0.00	0.00	0.00	0.00	-	0.00	0.00	0.00	0.80	0.00	0.00	0.80
Medicine		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Batteries	16 06 01	0.00	0.00	0.00	0.00	0.00	0.26	0.00	0.00	0.00	0.00	0.00	0.00	0.26
Paint	08 01 21	0.00	0.00	0.00	0.54	0.74	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.28
Aerosols	16 05 04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14	0.00	0.00	0.14
Fluorescent Lamps	16 02 11	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.10
Total Transferred		**44.18**	**36.86**	**31.00**	**41.42**	**52.72**	**34.28**	**0.00**	**3.28**	**30.80**	**21.62**	**22.18**	**17.98**	**336.22**

Appendix B

Monitoring Locations


LEGEND
EXTENT OF SITE
EXISTING LEACHATE MONITORING WELLS
GROUNDWATER MONITORING WELLS
SURFACE WATER MONITORING STATION
GAS MONITORING STATION
BH8
GW04
BH9
GW05
SW1
LT2
TIDAL AREA
LT1
LT1A
LT5
LT4B/B
LT3A
RC3
SW2
CARAVAN PARK
Weighbridge / Office
BH1/1
RC1
BH7B
BH2
SW3
GW06
GW07
GW08
TIDAL POND
TRAMORE BEACH
SW6
RC2
BH4A
GW01
GW02
GW03
BH6
SW4
SW5
WATERFORD COUNTY COUNCIL
Comhairle Chontae Phort Láirge
Civic Offices, Davitt's Quay, Dungarvan
Tel: +353 (0)58 22000
RPS Consulting Engineers
RPS Consulting Engineers, Carnegie House, Library Road, Dun Laoghaire, Co. Dublin, Ireland.
NOTES
1. This drawing is the property of RPS Consulting Engineers. It is a confidential document and must not be copied, used, or its content divulged without prior written consent.
2. All Levels refer to Ordnance Survey Datum, Malin Head.
C01 Apr'08 Issue for Construction MS
Project:
TRAMORE LANDFILL
Title:
GROUNDWATER MONITORING AND WELL LOCATIONS
Drawn by: RH
Job No: md0349
Checked by: MS
File No: md0349DG0112C01
Approved by: MS
Drg. No: DG0112
Rev: C01
Scale: NTS @ A3

Appendix C

Surface Water Results

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	16/06/08

Facility:	**Tramore Waste Disposal Site** Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No:	W0075-01

Date collected:	02/04/2008	Date received:	02/04/2008

			Laboratory Ref:	2801694	2801695	2801696	2801697	2801698	2801699	
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	
			Location code:	WST-W0075-01-SW1	WST-W0075-01-SW2	WST-W0075-01-SW3	WST-W0075-01-SW4	WST-W0075-01-SW5	WST-W0075-01-SW6	
			Sampling point:	no sample	Clear sample	Clear sample	Clear sample	Clear sample	Clear sample	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	nm	15:40	14:42	16:30	13:55	14:12	
			Start/End - Dates of Analysis:	/						
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
F	Temperature	°C		-	13.4	15.8	13.5	12.7	14.5	
F	Dissolved Oxygen	% Saturation		-	106.7	160.2	137.5	109.1	109.6	
	pH	pH		-	8.0	8.3	8.3	8.0	8.1	
	Salinity	‰		-	29.9	27.3	28.8	31.2	31.2	
	Ammonia	mg/l N		-	0.33	0.09	0.016	0.016	0.023	
	Chloride	mg/l Cl		-	697	699	696	696	697	
	Biochemical Oxygen Demand	mg/l O2		-	0.9	2.7	1.1	0.4	0.3	
	Suspended Solids	mg/l		-	43	80	70	nr	nr	
	Total coliforms	No/100 ml		-	76	365	96	nr	12	
	E Coli	per 100ml		-	1	3	5	nr	0	
	Aluminium	ug/l		-	<250	<250	<250	<250	<250	
	Antimony	ug/l		-	<50	<50	<50	<50	<50	
	Arsenic	ug/l		-	<50	<50	52.5	55.3	54.5	
	Barium	ug/l		-	<300	<300	<300	<300	<300	
	Beryllium	ug/l		-	<50	<50	<50	<50	<50	
	Boron	ug/l		-	2296	2979	1968	2076	2257	
	Cadmium	ug/l		-	<50	<50	<50	<50	<50	
	Calcium	mg/l		-	256	356	367	355	322	
	Chromium	ug/l		-	<50	<50	<50	<50	<50	
	Cobalt	ug/l		-	<50	<50	<50	<50	<50	
	Copper	ug/l		-	145	163	219	244	251	
	Iron	ug/l		-	<500	<500	<500	<500	<500	
	Lead	ug/l		-	<50	<50	<50	<50	<50	

		Laboratory Ref:	2 394	2801695	2801696	280	2801698	2801699	
		Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	
		Location code:	WST-W0075-01-SW1	WST-W0075-01-SW2	WST-W0075-01-SW3	WST-W0075-01-SW4	WST-W0075-01-SW5	WST-W0075-01-SW6	
		Sampling point:	no sample	Clear sample	Clear sample	Clear sample	Clear sample	Clear sample	
		Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
		Time Sampled:	nm	15:40	14:42	16:30	13:55	14:12	
		Start/End - Dates of Analysis:							
		Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**						
	Magnesium	mg/l		-	754	681	709	1155	1057	
	Manganese	ug/l		-	<500	<500	<500	<500	<500	
	Molybdenum	ug/l		-	<50	<50	<50	<50	<50	
	Nickel	ug/l		-	<50	<50	<50	<50	<50	
	Potassium	mg/l		-	233	346	352	351	314	
	Selenium	ug/l		-	94	143	167	178	177	
	Silver	ug/l		-	<50	<50	<50	<50	<50	
	Sodium	mg/l		-	8058	7198	7456	7760	7801	
	Thallium	ug/l		-	<50	<50	<50	<50	<50	
	Thorium	ug/l		-	nm	nm	nm	nm	nm	
	Tin	ug/l		-	<100	<100	<100	<100	<100	
	Uranium	ug/l		-	<50	<50	<50	<50	<50	
	Vanadium	ug/l		-	53.5	51.9	60.4	64	63.7	
	Zinc	ug/l		-	<300	<300	<300	<300	<300	

Comments: COD analysis was not carried out due to the high saline concentrations causing interference with the test method. Salinity results are given instead on conductivity results.

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA, Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: _____ Date: 16/6/08

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 16/06/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Sampling location: **WST-W0075-01-SW1, Tramore Landfill Site - W0075-01 -- SW1 - Surface Water Monitoring Point**

Date collected: 03/04/2008 Date received: 03/04/2008

			Laboratory Ref:	2801737
			Type of sample:	Surface Water
			Sampling point:	Clear sample
			Sampled by:	Jim McGarry
			Time Sampled:	13:55
			Start/End - Dates of Analysis:	
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
F	Temperature	°C		18.2
F	Dissolved Oxygen	% Saturation		116.3
	pH	pH		8.0
	Conductivity	µS/cm		3810
	Salinity	‰		1.9
	Ammonia	mg/l N		1.8
	Chloride	mg/l Cl		386
	Biochemical Oxygen Demand	mg/l O2		1.8
	Chemical Oxygen Demand	mg/l O2		52
	Suspended Solids	mg/l		30
	Total coliforms	No/100 ml		>2419
	E Coli	per 100ml		>2419
	Aluminium	ug/l		<250
	Antimony	ug/l		<50
	Arsenic	ug/l		<50
	Barium	ug/l		<300
	Beryllium	ug/l		<50
	Boron	ug/l		<500
	Cadmium	ug/l		<50
	Calcium	mg/l		82
	Chromium	ug/l		<50

			Laboratory Ref:	2801737
			Type of sample:	Surface Water
			Sampling point:	Clear sample
			Sampled by:	Jim McGarry
			Time Sampled:	13:55
			Start/End - Dates of Analysis:	
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
	Cobalt	ug/l		<50
	Copper	ug/l		<50
	Iron	ug/l		<500
	Lead	ug/l		<50
	Magnesium	mg/l		51.6
	Manganese	ug/l		<500
	Molybdenum	ug/l		<50
	Nickel	ug/l		<50
	Potassium	mg/l		<50
	Selenium	ug/l		<50
	Silver	ug/l		<50
	Sodium	mg/l		517
	Thallium	ug/l		<50
	Thorium	ug/l		nm
	Tin	ug/l		<100
	Uranium	ug/l		<50
	Vanadium	ug/l		<50
	Zinc	ug/l		<300

Comments:

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Date: 16/6/08

Michael Neill, Regional Chemist

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: EPA (Kilkenny)

Seville Lodge
Callan Road
Kilkenny

Attention: Jean Smith

Date: 8 May, 2008

Our Reference: 08-B02544/01

Your Reference: 75/2

Location:

A total of 9 samples was received for analysis on Monday, 28 April 2008 and authorised on Thursday, 8 May 2008. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Lorraine Mc Namara

Lorraine McNamara
Laboratory Technical Manager

Compiled By Paul Barry

Paul Barry

UKAS TESTING 1291

Printed at 10:15 on 09/05/2008

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 08-B02544/01
Client: EPA (Kilkenny)
Date of Receipt: 28/04/2008

Sample Type: WATER
Location:
Client Contact: Jean Smith
Client Ref: 75/2

Detection Method				HPLC													
UKAS Accredited [Testing Laboratory] No. 1291																	
ALcontrol Reference	Sample Identity	Other ID	P / V	Speciated Phenols by HPLC													
08-B02544-S0022-A01	BH8-1740	UNKNOWN	Glass Bottle + NaOH	X													
08-B02544-S0023-A01	BH9-1741	UNKNOWN	Glass Bottle + NaOH	X													
08-B02544-S0024-A01	BH1/1-1700	UNKNOWN	Glass Bottle + NaOH	X													
08-B02544-S0025-A01	BH5-1739	UNKNOWN	Glass Bottle + NaOH	X													
08-B02544-S0026-A01	GW5A-1748	UNKNOWN	Glass Bottle + NaOH	X													
08-B02544-S0027-A01	RC5A-1738	UNKNOWN	Glass Bottle + NaOH	X													
08-B02544-S0028-A01	RC4-1702	UNKNOWN	Glass Bottle + NaOH	X													
08-B02544-S0029-A01	GW1-1744	UNKNOWN	Glass Bottle + NaOH	X													
08-B02544-S0030-A01	BLANK	UNKNOWN	Glass Bottle + NaOH	X													

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number: 08-B02544/01
Client: EPA (Kilkenny)
Date of Receipt: 28/04/2008

Sample Type: WATER
Location:
Client Contact: Jean Smith
Client Ref: 75/2

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	HPLC	Speciated Phenols by HPLC	9

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 08-B02544/01
Client: EPA (Kilkenny)
Date of Receipt: 28/04/2008
(of first sample)

Sample Type: WATER
Location:
Client Contact: Jean Smith
Client Ref: 75/2

	Detection Method	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC
	Method Detection Limit	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l
UKAS Accredited [Testing Laboratory] No. 1291										
ALcontrol Reference	Sample Identity	Other ID	1 Naphthol	2- Isopropyl Phenol	2,3,5 -Trimethyl Phenol	Catechol	Phenol	Resorcinol	Total Cresols	Total Phenols	Total Xylenols
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
08-B02544-S0022	BH8-1740	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
08-B02544-S0023	BH9-1741	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
08-B02544-S0024	BHI/1-1700	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01
08-B02544-S0025	BH5-1739	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
08-B02544-S0026	GW5A-1748	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
08-B02544-S0027	RC6A-1738	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
08-B02544-S0028	RC4-1702	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
08-B02544-S0029	GW1-1744	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
08-B02544-S0030	BLANK	UNKNOWN	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Paul Barry

Printed at 10:15 on 09/05/2008

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide, SVOC, DRO, PAH, PCB, TPH CWG ,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, In this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK . If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005

☑ Interim

☐ Validated

ALcontrol Laboratories Irel. d

Table Of Results

Ref Number: 08-B04370/01

Client: EPA (Kilkenny)

Date of Receipt: 18/07/2008

(of first sample)

Sample Type: WATER

Location:

Client Contact: Jean Smith

Client Ref: 75/2

	Detection Method	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	SPECTRO
	Method Detection Limit	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.05mg/l
UKAS Accredited [Testing Laboratory] No. 1291		✓	✓	✓	✓	✓	✓	✓	
ALcontrol Reference	Sample Identity	Other ID	2- Isopropyl Phenol**	Catechol**	Naphthol**	Phenol**	Resorcinol**	Total Cresols**	Total Phenols**	Total Cyanide
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
08-B04370-S0001	BLANK	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0002	BH2-2941	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0003	RC4	2942.00	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0004	LT3	2943.00	-	-	-	-	-	-	-	<0.05
08-B04370-S0005	BH1/1-2998	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0006	RC6-2999	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0007	BH8-3001	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0008	BH9-3002	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0009	RC5-3004	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0010	GW2-3006	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0011	GW5A-3009	UNKNOWN	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.05
08-B04370-S0012	LT1-3011	UNKNOWN	-	-	-	-	-	-	-	<0.05
08-B04370-S0013	LT2-3012	UNKNOWN	-	-	-	-	-	-	-	<0.05

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL. **NDP** = NO DETERMINATION POSSIBLE

THE DATA ON THIS PRELIMINARY REPORT IS NOT VALIDATED AND MAY BE SUBJECT TO CHANGE.

Checked By : Paul Barry

Printed at 10:31 on 18/08/2008 * SUBCONTRACTED T ITHER LABORATORY / ** SAMPLES ANALYSED AT THE ESTER LABORATORY

			Laboratory Ref	2802936	2802937	1938	2802939	2802940
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0075-01-SW2	WST-W0075-01-SW3	WST-W0075-01-SW4	WST-W0075-01-SW5	WST-W0075-01-SW6
			Sampling point:	Clear sample - low tide	Clear sample	Clear sample	Clear sample	Clear sample
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	14:50	16:35	17:15	14:10	14:30
			Start/End - Dates of Analysis:					
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
	Calcium	mg/l		441	436	434	435	428
	Chromium	ug/l		41.4	38	38.2	36.8	36.8
	Cobalt	ug/l		<20	<20	<20	<20	<20
	Copper	ug/l		151	150	154	146	143
	Iron	ug/l		<1000	<1000	<1000	<1000	<1000
	Lead	ug/l		<20	<20	<20	<20	<20
	Magnesium	mg/l		1162	1068	1073	1066	1034
	Manganese	ug/l		<1000	<1000	<1000	<1000	<1000
	Mercury	ug/l		<5	<5	<5	<5	<5
	Molybdenum	ug/l		<20	<20	<20	<20	<20
	Nickel	ug/l		<20	<20	<20	<20	<20
	Potassium	mg/l		414	390	400	399	394
	Selenium	ug/l		218	202	213	106	205
	Silver	ug/l		<20	<20	<20	<20	<20
	Sodium	mg/l		10510	9786	9896	9748	9550
	Thallium	ug/l		<20	<20	<20	<20	<20
	Tin	ug/l		<40	<40	<40	<40	<40
	Uranium	ug/l		<20	<20	<20	<20	<20
	Vanadium	ug/l		80.4	78	80.2	78	78.8
	Zinc	ug/l		<120	<120	<120	<120	<120

			Laboratory Ref:	2805161	2805162	2805163	2805164	2805165
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0075-01-SW1	WST-W0075-01-SW2	WST-W0075-01-SW3	WST-W0075-01-SW5	WST-W0075-01-SW6
			Sampling point:	Clear sample	Clear sample	Clear sample	Clear sample	Clear sample
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	13:55	12:43	15:25	14:55	14:20
			Start/End - Dates of Analysis:					
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
	Lead	ug/l		<5	<5	<5	<5	<5
	Magnesium	mg/l		255	1140	847	1210	121
	Manganese	ug/l		301	<250	<250	<250	<250
	Molybdenum	ug/l		<5	17.3	14.2	17	7
	Nickel	ug/l		<5	<5	<5	<5	<5
	Potassium	mg/l		117	396	303	398	62.1
	Selenium	ug/l		<5	156	111	161	<5
	Sodium	mg/l		2590	1470	7010	10300	1070
	Thallium	ug/l		<5	<5	<5	<5	<5
	Tin	ug/l		49.8	108	107	107	106
	Uranium	ug/l		<5	6.4	5.6	6.4	<5
	Vanadium	ug/l		<5	66.9	59.7	71.8	25.2
	Zinc	ug/l		<100	<100	<100	<100	<100

Comments: COD was not carried as the high salinity of the samples causes interference with the test method. Insufficient sample volume in sample SW6 to carry out suspended solids analysis.

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Date: 14/1/09

Michael Neill, Regional Chemist

ALcontrol Laboratories (Dublin)

18a Rosemount Business Park,
Ballycoolin,
Dublin 11
Ireland
Tel: +353 (0) 1 8829893
Fax: +353 (0) 1 8829895

CERTIFICATE OF ANALYSIS

Client: EPA (Kilkenny)

Seville Lodge
Callan Road
Kilkenny

Attention: Jean Smith

Date: 11 November, 2008

Our Reference: 08-B06318/01

Your Reference: 75/2

Location:

A total of 12 samples was received for analysis on Monday, 3 November 2008. Accredited laboratory tests are defined in the log sheet, but opinions, interpretations and on-site data expressed herein are outside the scope of ISO 17025 accreditation. We are pleased to enclose our final report, it was a pleasure to be of service to you, and we look forward to our continuing association.

Should this report require incorporation into client reports, it must be used in its entirety and not simply with the data sections alone.

Signed

Dylan Halpin

Lorraine McNamara

Dylan Halpin
Team Leader Project Co-ordination

Lorraine McNamara
General Manager

Compiled By

Dylan Halpin

Dylan Halpin

UKAS TESTING
1291
GROUP

Printed at 14:41 on 13/11/2008

ALcontrol Laboratories Ireland

Test Schedule

Ref Number: 08-B06318/01

Client: EPA (Kilkenny)

Date of Receipt: 03/11/2008

Sample Type: WATER

Location:

Client Contact: Jean Smith

Client Ref: 75/2

Detection Method				HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC					
UKAS Accredited [Testing Laboratory] No. 1291																	
ALcontrol Reference	Sample Identity	Other ID	P / V	1 Naphthol	2- Isopropyl Phenol	2,3,5 -Trimethyl Phenol	Catechol	Phenol	Resorcinol	Total Cresols	Total Phenols	Total Xylenols					
08-B06318-S0005-A01	BH1/1 5166	06/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0006-A01	RC6a - 5167	06/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0007-A01	BH9 - 5168	06/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0008-A01	RC4 - 5169	06/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0009-A01	Blank	06/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0010-A01	Blank	20/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0011-A01	BH2 - 5495	20/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0012-A01	BH5 - 5496	20/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0013-A01	BH8 - 5497	20/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0014-A01	RC5 - 5499	20/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0015-A01	GW2 - 5501	20/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					
08-B06318-S0016-A01	GW5 - 5504	20/10/2008	Glass Bottle + NaOH	X	X	X	X	X	X	X	X	X					

Notes : NUMERIC VALUES INDICATE ADDITIONAL SCHEDULING

ALcontrol Laboratories Ireland

Test Schedule Summary

Ref Number: 08-B06318/01
Client: EPA (Kilkenny)
Date of Receipt: 03/11/2008

Sample Type: WATER
Location:
Client Contact: Jean Smith
Client Ref: 75/2

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

SCHEDULE	METHOD	TEST NAME	TOTAL
X	HPLC	Speciated Phenols by HPLC	12

☐ Interim
☑ Validated

ALcontrol Laboratories Ireland

Table Of Results

Ref Number: 08-B06318/01
Client: EPA (Kilkenny)
Date of Receipt: 03/11/2008
(of first sample)

Sample Type: WATER
Location:
Client Contact: Jean Smith
Client Ref: 75/2

	Detection Method		HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC	HPLC
	Method Detection Limit		<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l	<0.01mg/l
UKAS Accredited [Testing Laboratory] No. 1291											
ALcontrol Reference	Sample Identity	Other ID	1 Naphthol	2- Isopropyl Phenol	2,3,5 -Trimethyl Phenol	Catechol	Phenol	Resorcinol	Total Cresols	Total Phenols	Total Xylenols
			mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
08-B06318-S0005	BH1/1 5166	06/10/2008	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	0.04	<0.01
08-B06318-S0006	RC6a - 5167	06/10/2008	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
08-B06318-S0007	BH9 - 5168	06/10/2008	<0.01	<0.01	<0.01	<0.01	0.04	<0.01	<0.01	0.04	<0.01
08-B06318-S0008	RC4 - 5169	06/10/2008	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
08-B06318-S0009	Blank	06/10/2008	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
08-B06318-S0010	Blank	20/10/2008	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	0.03	<0.01
08-B06318-S0011	BH2 - 5495	20/10/2008	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	0.03	<0.01
08-B06318-S0012	BH5 - 5496	20/10/2008	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
08-B06318-S0013	BH8 - 5497	20/10/2008	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
08-B06318-S0014	RC5 - 5499	20/10/2008	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.01	<0.01
08-B06318-S0015	GW2 - 5501	20/10/2008	<0.01	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.02	<0.01
08-B06318-S0016	GW5 - 5504	20/10/2008	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	0.03	<0.01

Notes : METHOD DETECTION LIMITS ARE NOT ALWAYS ACHIEVABLE DUE TO VARIOUS CIRCUMSTANCES BEYOND OUR CONTROL.

NDP = NO DETERMINATION POSSIBLE

Checked By : Dylan Halpin

Printed at 14:41 on 13/11/2008

* SUBCONTRACTED TO OTHER LABORATORY / ** SAMPLES ANALYSED AT THE CHESTER LABORATORY

APPENDIX

1. Results are expressed as mg/kg dry weight (dried at 30°C) on all soil analyses except for the following: NRA Leach tests, flash point, and ammoniacal N_2 by the BRE method, VOC, PRO, Cyanide, Acid Soluble Sulphide,TPH by IR, OFGs and SEM.

2. Samples will be run in duplicate upon request, but an additional charge may be incurred.

3. A sub sample of all samples received will be retained free of charge for one month for soils and one month for waters (sample size permitting), but may then be discarded unless we are instructed to the contrary. Once the initial period has expired, a storage charge will be applied for each month or part thereof until the client cancels the request for sample storage.

4. With respect to turnaround, we will always endeavour to meet client requirements wherever possible, but turnaround times cannot be absolutely guaranteed due to so many variables beyond our control.

5. We take responsibility for any test performed by sub-contractors (marked with an asterisk). We endeavour to use UKAS Accredited Laboratories, who either complete a quality questionnaire or are audited by ourselves. For some determinands there are no UKAS Accredited Laboratories, in this instance a laboratory with a known track record will be utilised.

6. When requested, an asbestos screen is done in-house on soils and if no fibres are found will be reported as NFD – no fibres detected. If fibres are detected, then identification and quantification is carried out by ALcontrol Technichem or Alcontrol Shutlers in the UK . If a sample is suspected of containing asbestos, then drying and crushing will be suspended on that sample until the asbestos results are known. If asbestos is present, then no analysis requiring dry sample are undertaken.

7. If no separate volatile sample is supplied by the client, the integrity of the data may be compromised if the laboratory is required to create a sub-sample from the bulk sample – similarly, if a headspace is present in the volatile sample.

8. NDP – No Determination Possible due to insufficient/unsuitable sample.

9. Metals in water are performed on a filtered sample, and therefore represent dissolved metals – total metals must be requested separately.

10. A table containing the date of analysis for each parameter is not routinely included with the report, but is available upon request.

Last updated February 2005

Appendix D

Ground Water Results

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 16/06/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Sampling location: **WST-W0075-01-BH1/1, Tramore landfill site - W0075-01 -- BH1/1 - Groundwater/Leachate monitoring point**

Date collected: 02/04/2008 Date received: 02/04/2008

			Laboratory Ref:	2801700
			Type of sample:	Groundwater
			Sampling point:	Clear sample
			Sampled by:	Jim McGarry
			Time Sampled:	15:58
			Start/End - Dates of Analysis:	
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
F	Depth of Borehole	m		4
F	Water Level	m		2.6
F	Temperature	°C		10.0
F	Dissolved Oxygen	% Saturation		9.1
	pH	pH		6.9
	Conductivity	µS/cm		1470
	Ammonia	mg/l N		18
	Chloride	mg/l Cl		156
	Nitrite	mg/l N		<0.001
	Ortho-Phosphate	mg/l P		0.22
	Total Oxidised Nitrogen	mg/l N		<0.1
	Chemical Oxygen Demand	mg/l O2		30
	Biochemical Oxygen Demand	mg/l O2		0.9
	Total Organic Carbon	mg/l C		nm
	Total coliforms	No/100 ml		150
	E Coli	per 100ml		0
	Aluminium	ug/l		<250
	Antimony	ug/l		<50
	Arsenic	ug/l		<50
	Barium	ug/l		<300
	Beryllium	ug/l		<50

			Laboratory Ref:	2801700
			Type of sample:	Groundwater
			Sampling point:	Clear sample
			Sampled by:	Jim McGarry
			Time Sampled:	15:58
			Start/End - Dates of Analysis:	
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
	Boron	ug/l		<500
	Cadmium	ug/l		<50
	Calcium	mg/l		112
	Chromium	ug/l		<50
	Cobalt	ug/l		<50
	Copper	ug/l		<50
	Iron	ug/l		3840
	Lead	ug/l		<50
	Magnesium	mg/l		<50
	Manganese	ug/l		607
	Molybdenum	ug/l		<50
	Nickel	ug/l		<50
	Potassium	mg/l		<50
	Selenium	ug/l		<50
	Silver	ug/l		<50
	Sodium	mg/l		99.2
	Thallium	ug/l		<50
	Thorium	ug/l		nm
	Tin	ug/l		<100
	Uranium	ug/l		<50
	Vanadium	ug/l		<50
	Zinc	ug/l		<300

Comments:

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: _____ Date: 16/6/08

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 16/06/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Date collected: 02/04/2008 Date received: 02/04/2008

			Laboratory Ref:	2801701	2801702	
			Type of sample:	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	
			Sampling point:	Borehole under construction	Clear sample	
			Sampled by:	Jim McGarry	Jim McGarry	
			Time Sampled:	12:50	12:15	
			Start/End - Dates of Analysis:	/		
			Status of results:	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**			
F	Depth of Borehole	m		-	16	
F	Water Level	m		-	12.5	
F	Temperature	°C		-	13.2	
F	Dissolved Oxygen	% Saturation		-	32.2	
	pH	pH		-	7.1	
	Salinity	‰		-	33.0	
	nmonia	mg/l N		-	4.7	
	Chloride	mg/l Cl		-	>700	
	Total Oxidised Nitrogen	mg/l N		-	<0.1	
	Total Organic Carbon	mg/l C		-	3.2	
	Total coliforms	No/100 ml		-	0	
	E Coli	per 100ml		-	0	
	Aluminium	ug/l		-	<250	
	Antimony	ug/l		-	<50	
	Arsenic	ug/l		-	55	
	Barium	ug/l		-	<300	
	Beryllium	ug/l		-	<50	
	Boron	ug/l		-	3686	
	Cadmium	ug/l		-	<50	
	Calcium	mg/l		-	409	
	Chromium	ug/l		-	<50	
	Cobalt	ug/l		-	<50	
	Copper	ug/l		-	258	
	Iron	ug/l		-	1059	

		Laboratory Ref:	2801701	2801702	
		Type of sample:	Groundwater	Groundwater	
		Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	
		Sampling point:	Borehole under construction	Clear sample	
		Sampled by:	Jim McGarry	Jim McGarry	
		Time Sampled:	12:50	12:15	
		Start/End - Dates of Analysis:	/		
		Status of results:	**Final Report**	**Final Report**	
Parameter	**Units**	**Limits**			
Lead	ug/l		-	<50	
Msgnesium	mg/l		-	998	
Manganese	ug/l		-	5392	
Molybdenum	ug/l		-	<50	
Nickel	ug/l		-	<50	
Potassium	mg/l		-	309	
Selenium	ug/l		-	174	
Silver	ug/l		-	<50	
Sodium	mg/l		-	11969	
Thallium	ug/l		-	<50	
Thorium	ug/l		-	nm	
Tin	ug/l		-	<100	
Uranium	ug/l		-	<50	
Vanadium	ug/l		-	57.8	
Zinc	ug/l		-	<300	

Comments: The sampling pump could not be mounted on borehole RC4.

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory,
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: [signature] Date: 16/6/08

pp Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	16/06/08

Facility:	**Tramore Waste Disposal Site** Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No:	W0075-01

Date collected:	03/04/2008	Date received:	03/04/2008

			Laboratory Ref:	2801739	2801740	2801741	2801742	2801743
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH8	WST-W0075-01-BH9	WST-W0075-01-BH10	WST-W0075-01-RC5
			Sampling point:	Clear sample	Light brown colour	Brown colour	discontinued	no sample - unable to access the borehole
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	15:15	14:49	14:10	nm	16:00
			Start/End - Dates of Analysis:				/	/
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report
Parameter		Units	Limits					
F	Depth of Borehole	m		4.4	7.2	6	-	-
F	Water Level	m		nm	5.2	5.4	-	-
F	Temperature	°C		11.3	11.9	12.7	-	-
F	Dissolved Oxygen	% Saturation		97.8	16.8	13.7	-	-
	pH	pH		7.7	7.6	7.4	-	-
	Conductivity	µS/cm		48700	4310	1096	-	-
	Salinity	‰		30.7	2.2	-	-	-
	Ammonia	mg/l N		0.7	0.18	0.19	-	-
	Chloride	mg/l Cl		659	409	149	-	-
	Nitrite	mg/l N		0.003	<0.001	0.006	-	-
	Ortho-Phosphate	mg/l P		0.075	0.006	0.006	-	-
	Total Oxidised Nitrogen	mg/l N		1.1	0.2	0.1	-	-
	Total Organic Carbon	mg/l C		2.6	1.9	1.5	-	-
	Total coliforms	No/100 ml		3106	1	4	-	-
	E Coli	per 100ml		0	0	1	-	-
	Aluminium	ug/l		<250	<250	<250	-	-
	Antimony	ug/l		<50	<50	<50	-	-
	Arsenic	ug/l		53.6	<50	<50	-	-
	Barium	ug/l		<300	<300	<300	-	-
	Beryllium	ug/l		<50	<50	<50	-	-
	Boron	ug/l		2266	<500	<500	-	-
	Cadmium	ug/l		<50	<50	<50	-	-
	Calcium	mg/l		339	117	<50	-	-

			Laboratory Ref:	2801739	2801740	2801741	2801742	2801743
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH8	WST-W0075-01-BH9	WST-W0075-01-BH10	WST-W0075-01-RC5
			Sampling point:	Clear sample	Light brown colour	Brown colour	discontinued	no sample - unable to access the borehole
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	15:16	14:49	14:10	nm	16:00
			Start/End - Dates of Analysis:				/	/
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
	Chromium	ug/l		<50	<50	<50	-	-
	Cobalt	ug/l		<50	<50	<50	-	-
	Copper	ug/l		226	<50	<50	-	-
	Iron	ug/l		<500	<500	<500	-	-
	Lead	ug/l		<50	<50	<50	-	-
	Magnesium	mg/l		890	57	<50	-	-
	Manganese	ug/l		<500	<500	619	-	-
	Molybdenum	ug/l		<50	<50	<50	-	-
	Nickel	ug/l		<50	<50	<50	-	-
	Potassium	mg/l		291	<50	<50	-	-
	Selenium	ug/l		167	<50	<50	-	-
	Silver	ug/l		<50	<50	<50	-	-
	Sodium	mg/l		8113	530	105	-	-
	Thallium	ug/l		<50	<50	<50	-	-
	Thorium	ug/l		nm	nm	nm	-	-
	Tin	ug/l		<100	<100	<100	-	-
	Uranium	ug/l		<50	<50	<50	-	-
	Vanadium	ug/l		53.5	<50	<50	-	-
	Zinc	ug/l		<300	<300	<50	-	-

Comments:

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: _____ Date: 18/6/08

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	16/06/08

Facility:	**Tramore Waste Disposal Site** Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No:	W0075-01

Date collected:	03/04/2008	Date received:	03/04/2008

			Laboratory Ref:	2801744	2801745	2801746	2801747	2801748
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	WST-W0075-01-GW4	WST-W0075-01-GW5
			Sampling point:	Grey, muddy sample	no sample	no sample	no sample	GW5a - muddy sample
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	16:00	15:26	15:30	13:49	14:28
			Start/End - Dates of Analysis:	/	/	/	/	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report
Parameter		Units	Limits					
F	Depth of Borehole	m		6.3	-	-	-	4.3
F	Water Level	m		4.6	-	-	-	2.7
F	Temperature	°C		11.5	-	-	-	11.4
F	Dissolved Oxygen	% Saturation		58.0	-	-	-	93.9
	pH	pH		7.7	-	-	-	7.9
	Conductivity	µS/cm		17420	-	-	-	921
	Salinity	‰		10.1	-	-	-	-
	Ammonia	mg/l N		0.59	-	-	-	0.11
	Chloride	mg/l Cl		596	-	-	-	100
	Nitrite	mg/l N		0.027	-	-	-	<0.001
	Ortho-Phosphate	mg/l P		0.053	-	-	-	<0.006
	Total Oxidised Nitrogen	mg/l N		0.5	-	-	-	nr
	Total Organic Carbon	mg/l C		16.6	-	-	-	2.5
	Total coliforms	No/100 ml		>2419	-	-	-	1
	E Coli	per 100ml		0	-	-	-	0
	Aluminium	ug/l		<250	-	-	-	<250
	Antimony	ug/l		<50	-	-	-	<50
	Arsenic	ug/l		<50	-	-	-	<50
	Barium	ug/l		<300	-	-	-	<300
	Beryllium	ug/l		<50	-	-	-	<50
	Boron	ug/l		667	-	-	-	<500
	Cadmium	ug/l		<50	-	-	-	<50
	Calcium	mg/l		145	-	-	-	58.3

			Laboratory Ref:	2801744	2801745	2 '46	2801747	2801748
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	WST-W0075-01-GW4	WST-W0075-01-GW5
			Sampling point:	Grey, muddy sample	no sample	no sample	no sample	GW5a - muddy sample
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	16:00	15:25	15:30	13:49	14:28
			Start/End - Dates of Analysis:	/	/	/	/	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		Units	Limits					
	Chromium	ug/l		<50	-	-	-	<50
	Cobalt	ug/l		<50	-	-	-	<50
	Copper	ug/l		58.5	-	-	-	<50
	Iron	ug/l		<500	-	-	-	<500
	Lead	ug/l		<50	-	-	-	<50
	Magnesium	mg/l		209	-	-	-	<50
	Manganese	ug/l		<500	-	-	-	848
	Molybdenum	ug/l		<50	-	-	-	<50
	Nickel	ug/l		<50	-	-	-	<50
	Potassium	mg/l		70.9	-	-	-	<50
	Selenium	ug/l		<50	-	-	-	<50
	Silver	ug/l		<50	-	-	-	<50
	Sodium	mg/l		2854	-	-	-	74.6
	Thallium	ug/l		<50	-	-	-	<50
	Thorium	ug/l		nm	-	-	-	nm
	Tin	ug/l		<100	-	-	-	<100
	Uranium	ug/l		<50	-	-	-	<50
	Vanadium	ug/l		<50	-	-	-	<50
	Zinc	ug/l		<300	-	-	-	<300

Comments: No footvalve/tubing present in boreholes GW2, GW3 and GW4.

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Date: 16/6/08

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 07/08/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Date collected: 10/06/2008 Date received: 10/06/2008

			Laboratory Ref:	2802941	2802942	
			Type of sample:	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	
			Sampling point:	Clear with a lot of sediment	Clear with sediment	
			Sampled by:	Jim McGarry	Jim McGarry	
			Time Sampled:	15:55	15:15	
			Start/End - Dates of Analysis:			
			Status of results:	**Final Report**	**Final Report**	
	Parameter	**Units**	**Limits**			
F	Depth of Borehole	m		6.9	16	
F	Water Level	m		3.4	12.5	
F	Temperature	°C		15.6	15.3	
F	Dissolved Oxygen (as %Sat)	% Saturation		4.2	21.8	
	pH	pH		7.3	7.4	
	Conductivity @25°C	µS/cm		8230	nm	
	Salinity	‰		4.5	33.0	
	Ammonia	mg/l N		150	5.1	
	Chloride	mg/l Cl		456	nr	
	Nitrite (as N)	mg/l N		<0.001	<0.001	
	ortho-Phosphate (as P)	mg/l P		<0.006	<0.006	
	Total Oxidised Nitrogen (as N)	mg/l N		<0.1	<0.1	
	Fluoride	mg/l F		1.57	3.4	
	Sulphate	mg/l SO4		72.3	1442.1	
	Total Organic Carbon	mg/l C		33.0	3.9	
	Total coliforms	No/100 ml		>2419	0	
	E Coli	per 100ml		0	0	
	1,1,1,2-Tetrachloroethane	µg/l		<0.5	<0.5	
	1,1,1-Trichloroethane	µg/l		<0.5	<0.5	
	1,1,2,2-Tetrachloroethane	µg/l		<0.5	<0.5	
	1,1,2-Trichloroethane	µg/l		<0.5	<0.5	
	1,1-Dichloroethane	µg/l		<0.5	<0.5	
	1,1-Dichloroethene	µg/l		<0.5	<0.5	
	1,1-Dichloropropene	µg/l		<0.5	<0.5	

		Laboratory Ref:	2802941	2802942	
		Type of sample:	Groundwater	Groundwater	
		Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	
		Sampling point:	Clear with a lot of sediment	Clear with sediment	
		Sampled by:	Jim McGarry	Jim McGarry	
		Time Sampled:	15:55	15:15	
		Start/End - Dates of Analysis:			
		Status of results:	**Final Report**	**Final Report**	
Parameter	**Units**	**Limits**			
1,2,3-Trichlorobenzene	µg/l		<0.5	<0.5	
1,2,3-Trichloropropane	µg/l		<0.5	<0.5	
1,2,4-Trichlorobenzene	µg/l		<0.5	<0.5	
1,2,4-Trimethylbenzene	µg/l		<0.5	<0.5	
1,2-Dibromo-3-Chloropropane	µg/l		<0.5	<0.5	
1,2-Dibromoethene	µg/l		<0.5	<0.5	
1,2-Dichlorobenzene	µg/l		<0.5	<0.5	
1,2-Dichloroethane	µg/l		<0.5	<0.5	
1,2-Dichloropropane	µg/l		<0.5	<0.5	
,5-Trimethylbenzene	µg/l		<0.5	<0.5	
1,3-Dichlorobenzene	µg/l		<0.5	<0.5	
1,3-Dichloropropane	µg/l		<0.5	<0.5	
1,4-Dichlorobenzene	µg/l		<0.5	<0.5	
2,2-Dichloropropane	µg/l		<0.5	<0.5	
2-Chlorotoluene	µg/l		<0.5	<0.5	
4-Chlorotoluene	µg/l		<0.5	<0.5	
4-Isopropyltoluene	µg/l		<0.5	<0.5	
Benzene	µg/l		<0.5	<0.5	
Bromobenzene	µg/l		<0.5	<0.5	
Bromochloromethane	µg/l		<0.5	<0.5	
Bromodichloromethane	µg/l		<0.5	<0.5	
Bromoform	µg/l		<0.5	<0.5	
Bromomethane	µg/l		<0.5	<0.5	
,2-Dichloroethene	µg/l		<0.5	<0.5	
c-1,3-Dichloropropene	µg/l		<0.5	<0.5	
Carbon Tetrachloride	µg/l		<0.5	<0.5	
Chlorobenzene	µg/l		<0.5	<0.5	
Chloroform	µg/l		<0.5	<0.5	
Dibromochloromethane	µg/l		<0.5	<0.5	
Dibromomethane	µg/l		<0.5	<0.5	
Dichlorodifluoromethane	µg/l		<0.5	<0.5	
Ethylbenzene	µg/l		<0.5	<0.5	
Hexachlorobutadiene	µg/l		<0.5	<0.5	
Isopropylbenzene	µg/l		<0.5	<0.5	
m,p-Xylene	µg/l		<0.5	<0.5	
Methylene Chloride	µg/l		<0.5	<0.5	
Naphthalene	µg/l		<0.5	<0.5	
n-Butylbenzene	µg/l		<0.5	<0.5	
n-Propylbenzene	µg/l		<0.5	<0.5	
o-Xylene	µg/l		<0.5	<0.5	

			Laboratory Ref:	2802941	2802942	
			Type of sample:	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	
			Sampling point:	Clear with a lot of sediment	Clear with sediment	
			Sampled by:	Jim McGarry	Jim McGarry	
			Time Sampled:	15:55	15:15	
			Start/End - Dates of Analysis:			
			Status of results:	**Final Report**	**Final Report**	
	Parameter	Units	Limits			
	sec-Butylbenzene	µg/l		<0.5	<0.5	
	Styrene	µg/l		<0.5	<0.5	
	t-1,2-Dichloroethene	µg/l		<0.5	<0.5	
	t-1,3-Dichloropropene	µg/l		<0.5	<0.5	
	tert-Butylbenzene	µg/l		<0.5	<0.5	
	Toluene	µg/l		<0.5	<0.5	
	Trichloroethene	µg/l		<0.5	<0.5	
	Trichlorofluoromethane	µg/l		<0.5	<0.5	
	Vinyl Chloride	µg/l		<0.5	<0.5	
	Aluminium	ug/l		<250	<2500	
	Antimony	ug/l		<10	<100	
	Arsenic	ug/l		27.2	<100	
	Barium	ug/l		631	<600	
	Beryllium	ug/l		<10	<100	
	Boron	ug/l		2117	4852	
	Cadmium	ug/l		<10	<100	
	Calcium	mg/l		212	532	
	Chromium	ug/l		10.5	<100	
	Cobalt	ug/l		<10	<100	
	Copper	ug/l		16.8	126	
	Iron	ug/l		2862	<1000	
	Lead	ug/l		<10	<100	
	Magnesium	mg/l		184	1263	
	Manganese	ug/l		1161	<1000	
	Mercury	ug/l		<5	<5	
	Molybdenum	ug/l		<10	<100	
	Nickel	ug/l		<10	<100	
	Potassium	mg/l		171	386	
	Selenium	ug/l		21.9	185	
	Silver	ug/l		<10	<100	
	Sodium	mg/l		1104	10831	
	Thallium	ug/l		<10	<100	
	Tin	ug/l		<20	<200	
	Uranium	ug/l		<10	<100	
	Vanadium	ug/l		12	<100	
	Zinc	ug/l		<60	<600	

Comments: Conductivity and chloride are not reported where high salinity causes interference with the test method.

1) Results highlighted and in bold are outside specified limits.

2) All Metals Analysed in the EPA Dublin Laboratory,
Cyanide Analysed in the EPA Cork Laboratory.
Phenols Analysed in the EPA Castlebar Laboratory.

3) **nm** "Not measured"
4) **nd** "None detected"
5) **nt** "No time" - Time not recorded
6) **tntc** "Too numerous to count"
7) **F** "Field measured parameters"

Signed: Date: 7/8/08

Michael Neill, Regional Chemist

	Laboratory Ref:	2802998	2802999	2803000	2803001	2803002	2803003	2803004
	Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
	Location code:	WST-W0075-01-BH1/1	WST-W0075-01-RC6a	WST-W0075-01-BH5	WST-W0075-01-BH8	WST-W0075-01-BH9	WST-W0075-01-BH10	WST-W0075-01-RC5
	Sampling point:	Clear sample	Brown colour with sediment	Clear sample	Brown colour	Brown colour	Borehole disconnected	Brown colour
	Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
	Time Sampled:	12:22	15:06	13:40	16:24	11:54	12:00	14:40
	Start/End - Dates of Analysis:							
	Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter	**Units**	**Limits**						
1,1-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,1-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2,3-Trichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2,3-Trichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2,4-Trichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2,4-Trimethylbenzene	µg/l		1.4	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2-Dibromo-3-Chloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2-Dibromoethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2-Dichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,2-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,3,5-Trimethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,3-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,3-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
1,4-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
2,2-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
2-Chlorotoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
4-Chlorotoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
4-Isopropyltoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
Benzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
Bromobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
Bromochloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
Bromodichloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5

		Laboratory Ref:	02998	2802999	2803000	2[illegible]01	2803002	2803003	2803004
		Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
		Location code:	WST-W0075-01-BH1/1	WST-W0075-01-RC6a	WST-W0075-01-BH5	WST-W0075-01-BH8	WST-W0075-01-BH9	WST-W0075-01-BH10	WST-W0075-01-RC5
		Sampling point:	Clear sample	Brown colour with sediment	Clear sample	Brown colour	Brown colour	Borehole disconnected	Brown colour
		Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
		Time Sampled:	12:22	15:06	13:40	16:24	11:54	12:00	14:40
		Start/End - Dates of Analysis:							
		Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**						
	Bromoform	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Bromomethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	c-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	c-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Carbon Tetrachloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Chlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Chloroform	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Dibromochloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Dibromomethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Dichlorodifluoromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Ethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Hexachlorobutadiene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Isopropylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	m,p-Xylene	µg/l		0.8	<0.5	0.6	<0.5	<0.5	-	<0.5
	Methylene Chloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Naphthalene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	n-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	n-Propylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	o-Xylene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	sec-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Styrene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	t-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	t-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5

			Laboratory Ref:	998	2802999	2803000	280	2803002	2803003	2803004
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-BH1/1	WST-W0075-01-RC6a	WST-W0075-01-BH5	WST-W0075-01-BH8	WST-W0075-01-BH9	WST-W0075-01-BH10	WST-W0075-01-RC5
			Sampling point:	Clear sample	Brown colour with sediment	Clear sample	Brown colour	Brown colour	Borehole disconnected	Brown colour
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	12:22	15:06	13:40	16:24	11:54	12:00	14:40
			Start/End - Dates of Analysis:						/	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**							
	tert-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Toluene	µg/l		<0.5	<0.5	1.3	<0.5	<0.5	-	0.6
	Trichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Trichlorofluoromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Vinyl Chloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	-	<0.5
	Aluminium	ug/l		<250	781	<2500	547	496	-	<2500
	Antimony	ug/l		<10	<10	<100	<1.0	<1.0	-	<100
	Arsenic	ug/l		<10	<10	<100	3.5	<1.0	-	<100
	Barium	ug/l		265	<60	<600	69.4	48.2	-	<600
	Beryllium	ug/l		<10	<10	<100	<1.0	<1.0	-	<100
	Boron	ug/l		462	94.3	3657	135	69.1	-	1475
	Cadmium	ug/l		<10	<10	<100	<1.0	<1.0	-	<100
	Calcium	mg/l		141	75.3	357	133	54.8	-	647
	Chromium	ug/l		<10	<10	<100	2.3	1.1	-	<100
	Cobalt	ug/l		<10	<10	<100	1.1	<1.0	-	<100
	Copper	ug/l		<10	<10	<100	7.9	2.8	-	<100
	Iron	ug/l		9367	1491	<1000	1023	723	-	6395
	Lead	ug/l		<10	<10	<100	1.4	<1.0	-	<100
	Magnesium	mg/l		27	28.4	938	54.7	23.4	-	1038
	Manganese	ug/l		660	960	<1000	509	955	-	<1000
	Mercury	ug/l		<5	<5	<5	<5	<5	-	<5
	Molybdenum	ug/l		<10	<10	<100	<1.0	<1.0	-	<100
	Nickel	ug/l		<10	<10	<100	3.2	1.7	-	<100

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	14/01/09

Facility:	**Tramore Waste Disposal Site** Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No:	W0075-01

Date collected:	06/10/2008	Date received:	06/10/2008

				Laboratory Ref:	2805166	2805167	2805168	2805169	
				Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
				Location code:	WST-W0075-01-BH1/1	WST-W0075-01-RC6a	WST-W0075-01-BH9	WST-W0075-01-RC4	
				Sampling point:	Clear sample	Clear sample with mud	Clear sample with mud	Clear sample	
				Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
				Time Sampled:	16:03	16:19	14:00	12:50	
				Start/End - Dates of Analysis:					
				Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**						
F	Depth of Borehole	m			3.9	5.3	6	15.3	
F	Water Level	m			2.5	4.4	5.6	12.6	
F	Temperature	°C			14.1	14.2	13.2	13.3	
F	Dissolved Oxygen (as %Sat)	% Saturation			16.7	79.3	16.9	28.6	
	pH	pH			7.0	7.8	7.4	7.5	
	Conductivity @25°C	µS/cm			1652	1083	930	51000	
	Ammonia	mg/l N			22	1.2	0.58	nr	
	Chloride	mg/l Cl			167	186	182	>4921	
	Total Oxidised Nitrogen (as N)	mg/l N			<0.1	0.1	0.1	0.2	
	Total Organic Carbon	mg/l C			nm	nm	nm	nm	
	E Coli	per 100ml			<2	<2	<2	<2	
	Total coliforms	No/100 ml			32	143	<2	<2	
	Aluminium	ug/l			-	-	<250	<250	
	Aluminium	ug/l			<250	<250	-	-	
	Antimony	ug/l			-	-	<5	5.4	
	Antimony	ug/l			<5	<5	-	-	
	Arsenic	ug/l			-	-	<5	38.5	
	Arsenic	ug/l			<5	<5	-	-	
	Barium	ug/l			-	-	102	100	
	Barium	ug/l			270	240	-	-	
	Beryllium	ug/l			-	-	<5	<5	
	Beryllium	ug/l			<5	<5	-	-	
	Boron	ug/l			-	-	<50	3510	

			Laboratory Ref:	2805166	2805167	2805168	2805169	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH1/1	WST-W0075-01-RC6a	WST-W0075-01-BH9	WST-W0075-01-RC4	
			Sampling point:	Clear sample	Clear sample with mud	Clear sample with mud	Clear sample	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	16:03	16:19	14:00	12:50	
			Start/End - Dates of Analysis:					
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
	Boron	ug/l		320	270	-	-	
	Cadmium	ug/l		-	-	<5	<5	
	Cadmium	ug/l		<5	<5	-	-	
	Calcium	mg/l		-	-	67.2	555	
	Calcium	mg/l		180	160	-	-	
	Chromium	ug/l		-	-	6.1	41.8	
	Chromium	ug/l		22	22	-	-	
	Cobalt	ug/l		-	-	<5	5.5	
	Cobalt	ug/l		<5	<5	-	-	
	Copper	ug/l		-	-	<50	223	
	Copper	ug/l		<50	<50	-	-	
	Iron	ug/l		-	-	475	3450	
	Iron	ug/l		15000	13000	-	-	
	Lead	ug/l		-	-	<5	<5	
	Lead	ug/l		<5	<5	-	-	
	Magnesium	mg/l		-	-	35.4	1200	
	Magnesium	mg/l		42	38	-	-	
	Manganese	ug/l		-	-	1040	7290	
	Manganese	ug/l		870	740	-	-	
	Molybdenum	ug/l		-	-	6	13.4	
	Molybdenum	ug/l		6	5.9	-	-	
	Nickel	ug/l		-	-	<5	<5	
	Nickel	ug/l		7.7	<5	-	-	
	Potassium	mg/l		-	-	7.3	425	

			Laboratory Ref:	2805166	2805167	2805168	2805169	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH1/1	WST-W0075-01-RC6a	WST-W0075-01-BH9	WST-W0075-01-RC4	
			Sampling point:	Clear sample	Clear sample with mud	Clear sample with mud	Clear sample	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	16:03	16:19	14:00	12:50	
			Start/End - Dates of Analysis:					
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
	Potassium	mg/l		41	36	-	-	
	Selenium	ug/l		-	-	<5	187	
	Selenium	ug/l		<5	<5	-	-	
	Sodium	mg/l		-	-	210	10400	
	Sodium	mg/l		210	180	-	-	
	Thallium	ug/l		-	-	<5	<5	
	Thallium	ug/l		<5	<5	-	-	
	Tin	ug/l		-	-	106	107	
	Tin	ug/l		110	110	-	-	
	Uranium	ug/l		-	-	<5	15.5	
	Uranium	ug/l		<5	<5	-	-	
	Vanadium	ug/l		-	-	13	689	
	Vanadium	ug/l		16	14	-	-	
	Zinc	ug/l		-	-	<100	<100	
	Zinc	ug/l		<100	<100	-	-	

Comments:

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) **nm** "Not measured"
4) **nd** "None detected"
5) **nt** "No time" - Time not recorded
6) **tntc** "Too numerous to count"
7) **F** "Field measured parameters"

Signed: Date: 14-1-05

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	14/01/09

Facility:	**Tramore Waste Disposal Site** Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No:	W0075-01

Date collected:	20/10/2008	Date received:	20/10/2008

			Laboratory Ref:	2805495	2805496	2805497	2805499	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-BH5	WST-W0075-01-BH8	WST-W0075-01-RC5	
			Sampling point:		Clear sample	Brown colour	check ammonia priors	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	16:30	14:55	13:55	15:36	
			Start/End - Dates of Analysis:					
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
F	Depth of Borehole	m		6.6	4.4	7	24.3	
F	Water Level	m		3	nm	6	22.8	
F	Temperature	°C		14.0	13.6	12.5	12.4	
F	Dissolved Oxygen (as %Sat)	% Saturation		6.8	73.3	30.8	26.5	
	pH	pH		7.2	7.6	7.6	7.0	
	Conductivity @25°C	µS/cm		4150	-	2860	-	
	Salinity	‰		-	31.1	-	30.2	
	Ammonia	mg/l N		87	<0.01	<0.01	0.19	
	Chloride	mg/l Cl		>79	>1006	>363	>1490	
	Total Oxidised Nitrogen (as N)	mg/l N		0.1	<0.1	0.2	<0.1	
	Total coliforms	No/100 ml		54	<1	<1	<1	
	E Coli	per 100ml		<1	<1	<1	<1	
	Aluminium	ug/l		<250	<250	<250	<250	
	Antimony	ug/l		<5	<5	<5	<5	
	Arsenic	ug/l		<5	nr	<5	40	
	Barium	ug/l		320	99	100	110	
	Beryllium	ug/l		<5	<5	<5	<5	
	Boron	ug/l		1300	3400	<50	980	
	Cadmium	ug/l		<5	<5	<5	<5	
	Calcium	mg/l		190	490	120	550	
	Chromium	ug/l		29	120	<10	26	
	Cobalt	ug/l		<0.5	<5	<5	<5	
	Copper	ug/l		<30	190	<30	200	

			Laboratory Ref.	2805495	2805496	5497	2805499	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-BH5	WST-W0075-01-BH8	WST-W0075-01-RC5	
			Sampling point:		Clear sample	Brown colour	check ammonia priors	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	16:30	14:55	13:55	15:36	
			Start/End - Dates of Analysis:					
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
	Iron	ug/l		2400	4300	230	5300	
	Lead	ug/l		<5	<5	<5	<5	
	Magnesium	mg/l		130	1400	57	1300	
	Manganese	ug/l		960	1000	620	1100	
	Molybdenum	ug/l		<5	<5	<5	<5	
	Nickel	ug/l		<5	<5	<5	<5	
	Potassium	mg/l		180	420	11	240	
	Selenium	ug/l		<5	180	<5	170	
	Sodium	mg/l		570	13000	440	12000	
	Thallium	ug/l		<5	<5	<5	<5	
	Tin	ug/l		<10	<10	<10	<10	
	Uranium	ug/l		<5	<5	<5	<5	
	Vanadium	ug/l		<5	40	<5	38	
	Zinc	ug/l		<100	<100	79	<100	

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	14/01/09

Facility:	**Tramore Waste Disposal Site** Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No:	W0075-01

Date collected:	20/10/2008	Date received:	20/10/2008

			Laboratory Ref:	2805500	2805501	2805502	2805503	2805504
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	WST-W0075-01-GW4	WST-W0075-01-GW5
			Sampling point:	No sample - no tubing	Clear sample with mud	No sample - no tubing	No sample - no tubing	Clear sample with mud
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	15:10	15:18	15:10	13:00	13:25
			Start/End - Dates of Analysis:	/		/	/	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
F	Depth of Borehole	m		6.5	6.4	3.3	7.8	4.2
F	Water Level	m		-	5.5	-	-	3.2
F	Temperature	°C		-	12.9	-	-	13.0
F	Dissolved Oxygen (as %Sat)	% Saturation		-	3.0	-	-	93.8
	pH	pH		-	7.6	-	-	7.8
	Conductivty @25°C	µS/cm		-	11970	-	-	937
	Ammonia	mg/l N		-	0.18	-	-	0.088
	Chloride	mg/l Cl		-	>1839	-	-	87
	Total Oxidised Nitrogen (as N)	mg/l N		-	0.2	-	-	0.1
	Total coliforms	No/100 ml		-	nm	-	-	2
	E Coli	per 100ml		-	nm	-	-	<1
	Aluminium	ug/l		-	45	-	-	74
	Antimony	ug/l		-	<5	-	-	<5
	Arsenic	ug/l		-	15	-	-	<5
	Barium	ug/l		-	120	-	-	93
	Beryllium	ug/l		-	<5	-	-	<5
	Boron	ug/l		-	1100	-	-	<50
	Cadmium	ug/l		-	<5	-	-	<5
	Calcium	mg/l		-	220	-	-	98
	Chromium	ug/l		-	<10	-	-	<10
	Cobalt	ug/l		-	<5	-	-	<5
	Copper	ug/l		-	<30	-	-	<30
	Iron	ug/l		-	550	-	-	170

			Laboratory Ref:	2805161	2805162	2805163	2805164	2805165
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0075-01-SW1	WST-W0075-01-SW2	WST-W0075-01-SW3	WST-W0075-01-SW5	WST-W0075-01-SW6
			Sampling point:	Clear sample	Clear sample	Clear sample	Clear sample	Clear sample
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	13:55	12:43	15:25	14:55	14:20
			Start/End - Dates of Analysis:					
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
F	Temperature	°C		15.6	14.2	14.6	14.2	14.1
F	Dissolved Oxygen (as %Sat)	% Saturation		12.9	116.0	105.0	97.2	97.4
	pH	pH		8.1	8.1	8.1	8.0	8.0
	Salinity	‰		6.6	32.6	22.4	33.5	33.8
	Ammonia	mg/l N		1.2	nr	nr	nr	-
	Chloride	mg/l Cl		>2632	>4861	>4472	>5103	>4949
	Total Oxidised Nitrogen (as N)	mg/l N		-	0.4	-	-	-
	Biochemical Oxygen Demand	mg/l O2		2.2	1.1	1.3	1.1	1.3
	Suspended Solids	mg/l		23	26	38	46	nm
	Total coliforms	No/100 ml		>2419	105	>2419	12	10
	E Coli	per 100ml		>2419	8	173	3	0
	Aluminium	ug/l		<250	<250	<250	<250	<250
	Antimony	ug/l		<5	6.1	5.5	5.7	<5
	Arsenic	ug/l		<5	36.5	21.9	36.5	<5
	Barium	ug/l		<60	80.1	82.6	80.1	72.8
	Beryllium	ug/l		<5	<5	<5	<5	<5
	Boron	ug/l		244	3510	2600	3140	244
	Cadmium	ug/l		<5	<5	<5	<5	<5
	Calcium	mg/l		147	408	324	416	47.7
	Chromium	ug/l		<5	27.2	25.2	29.5	6
	Cobalt	ug/l		<5	<5	<5	<5	<5
	Copper	ug/l		<50	194	161	222	<50
	Iron	ug/l		1640	547	606	574	113

			Laboratory Ref:	2805500	2805501	2805502	2805503	2805504
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	WST-W0075-01-GW4	WST-W0075-01-GW5
			Sampling point:	No sample - no tubing	Clear sample with mud	No sample - no tubing	No sample - no tubing	Clear sample with mud
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	15:10	15:18	15:10	13:00	13:25
			Start/End - Dates of Analysis:	/		/	/	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
	Lead	ug/l		-	<5	-	-	<5
	Magnesium	mg/l		-	250	-	-	30
	Manganese	ug/l		-	410	-	-	890
	Molybdenum	ug/l		-	20	-	-	<5
	Nickel	ug/l		-	<5	-	-	<5
	Potassium	mg/l		-	160	-	-	<5
	Selenium	ug/l		-	<5	-	-	<5
	Sodium	mg/l		-	4300	-	-	220
	Thallium	ug/l		-	<5	-	-	<5
	Tin	ug/l		-	<10	-	-	<10
	Uranium	ug/l		-	<5	-	-	<5
	Vanadium	ug/l		-	<5	-	-	<5
	Zinc	ug/l		-	<100	-	-	<100

Comments:

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Date: 4-1-09

Michael Neill, Regional Chemist

Appendix E

Leachate Results

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 16/06/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Date collected: 02/04/2008 Date received: 02/04/2008

			Laboratory Ref:	2801703	2801704	2801705
			Type of sample:	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-LT3a	WST-W0075-01-LT4	WST-W0075-01-LT5
			Sampling point:		Dry- no sample	Black colour
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	12:40	12:39	15:15
			Start/End - Dates of Analysis:		/	
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
F	Depth of Borehole	m		4.4	-	7.9
F	Temperature	°C		-	-	13.0
	pH	pH		7.7	-	7.0
	Conductivity	µS/cm		24500	-	7990
	Ammonia	mg/l N		<0.003	-	<0.003
	Chloride	mg/l Cl		550	-	386
	trite	mg/l N		<0.001	-	0.056
	Ortho-Phosphate	mg/l P		6.2	-	0.13
	Total Oxidised Nitrogen	mg/l N		0.3	-	<0.1
	Chemical Oxygen Demand	mg/l O2		2010	-	495
	Biochemical Oxygen Demand	mg/l O2		110.0	-	16.5
	Aluminium	ug/l		<250	-	<250
	Antimony	ug/l		<50	-	<50
	Arsenic	ug/l		<50	-	<50
	Barium	ug/l		<300	-	<300
	Beryllium	ug/l		<50	-	<50
	Boron	ug/l		3672	-	1748
	Cadmium	ug/l		<50	-	<50
	Calcium	mg/l		38	-	140
	Chromium	ug/l		107	-	<50
	Cobalt	ug/l		50.1	-	<50
	Copper	ug/l		81.8	-	<50
	Iron	ug/l		7903	-	6255
	Lead	ug/l		<50	-	<50

		Laboratory Ref:	2801703	2801704	2801705
		Type of sample:	Leachate	Leachate	Leachate
		Location code:	WST-W0075-01-LT3a	WST-W0075-01-LT4	WST-W0075-01-LT5
		Sampling point:		Dry- no sample	Black colour
		Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
		Time Sampled:	12:40	12:39	15:15
		Start/End - Dates of Analysis:		/	
		Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter	**Units**	**Limits**			
Magnesium	mg/l		259	-	142
Manganese	ug/l		<500	-	796
Molybdenum	ug/l		<50	-	<50
Nickel	ug/l		270	-	<50
Potassium	mg/l		884	-	241
Selenium	ug/l		<50	-	<50
Silver	ug/l		<50	-	<50
Sodium	mg/l		1901	-	574
Thallium	ug/l		<50	-	<50
Thorium	ug/l		nm	-	nm
Tin	ug/l		<100	-	<100
Uranium	ug/l		<50	-	<50
Vanadium	ug/l		67.8	-	<50
Zinc	ug/l		<300	-	<300

Comments:

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Jean Smith Date: 16/6/08

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 16/06/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Sampling location: **WST-W0075-01-RC6a, Tramore landfill site - W0075-01 -- RC6a - Groundwater/leachate monitoring point**

Date collected: 03/04/2008 Date received: 03/04/2008

			Laboratory Ref:	2801738
			Type of sample:	Leachate
			Sampling point:	WST-W0075-01-RC6a
			Sampled by:	Jim McGarry
			Time Sampled:	13:32
			Start/End - Dates of Analysis:	
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
F	Depth of Borehole	m		5.3
F	Water Level	m		4.2
F	Temperature	°C		11.7
F	Dissolved Oxygen	% Saturation		89.0
	pH	pH		7.7
	Conductivity	µS/cm		1087
	Ammonia	mg/l N		0.5
	Chloride	mg/l Cl		119
	Nitrite	mg/l N		0.007
	Ortho-Phosphate	mg/l P		0.012
	Total Oxidised Nitrogen	mg/l N		0.1
	Aluminium	ug/l		<250
	Antimony	ug/l		<50
	Arsenic	ug/l		<50
	Barium	ug/l		<300
	Beryllium	ug/l		<50
	Boron	ug/l		<500
	Cadmium	ug/l		<50
	Calcium	mg/l		58.6
	Chromium	ug/l		<50
	Cobalt	ug/l		<50

			Laboratory Ref:	2801738
			Type of sample:	Leachate
			Sampling point:	WST-W0075-01-RC6a
			Sampled by:	Jim McGarry
			Time Sampled:	13:32
			Start/End - Dates of Analysis:	
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
	Copper	ug/l		<50
	Iron	ug/l		<500
	Lead	ug/l		<50
	Magnesium	mg/l		<50
	Manganese	ug/l		748
	Molybdenum	ug/l		<50
	Nickel	ug/l		<50
	Potassium	mg/l		<50
	Selenium	ug/l		<50
	Silver	ug/l		<50
	Sodium	mg/l		100
	Thallium	ug/l		<50
	Thorium	ug/l		nm
	Tin	ug/l		<100
	Uranium	ug/l		<50
	Vanadium	ug/l		<50
	Zinc	ug/l		<300
	E Coli	per 100ml		0
	Total coliforms	No/100 ml		0

Comments:

1) Results highlighted and in bold are outside specified limits
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Date:

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 16/06/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Date collected: 03/04/2008 Date received: 03/04/2008

			Laboratory Ref:	2801749	2801750	2801751
			Type of sample:	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-BH7	WST-W0075-01-LT1	WST-W0075-01-LT2
			Sampling point:	BH7b - Black colour	Brown colour	Black colour
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	14:40	12:26	12:05
			Start/End - Dates of Analysis:			
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
F	Depth of Borehole	m		7.5	7.2	5.5
F	Temperature	°C		14.0	12.0	13.0
	pH	pH		7.2	6.8	7.3
	Conductivity	µS/cm		3110	3300	5210
	Ammonia	mg/l N		64	72	300
	Chloride	mg/l Cl		195	181	331
	trite	mg/l N		<0.001	<0.001	<0.001
	Ortho-Phosphate	mg/l P		<0.006	<0.006	0.16
	Total Oxidised Nitrogen	mg/l N		nr	nr	nr
	Chemical Oxygen Demand	mg/l O2		326	162	372
	Biochemical Oxygen Demand	mg/l O2		6.0	16.9	14.0
	Aluminium	ug/l		<250	<250	<250
	Antimony	ug/l		<50	<50	<50
	Arsenic	ug/l		<50	<50	<50
	Barium	ug/l		<300	<50	<300
	Beryllium	ug/l		<50	<50	<50
	Boron	ug/l		<500	524	1015
	Cadmium	ug/l		<50	<50	<50
	Calcium	mg/l		196	251	137
	Chromium	ug/l		<50	<50	<50
	Cobalt	ug/l		<50	<50	<50
	Copper	ug/l		<50	<50	<50
	Iron	ug/l		2199	22119	3094
	Lead	ug/l		<50	<50	<50

			Laboratory Ref:	2801749	2801750	2801751
			Type of sample:	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-BH7	WST-W0075-01-LT1	WST-W0075-01-LT2
			Sampling point:	BH7b - Black colour	Brown colour	Black colour
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	14:40	12:26	12:05
			Start/End - Dates of Analysis:			
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
	Magnesium	mg/l		55.3	<50	92.6
	Manganese	ug/l		5773	4133	1696
	Molybdenum	ug/l		<50	<50	<50
	Nickel	ug/l		60.4	<50	<50
	Potassium	mg/l		<50	50	192
	Selenium	ug/l		<50	<50	<50
	Silver	ug/l		<50	<50	<50
	Sodium	mg/l		143	113	362
	Thallium	ug/l		<50	<50	<50
	Thorium	ug/l		nm	nm	nm
	Tin	ug/l		<100	<100	<100
	Uranium	ug/l		<50	<50	<50
	Vanadium	ug/l		<50	<50	<50
	Zinc	ug/l		<300	<300	<300

Comments:

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
   Cyanide Analysed in the EPA Cork Laboratory.
   Phenols Analysed in the EPA Castlebar Laboratory.
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4) nd "None detected"
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6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Date: 16/6/08

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 07/08/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Date collected: 10/06/2008 Date received: 10/06/2008

			Laboratory Ref:	2802943	2802944	2802945
			Type of sample:	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-LT3	WST-W0075-01-LT4	WST-W0075-01-LT5
			Sampling point:	Black colour - pumped by hand	No sample - Borehole dry	No sample-no tubing in borehole
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	15:25	15:35	14:40
			Start/End - Dates of Analysis:		/	/
			Status of results:	**Final Report**	**Final Report**	**Final Report**
	Parameter	Units	Limits			
F	Depth of Borehole	m		4.4	-	-
F	Leachate Level	m		nm	-	-
F	Temperature	°C		15.0	-	-
	pH	pH		7.8	-	-
	Conductivity @25°C	µS/cm		24500	-	-
	Ammonia	mg/l N		1500	-	-
	Chloride	mg/l Cl		nr	-	-
	Nitrite (as N)	mg/l N		<0.001	-	-
	ortho-Phosphate (as P)	mg/l P		4.5	-	-
	Total Oxidised Nitrogen (as N)	mg/l N		nr	-	-
	Biochemical Oxygen Demand	mg/l O2		320.0	-	-
	Chemical Oxygen Demand	mg/l O2		2406	-	-
	Fluoride	mg/l F		57.4	-	-
	Sulphate	mg/l SO4		18.1	-	-
	Total coliforms	No/100 ml		>9677	-	-
	E Coli	per 100ml		0	-	-
	Aluminium	ug/l		<250	-	-
	Antimony	ug/l		<10	-	-
	Arsenic	ug/l		42.8	-	-
	Barium	ug/l		102	-	-
	Beryllium	ug/l		<10	-	-
	Boron	ug/l		7185	-	-
	Cadmium	ug/l		<10	-	-
	Calcium	mg/l		54.2	-	-

Q3 '08

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	07/08/08

Facility:	**Tramore Waste Disposal Site** Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No:	W0075-01

Date collected:	10/06/2008	Date received:	10/06/2008

			Laboratory Ref:	2802943	2802944	2802945
			Type of sample:	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-LT3	WST-W0075-01-LT4	WST-W0075-01-LT5
			Sampling point:	Black colour - pumped by hand	No sample - Borehole dry	No sample-no tubing in borehole
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	15:25	15:35	14:40
			Start/End - Dates of Analysis:		/	/
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
	Chromium	ug/l		329	-	-
	Cobalt	ug/l		51	-	-
	Copper	ug/l		36.8	-	-
	Iron	ug/l		9034	-	-
	Lead	ug/l		<10	-	-
	Magnesium	mg/l		373	-	-
	Manganese	ug/l		<500	-	-
	Mercury	ug/l		<5	-	-
	Molybdenum	ug/l		<10	-	-
	ckel	ug/l		292	-	-
	Potassium	mg/l		1209	-	-
	Selenium	ug/l		31.1	-	-
	Silver	ug/l		<10	-	-
	Sodium	mg/l		2565	-	-
	Thallium	ug/l		<10	-	-
	Tin	ug/l		22.1	-	-
	Uranium	ug/l		<10	-	-
	Vanadium	ug/l		67.8	-	-
	Zinc	ug/l		140	-	-

Comments: High chloride results can cause interference with the TON test method and may not be reported.

1) Results highlighted and in bold are outside specified limits.

All Metals Analysed in the EPA Dublin Laboratory,
Cyanide Analysed in the EPA Cork Laboratory.
Phenols Analysed in the EPA Castlebar Laboratory.

3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Date: 7/8/08

pp Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 07/08/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Sampling location: **WST-W0075-01-SW1, Tramore Landfill Site - W0075-01 -- SW1 - Surface Water Monitoring Point**

Date collected: 11/06/2008 Date received: 11/06/2008

			Laboratory Ref:	2802997
			Type of sample:	Surface Water
			Sampling point:	Clear sample
			Sampled by:	Jim McGarry
			Time Sampled:	11:52
			Start/End - Dates of Analysis:	
			Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
F	Temperature	°C		22.3
F	Dissolved Oxygen (as %Sat)	% Saturation		134.5
	pH	pH		8.0
	Conductivity @25°C	µS/cm		19040
	Salinity	‰		11.0
	Ammonia	mg/l N		1.7
	Chloride	mg/l Cl		nr
	Nitrite (as N)	mg/l N		0.11
	ortho-Phosphate (as P)	mg/l P		0.11
	Total Oxidised Nitrogen (as N)	mg/l N		<0.1
	Biochemical Oxygen Demand	mg/l O2		3.0
	Chemical Oxygen Demand	mg/l O2		272
	Sulphate	mg/l SO4		778.3
	Suspended Solids	mg/l		nm
	Total coliforms	No/100 ml		>2419.2
	E Coli	per 100ml		4
	Aluminium	ug/l		<250
	Antimony	ug/l		<10
	Arsenic	ug/l		<10
	Barium	ug/l		<60
	Beryllium	ug/l		<10

		Laboratory Ref:	2802997
		Type of sample:	Surface Water
		Sampling point:	Clear sample
		Sampled by:	Jim McGarry
		Time Sampled:	11:52
		Start/End - Dates of Analysis:	
		Status of results:	**Final Report**
Parameter		**Units**	**Limits**	
	Boron	ug/l		2158
	Cadmium	ug/l		<10
	Calcium	mg/l		228
	Chromium	ug/l		16.4
	Cobalt	ug/l		<10
	Copper	ug/l		49.5
	Iron	ug/l		1781
	Lead	ug/l		<10
	Magnesium	mg/l		424
	Manganese	ug/l		717
	Mercury	ug/l		<5
	Molybdenum	ug/l		<10
	Nickel	ug/l		<10
	Potassium	mg/l		169
	Selenium	ug/l		<10
	Silver	ug/l		<10
	Sodium	mg/l		4092
	Thallium	ug/l		<10
	Tin	ug/l		<20
	Uranium	ug/l		<10
	Vanadium	ug/l		30
	Zinc	ug/l		<60

Comments: COD, conductivity and chloride may not reported as high salinity causes interference with the test method.

1) Results highlighted and in bold are outside specified limits.

2) All Metals Analysed in the EPA Dublin Laboratory,
Cyanide Analysed in the EPA Cork Laboratory.
Phenols Analysed in the EPA Castlebar Laboratory.

3) **nm** "Not measured"
4) **nd** "None detected"
5) **nt** "No time" - Time not recorded
6) **tntc** "Too numerous to count"
7) **F** "Field measured parameters"

Signed: Date: 7/8/09

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 07/08/08

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Date collected: 11/06/2008 Date received: 11/06/2008

			Laboratory Ref:	2803010	2803011	2803012
			Type of sample:	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-BH7	WST-W0075-01-LT1	WST-W0075-01-LT2
			Sampling point:	No sample	Brown colour	Black colour
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	12:12	11:05	11:25
			Start/End - Dates of Analysis:	/		
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
F	Depth of Borehole	m		-	7.2	5.5
F	Leachate Level	m		-	nm	nm
F	Temperature	°C		-	12.0	14.0
	pH	pH		-	6.9	7.6
	Conductivity @25°C	µS/cm		-	3400	6440
	Ammonia	mg/l N		-	84	290
	Chloride	mg/l Cl		-	184	344
	Nitrite (as N)	mg/l N		-	<0.001	0.022
	ortho-Phosphate (as P)	mg/l P		-	<0.006	0.18
	Total Oxidised Nitrogen (as N)	mg/l N		-	<0.1	<0.1
	Biochemical Oxygen Demand	mg/l O2		-	17.8	10.5
	Chemical Oxygen Demand	mg/l O2		-	183	404
	Fluoride	mg/l F		-	1.43	1.9
	Sulphate	mg/l SO4		-	20.0	46.8
	Total coliforms	No/100 ml		-	<2	<2
	E Coli	per 100ml		-	<2	<2
	Aluminium	ug/l		-	<250	230
	Antimony	ug/l		-	<10	<1.0
	Arsenic	ug/l		-	<10	23.1
	Barium	ug/l		-	224	185
	Beryllium	ug/l		-	<10	<1.0
	Boron	ug/l		-	845	1427
	Cadmium	ug/l		-	<10	<1.0
	Calcium	mg/l		-	372	198

		Laboratory Ref:	2803010	2803011	2803012
		Type of sample:	Leachate	Leachate	Leachate
		Location code:	WST-W0075-01-RH7	WST-W0075-01-LT1	WST-W0075-01-LT2
		Sampling point:	No sample	Brown colour	Black colour
		Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
		Time Sampled:	12:12	11:05	11:25
		Start/End - Dates of Analysis:	/		
		Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter	**Units**	**Limits**			
Chromium	ug/l		-	<10	13.4
Cobalt	ug/l		-	<10	3.6
Copper	ug/l		-	<10	8.2
Iron	ug/l		-	28987	2411
Lead	ug/l		-	<10	1.3
Magnesium	mg/l		-	51.5	126
Manganese	ug/l		-	5706	1799
Mercury	ug/l		-	<5	<5
Molybdenum	ug/l		-	<10	<1.0
Nickel	ug/l		-	18.4	11.9
Potassium	mg/l		-	84.2	282
Selenium	ug/l		-	<10	14.5
Silver	ug/l		-	<10	<1.0
Sodium	mg/l		-	158	438
Thallium	ug/l		-	<10	<1.0
Tin	ug/l		-	<20	<2.0
Uranium	ug/l		-	<10	<1.0
Vanadium	ug/l		-	<10	5.3
Zinc	ug/l		-	<60	21.3

Comments: Conductivity and chloride may not reported as high salinity causes interference with the test method.

1) Results highlighted and in bold are outside specified limits.

All Metals Analysed in the EPA Dublin Laboratory.
Cyanide Analysed in the EPA Cork Laboratory.
Phenols Analysed in the EPA Castlebar Laboratory.

3) **nm** "Not measured"
4) **nd** "None detected"
5) **nt** "No time" - Time not recorded
6) **tntc** "Too numerous to count"
7) **F** "Field measured parameters"

Signed: Date: 7/8/08

Michael Neill, Regional Chemist

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	14/01/09

Facility:	**Tramore Waste Disposal Site** Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No:	W0075-01

Date collected:	06/10/2008	Date received:	06/10/2008

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 14/01/09

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Date collected: 06/10/2008 Date received: 06/10/2008

			Laboratory Ref:	2805170	2805171	2805172
			Type of sample:	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-LT2	WST-W0075-01-LT3	WST-W0075-01-LT4a
			Sampling point:	Black colour	Black colour	Borehole dry
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	13:39	13:11	13:24
			Start/End - Dates of Analysis:			/
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
F	Depth of Borehole	m		6.2	6.6	5.9
F	Leachate Level	m		1.4	2.6	-
F	Temperature	°C		14.0	15.0	-
	pH	pH		7.6	7.7	-
	Conductivity @25°C	µS/cm		4990	25300	-
	Ammonia	mg/l N		330	1500	-
	Chloride	mg/l Cl		712	>1936	-
	Total Oxidised Nitrogen (as N)	mg/l N		0.2	0.5	-
	Chemical Oxygen Demand	mg/l O2		330	2165	-
	Biochemical Oxygen Demand	mg/l O2		14.0	200.0	-
	Aluminium	ug/l		<25	<250	-
	Antimony	ug/l		5.5	9.9	-
	Arsenic	ug/l		<0.5	27	-
	Barium	ug/l		170	150	-
	Beryllium	ug/l		<0.5	<5	-
	Boron	ug/l		1100	6500	-
	Cadmium	ug/l		<0.5	<5	-
	Calcium	mg/l		170	56	-
	Chromium	ug/l		39	380	-
	Cobalt	ug/l		<0.5	57	-
	Copper	ug/l		<3	41	-
	Iron	ug/l		3200	7400	-
	Lead	ug/l		<0.5	<5	-
	Magnesium	mg/l		100	340	-

Environmental Protection Agency
Regional Inspectorate
Seville Lodge, Callan Road,
Kilkenny

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 14/01/09

Facility: **Tramore Waste Disposal Site**
Tramore Intake & Tramore Burrows, Tramore, Co. Waterford
Reference No: W0075-01

Date collected: 20/10/2008 Date received: 20/10/2008

				Laboratory Ref:	2805505	2805506	2805507
				Type of sample:	Leachate	Leachate	Leachate
				Location code:	WST-W0075-01-BH7	WST-W0075-01-LT1	WST-W0075-01-LT5
				Sampling point:	Unable to access borehole - concrete on lock	Brown colour	No tubing - no sample
				Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
				Time Sampled:	16:25	16:06	16:14
				Start/End - Dates of Analysis:	/		/
				Status of results:	**Final Report**	**Final Report**	**Interim**
F	Depth of Borehole	m			7.5	7.1	7.9
F	Leachate Level	m			-	3.1	-
F	Temperature	°C			-	13.0	-
	pH	pH			-	6.9	-
	Conductivity @25°C	µS/cm			-	3790	-
	Ammonia	mg/l N			-	110	-
	Chloride	mg/l Cl			-	282	-
	Total Oxidised Nitrogen (as N)	mg/l N			-	0.1	-
	Chemical Oxygen Demand	mg/l O2			-	320	-
	Biochemical Oxygen Demand	mg/l O2			-	19.0	-

Comments:

1) Results highlighted and in bold are outside specified limits.
2) All Metals Analysed in the EPA Dublin Laboratory.
Cyanide Analysed in the EPA Cork Laboratory.
Phenols Analysed in the EPA Castlebar Laboratory.
3) nm "Not measured"
4) nd "None detected"
5) nt "No time" - Time not recorded
6) tntc "Too numerous to count"
7) F "Field measured parameters"

Signed: Date: 14-1-09

Michael Neill, Regional Chemist

Appendix F

Meteorological Data

DAILY RAINFALL AT TRAMORE AND TEMPERATURE AND WIND SPEED AT JOHNSTOWN CASTLE IN 2008

				temperature			mean wind
month	day	rain	ind	max	min	grass min	speed
1	1	0.0	0	11.0	9.9	8.9	n/a
1	2	0.0	0	7.4	6.9	5.0	17.8
1	3	0.3	0	3.5	2.8	1.2	15.7
1	4	10.2	0	8.5	-4.4	-7.8	9.7
1	5	1.3	0	7.9	-1.2	-1.3	10.7
1	6	0.5	0	9.9	1.2	-2.8	9.9
1	7	6.5	0	9.3	2.6	-1.5	13.8
1	8	4.6	0	10.7	5.0	0.7	16.7
1	9	30.0	0	10.2	2.2	-0.7	14.8
1	10	2.0	0	8.2	4.2	0.9	11.2
1	11	0.0	0	5.7	1.2	-2.8	7.5
1	12	24.1	0	10.8	-0.2	-4.2	11.0
1	13	0.4	0	9.4	2.8	-0.7	15.0
1	14	5.1	0	9.9	6.8	3.5	14.2
1	15	0.3	0	8.7	5.9	1.7	7.3
1	16	2.7	0	10.2	2.8	-1.8	5.9
1	17	8.8	0	11.7	3.0	-0.2	14.2
1	18	5.7	0	13.0	6.2	2.2	16.4
1	19	2.9	0	11.4	9.1	8.3	9.3
1	20	5.0	0	12.2	9.2	8.8	13.6
1	21	5.1	0	12.7	10.2	9.3	n/a
1	22	2.4	0	11.2	2.2	0.2	8.8
1	23	0.7	0	12.5	7.7	4.7	15.9
1	24	0.0	0	9.7	3.5	1.0	10.2
1	25	0.0	0	11.2	3.5	1.7	16.0
1	26	0.0	0	11.0	8.2	4.6	n/a
1	27	0.0	0	11.3	5.7	2.1	6.8
1	28	0.0	4	10.4	6.0	1.9	9.3
1	29	5.4	0	11.8	8.0	6.2	10.6
1	30	2.7	0	9.2	1.3	-1.8	10.3
1	31	0.4	0	7.5	2.9	0.1	15.8
2	1	0.4	0	6.1	1.2	-1.5	9.0
2	2	4.1	0	9.0	-2.1	-6.3	12.8
2	3	0.0	0	9.0	1.9	-0.3	16.4
2	4	9.0	0	9.9	0.5	-3.5	12.7
2	5	2.1	0	10.2	5.1	3.4	14.9
2	6	0.0	0	11.0	1.8	-2.5	8.7
2	7	0.1	0	12.4	2.7	0.2	15.5
2	8	0.0	0	11.3	9.2	8.3	15.5
2	9	0.0	0	10.1	9.0	7.4	9.2
2	10	0.0	0	9.5	7.3	6.4	83.7
2	11	0.0	0	11.2	3.9	-1.7	5.9
2	12	0.0	0	11.6	4.2	-1.7	4.8
2	13	0.0	0	11.8	4.9	-1.1	4.3
2	14	0.0	0	7.2	3.8	-1.1	6.7
2	15	0.1	0	6.2	3.8	0.5	7.3
2	16	0.0	0	5.3	1.7	-1.7	n/a
2	17	0.0	0	7.5	-0.3	-5.8	8.7
2	18	0.0	0	7.7	0.4	-3.7	175.0
2	19	0.0	0	7.2	1.5	-5.8	4.9
2	20	0.4	0	10.7	3.8	-1.0	7.0
2	21	0.0	0	11.0	5.1	2.7	14.9
2	22	0.0	0	13.4	9.3	8.2	12.2
2	23	0.7	0	11.4	3.0	-1.1	15.7
2	24	0.0	0	9.3	6.7	6.1	8.1
2	25	3.8	0	10.1	1.6	-2.0	15.8
2	26	0.0	0	11.1	4.5	1.1	11.5
2	27	0.0	0	11.4	2.7	-1.5	4.5
2	28	1.4	0	9.7	2.4	-1.4	4.5
2	29	1.6	0	13.1	4.8	0.2	15.8
3	1	0.7	0	12.8	6.9	3.4	n/a
3	2	0.0	0	11.0	5.8	1.4	9.4
3	3	1.2	0	6.7	0.3	-2.4	11.2
3	4	0.0	0	10.7	1.7	-1.1	9.0
3	5	0.0	0	9.8	3.7	-0.7	7.8
3	6	2.4	0	10.3	5.8	5.2	15.0
3	7	0.5	0	10.2	2.3	-0.8	11.3
3	8	0.2	0	11.8	5.6	3.4	15.0
3	9	13.1	0	9.2	2.2	-1.2	11.5
3	10	6.4	0	9.4	2.7	0.1	16.7
3	11	0.8	0	13.0	4.1	1.1	12.8
3	12	0.0	0	10.7	3.3	0.8	14.1

Rainfall in mm.
Temperature in degrees Celsius
Speed in knots

Terminal hour of readings shown is 09h to 09h UTC
for rainfall and temperature but 00h to 24h UTC for wind.

Daily Rain Indicator:

0. Satisfactory
1. Estimated
2. Cumulative,no reading
3. Estimated cumulative total
4. Trace
5. Estimated trace.
6. Cumulative trace
7. Estimated cumulative trace
8. Not available
9. Cumulative total

3	13	0.6	0	10.0	3.2	-0.7	8.8
3	14	3.1	0	9.5	4.9	2.0	3.8
3	15	3.5	0	10.5	6.5	5.9	7.9
3	16	0.0	0	9.7	6.5	6.4	19.9
3	17	0.0	0	9.2	4.4	1.1	14.5
3	18	0.0	0	9.1	2.8	0.0	7.0
3	19	0.0	0	10.7	2.0	0.5	6.0
3	20	1.0	0	11.4	3.2	0.2	9.9
3	21	0.4	0	10.3	5.2	3.0	19.3
3	22	0.0	2	8.2	1.8	-0.8	19.5
3	23	1.6	9	9.6	2.2	-0.6	12.3
3	24	1.0	0	9.8	3.8	1.2	n/a
3	25	0.0	0	9.6	-0.3	-3.4	6.6
3	26	0.0	0	10.6	4.3	1.5	7.0
3	27	7.8	0	11.2	0.2	-3.5	8.0
3	28	5.6	0	10.9	6.6	5.5	14.4
3	29	2.2	0	11.5	3.7	0.9	16.0
3	30	16.5	0	10.7	2.2	-1.5	8.6
3	31	0.5	0	12.4	3.8	1.5	12.7
4	1	0.0	0	14.3	7.8	5.0	10.7
4	2	0.0	0	15.7	7.7	4.4	6.0
4	3	0.0	0	18.2	5.3	1.4	4.7
4	4	0.0	0	13.3	6.1	5.0	5.3
4	5	0.7	0	10.2	2.2	-1.2	6.8
4	6	2.2	0	9.0	-0.2	-2.7	8.6
4	7	1.0	0	9.3	0.0	-2.3	5.2
4	8	4.0	0	8.9	-0.7	-2.8	4.2
4	9	0.6	0	11.2	0.5	-0.8	4.1
4	10	2.2	0	12.0	2.7	-1.2	6.9
4	11	1.5	0	11.2	3.7	1.3	8.3
4	12	1.0	0	11.3	1.7	-0.7	6.4
4	13	0.8	0	11.7	4.0	1.7	5.7
4	14	0.0	0	11.5	3.7	0.8	5.4
4	15	0.0	0	12.4	0.0	-1.8	5.5
4	16	0.0	0	11.2	2.8	-1.2	8.4
4	17	0.0	0	9.3	6.0	1.7	15.4
4	18	1.9	0	11.7	5.0	1.8	12.8
4	19	0.1	0	8.9	6.5	5.7	11.3
4	20	0.0	0	9.9	6.6	6.7	8.0
4	21	0.0	0	12.7	7.7	7.4	6.9
4	22	11.1	0	13.9	6.7	3.2	7.1
4	23	4.5	0	13.8	6.2	3.3	8.6
4	24	3.1	0	13.1	7.8	6.2	9.3
4	25	3.4	0	11.9	9.2	7.8	9.6
4	26	3.2	0	13.0	10.1	10.2	8.0
4	27	1.7	0	14.0	5.1	3.9	5.2
4	28	2.5	0	13.7	6.6	6.2	6.2
4	29	1.1	0	11.9	4.9	1.8	9.4
4	30	0.0	0	13.1	6.6	5.7	9.0
5	1	0.9	0	12.7	3.7	0.2	6.9
5	2	0.2	0	16.7	6.2	2.7	7.1
5	3	10.2	0	16.2	9.8	8.1	11.2
5	4	0.0	4	16.3	11.2	10.2	8.9
5	5	0.0	0	15.2	8.8	6.2	3.6
5	6	0.0	0	18.2	8.5	6.8	4.5
5	7	0.1	0	20.2	9.8	6.3	4.7
5	8	7.5	0	19.3	11.3	8.4	6.0
5	9	1.6	0	16.3	11.4	11.8	2.8
5	10	0.1	0	15.6	11.2	9.8	5.6
5	11	0.0	0	17.2	10.9	9.2	5.1
5	12	0.0	0	18.4	12.8	10.8	5.6
5	13	0.0	0	17.2	11.9	9.5	7.8
5	14	0.0	0	18.5	10.2	8.5	8.2
5	15	0.0	0	13.3	9.0	7.5	7.5
5	16	0.0	0	15.0	10.8	8.8	4.7
5	17	7.1	0	15.0	7.7	6.2	5.3
5	18	0.0	0	13.2	8.8	6.6	6.3
5	19	0.0	0	14.4	8.2	7.2	4.5
5	20	0.0	0	13.3	6.3	2.2	7.1
5	21	19.2	0	14.0	10.2	9.7	8.7
5	22	1.2	0	13.8	10.5	10.7	6.3
5	23	0.0	0	16.2	10.2	8.4	5.6
5	24	0.0	0	16.3	12.0	10.0	10.2
5	25	2.1	0	15.3	9.0	7.3	12.4
5	26	5.7	0	15.0	10.4	8.5	13.8

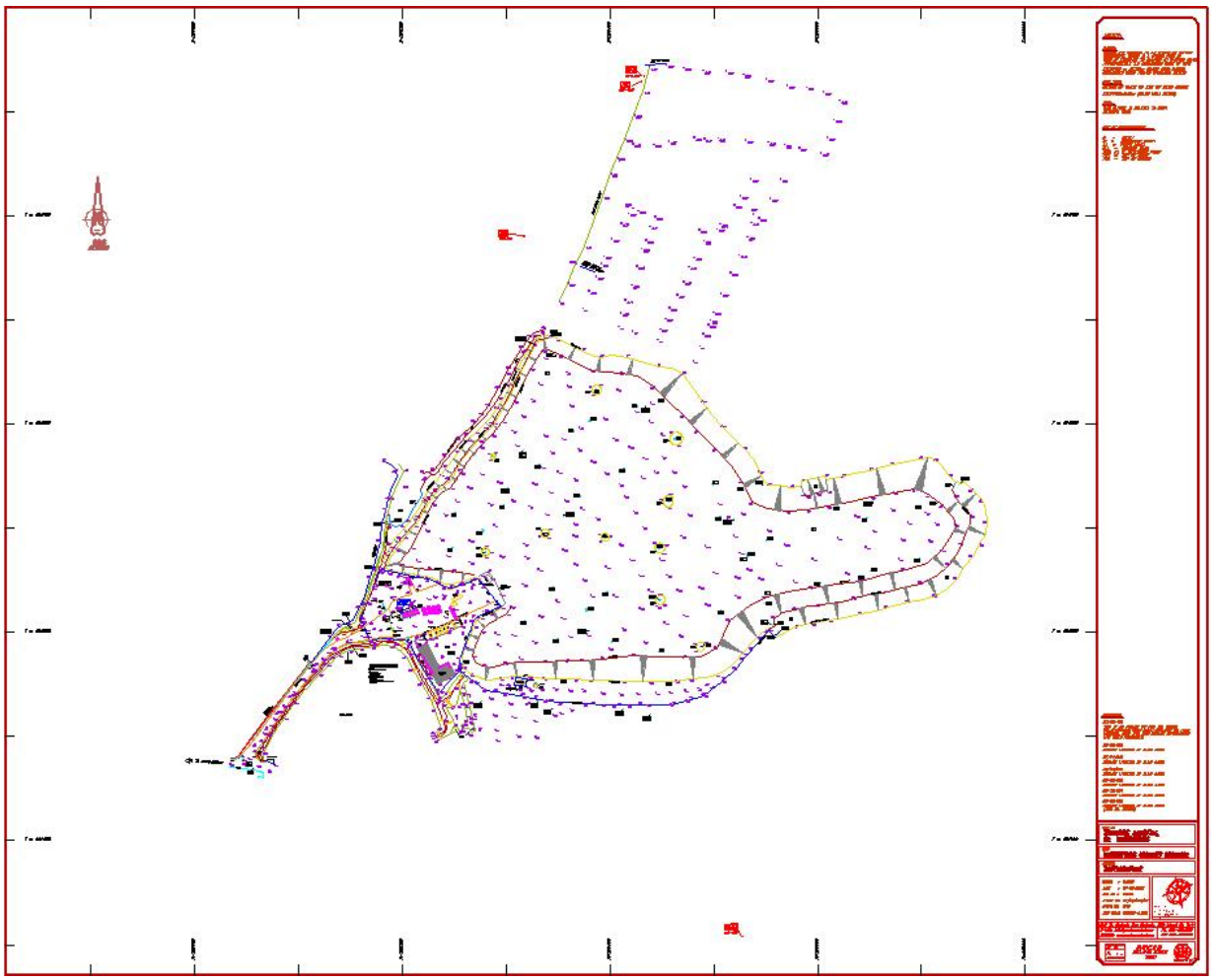
5	27	0.0	0	14.8	9.3	8.3	9.0
5	28	0.0	0	16.7	8.8	7.5	5.2
5	29	0.1	0	15.8	8.9	9.8	4.7
5	30	0.0	0	19.1	11.7	11.5	3.8
5	31	0.0	0	20.2	8.6	7.0	3.1
6	1	2.1	0	19.2	11.2	8.6	5.4
6	2	0.0	4	17.0	9.4	8.4	4.4
6	3	0.6	0	18.1	8.8	6.0	7.3
6	4	6.2	0	13.4	8.2	5.6	6.6
6	5	1.1	0	18.2	9.4	9.2	5.2
6	6	0.0	0	16.6	8.3	6.5	5.2
6	7	0.0	0	17.7	9.0	7.8	5.2
6	8	0.0	0	19.6	9.6	10.2	5.0
6	9	0.0	0	23.1	14.6	14.0	4.1
6	10	0.0	0	21.8	11.6	8.5	5.3
6	11	3.0	0	18.8	12.3	10.3	4.1
6	12	0.0	0	15.2	9.2	7.8	5.9
6	13	0.0	0	15.8	9.3	6.9	4.1
6	14	0.0	0	17.3	9.8	7.9	5.4
6	15	0.0	0	15.0	9.4	7.7	4.0
6	16	0.0	0	15.7	8.2	6.9	5.4
6	17	4.4	0	16.5	10.2	9.1	10.3
6	18	25.3	0	15.2	12.0	12.0	9.9
6	19	0.0	4	17.0	8.2	7.2	6.9
6	20	40.1	0	17.3	10.8	7.8	4.6
6	21	8.0	0	15.0	10.3	10.2	9.5
6	22	0.0	0	17.1	11.8	10.7	12.4
6	23	0.6	0	16.4	8.4	6.2	5.0
6	24	3.1	0	16.4	10.5	7.7	7.2
6	25	3.2	0	17.5	11.8	12.4	11.8
6	26	8.7	0	15.8	11.7	10.3	11.3
6	27	0.4	0	17.1	8.9	7.6	8.5
6	28	2.1	0	17.0	11.7	11.5	8.7
6	29	0.0	0	19.0	12.0	11.4	6.5
6	30	8.5	0	17.4	10.9	10.0	9.0
7	1	6.7	0	16.0	13.8	13.8	10.4
7	2	4.7	0	17.1	13.1	12.5	8.6
7	3	0.8	0	16.6	11.0	11.1	5.1
7	4	23.6	0	16.4	8.8	7.3	9.0
7	5	1.3	0	16.1	11.7	12.8	8.4
7	6	7.5	0	17.7	11.2	10.5	5.6
7	7	1.7	0	17.4	12.0	11.2	5.6
7	8	7.3	0	17.7	10.6	10.0	7.6
7	9	0.3	0	16.3	12.7	13.2	8.0
7	10	0.9	0	17.7	12.7	12.0	9.4
7	11	0.0	0	17.7	11.8	10.8	6.6
7	12	0.0	0	17.2	10.7	9.3	5.1
7	13	0.8	0	18.7	10.4	8.2	6.2
7	14	0.0	0	21.0	14.4	14.4	5.2
7	15	0.0	0	21.7	15.0	15.0	6.3
7	16	0.2	0	18.3	11.8	10.7	5.4
7	17	0.5	0	19.2	12.3	11.2	6.2
7	18	0.0	4	21.2	14.1	13.2	6.3
7	19	0.0	0	19.7	11.3	10.2	6.3
7	20	0.0	0	19.2	8.3	5.5	4.7
7	21	0.0	0	20.2	9.2	7.2	5.0
7	22	0.0	0	19.8	13.2	10.2	5.6
7	23	0.4	0	17.2	13.3	12.0	4.6
7	24	3.3	0	21.8	13.6	12.5	5.6
7	25	0.0	0	20.0	15.2	11.8	4.4
7	26	0.0	0	21.5	12.8	8.3	4.6
7	27	0.0	0	21.5	13.1	8.3	3.6
7	28	41.4	0	20.9	12.0	8.0	5.2
7	29	22.9	0	19.9	14.1	12.8	7.2
7	30	22.1	0	19.2	13.8	13.0	9.0
7	31	24.3	0	16.9	14.3	13.7	8.6
8	1	0.0	2	18.9	13.0	9.5	9.7
8	2	0.2	9	19.7	12.8	9.1	7.9
8	3	0.5	0	19.3	13.6	10.6	5.9
8	4	13.1	0	19.0	12.5	8.3	5.6
8	5	9.7	0	19.0	13.6	11.9	8.3
8	6	0.4	0	18.6	15.4	13.3	7.6
8	7	0.3	0	19.5	15.1	12.5	4.6
8	8	22.9	0	18.1	12.8	9.4	5.4
8	9	2.9	0	17.7	14.3	11.5	11.1

8	10	5.3	0	18.8	13.3	10.3	10.3
8	11	20.5	0	17.7	12.4	8.5	7.9
8	12	16.6	0	16.5	11.2	8.6	5.1
8	13	1.0	0	15.7	11.0	6.7	6.9
8	14	0.0	0	17.2	9.2	4.8	6.3
8	15	12.5	0	19.2	10.6	5.5	7.0
8	16	21.3	0	17.3	13.5	11.6	10.2
8	17	17.4	0	16.5	11.3	8.2	9.0
8	18	1.9	0	17.7	12.7	10.6	8.5
8	19	1.1	0	20.9	14.0	11.5	6.0
8	20	2.4	0	17.9	12.7	9.5	6.8
8	21	1.8	0	19.6	13.1	10.8	3.8
8	22	0.0	0	18.6	10.3	7.5	4.4
8	23	9.5	0	16.2	10.1	5.8	7.9
8	24	0.3	0	17.7	12.1	8.3	8.9
8	25	0.0	4	18.5	14.7	12.7	12.4
8	26	0.0	0	17.2	14.9	13.6	11.7
8	27	0.0	0	19.0	14.6	12.5	6.6
8	28	0.0	0	21.3	14.8	12.8	5.3
8	29	5.4	0	19.2	13.3	9.2	4.2
8	30	5.2	0	17.3	14.2	13.5	3.8
8	31	1.1	0	18.8	13.0	11.4	5.3
9	1	0.6	0	16.8	11.6	9.4	8.0
9	2	0.6	0	17.1	10.6	6.5	8.9
9	3	0.7	0	15.7	8.9	4.2	9.1
9	4	27.8	0	17.2	10.0	7.2	4.9
9	5	4.4	0	18.0	10.4	6.2	8.0
9	6	0.0	0	15.2	12.4	9.3	7.4
9	7	0.0	0	18.5	9.1	5.6	5.7
9	8	15.2	0	16.7	9.3	5.6	5.4
9	9	0.0	0	17.2	12.3	12.2	12.3
9	10	3.9	0	15.8	10.0	7.4	10.7
9	11	0.3	0	15.8	13.2	11.5	9.5
9	12	0.0	0	17.3	9.6	6.9	3.7
9	13	10.5	0	17.0	10.3	7.5	4.8
9	14	4.1	0	17.1	12.2	8.5	5.6
9	15	0.0	0	16.7	13.0	10.5	3.9
9	16	0.0	0	15.9	11.0	9.5	4.8
9	17	0.0	0	16.9	11.0	10.8	3.3
9	18	0.4	0	17.2	8.3	5.7	4.0
9	19	0.0	0	17.5	12.1	11.5	5.3
9	20	0.0	0	18.2	10.5	6.8	3.8
9	21	0.0	0	17.0	9.0	4.0	3.0
9	22	0.0	0	16.5	11.1	8.5	7.1
9	23	0.0	0	15.8	9.3	7.1	6.2
9	24	0.0	0	16.9	8.6	6.8	5.3
9	25	0.0	0	17.0	10.0	7.2	4.4
9	26	0.0	0	16.8	10.7	7.2	3.2
9	27	0.0	4	17.2	6.7	4.5	3.3
9	28	0.0	0	16.2	6.7	6.2	3.2
9	29	0.0	0	14.8	7.0	3.5	6.7
9	30	2.7	0	14.3	11.8	10.5	9.4
10	1	1.0	0	14.1	8.7	6.4	8.7
10	2	2.2	0	12.0	4.8	2.7	8.2
10	3	3.1	0	12.3	4.7	2.1	5.9
10	4	24.9	0	14.2	5.8	3.2	11.9
10	5	0.9	0	13.2	7.7	7.5	6.9
10	6	8.5	0	15.0	4.7	2.5	7.6
10	7	0.0	0	13.2	11.2	11.6	5.6
10	8	2.8	0	16.2	6.5	3.4	4.1
10	9	10.6	0	14.7	8.6	4.6	11.0
10	10	6.4	0	14.2	13.7	12.4	13.2
10	11	0.0	4	16.5	12.3	12.2	3.1
10	12	1.1	0	16.1	8.9	7.0	4.2
10	13	6.7	0	16.7	10.8	9.1	7.1
10	14	35.9	0	14.2	11.8	11.7	9.0
10	15	1.0	0	13.3	7.2	7.3	4.9
10	16	0.0	0	13.6	6.5	5.5	4.5
10	17	0.0	0	13.0	5.7	4.2	4.5
10	18	2.2	0	13.9	6.8	4.3	6.5
10	19	8.2	0	14.4	9.2	6.0	14.8
10	20	0.0	0	14.6	11.8	10.0	11.0
10	21	0.4	0	12.1	5.0	3.7	6.1
10	22	3.9	0	13.6	4.2	3.2	7.6
10	23	9.8	0	13.9	9.5	9.3	16.0

10	24	1.3	0	12.4	5.2	3.0	6.4
10	25	15.6	0	13.5	8.2	7.2	15.3
10	26	0.0	0	15.0	9.8	9.3	6.6
10	27	0.0	0	8.9	3.0	2.0	6.8
10	28	0.4	0	8.0	1.0	0.1	6.4
10	29	6.7	0	8.3	0.0	-2.7	5.6
10	30	3.1	0	9.0	2.4	2.0	9.6
10	31	0.0	0	9.6	2.9	-0.1	8.9
11	1	0.0	0	9.2	2.9	1.2	8.3
11	2	0.0	0	10.8	4.5	2.2	7.3
11	3	0.0	0	12.3	5.5	2.5	7.2
11	4	0.4	0	10.2	7.2	4.9	4.5
11	5	0.5	0	11.7	9.1	5.9	2.2
11	6	5.0	0	11.3	7.5	4.9	5.3
11	7	7.3	0	11.1	7.0	4.6	13.1
11	8	14.4	0	12.1	8.7	5.9	11.2
11	9	5.4	0	9.9	4.5	1.9	10.0
11	10	0.5	0	9.8	4.2	1.7	10.5
11	11	0.7	0	11.2	4.5	2.2	7.7
11	12	3.5	0	11.0	3.9	-0.2	4.3
11	13	0.0	0	13.1	3.8	2.7	6.3
11	14	0.0	0	13.1	9.3	6.4	8.7
11	15	0.0	0	14.2	9.6	8.2	8.2
11	16	4.6	0	12.2	10.4	9.3	4.4
11	17	0.8	0	11.4	9.1	9.5	7.9
11	18	0.0	0	11.6	8.3	6.0	6.7
11	19	0.0	0	12.7	7.5	6.8	6.1
11	20	3.1	0	12.7	8.3	6.3	6.3
11	21	0.2	0	11.2	9.0	8.2	6.5
11	22	5.4	0	10.8	7.4	5.0	5.3
11	23	1.4	0	8.8	6.9	4.9	10.1
11	24	0.0	0	7.8	4.1	2.1	10.7
11	25	0.0	0	10.0	3.1	0.9	7.4
11	26	1.5	0	13.0	3.3	1.8	4.9
11	27	0.0	0	9.6	8.1	4.2	8.3
11	28	0.0	0	8.1	2.1	-0.8	3.4
11	29	0.0	0	3.6	-0.7	-3.1	6.5
11	30	0.0	0	3.0	0.0	-1.1	8.8
12	1	0.3	0	5.7	0.2	-2.5	6.9
12	2	3.7	0	5.2	1.2	-1.2	5.2
12	3	7.7	0	9.0	0.7	-0.9	7.0
12	4	2.5	0	7.7	1.2	-0.1	9.4
12	5	0.1	0	9.3	3.9	0.3	7.5
12	6	0.0	0	8.2	2.2	-0.2	4.8
12	7	0.7	0	10.2	1.1	-2.0	4.7
12	8	4.7	0	9.2	3.9	1.1	6.3
12	9	0.0	0	7.3	2.4	-1.1	6.8
12	10	1.2	0	6.3	-0.1	-5.3	3.7
12	11	2.7	0	5.7	-0.2	-4.5	2.1
12	12	14.4	0	10.3	0.7	-3.8	9.4
12	13	0.0	0	6.0	2.2	-2.2	4.5
12	14	0.0	0	4.2	-0.6	-5.5	5.5
12	15	0.4	0	9.7	0.1	-3.9	5.8
12	16	4.5	0	10.1	0.7	-2.2	8.2
12	17	0.0	4	9.9	2.1	-1.7	7.4
12	18	0.5	0	11.1	3.0	0.3	8.6
12	19	0.0	0	11.0	3.1	-1.2	11.3
12	20	0.3	0	13.2	7.7	4.3	10.1
12	21	0.1	0	12.9	9.8	6.5	12.3
12	22	0.2	0	9.7	9.1	7.6	7.3
12	23	0.0	0	9.3	7.9	5.7	3.7
12	24	0.0	0	9.1	5.2	0.5	1.7
12	25	0.0	0	8.7	6.6	3.7	5.4
12	26	0.0	0	7.0	5.0	0.7	7.3
12	27	0.0	0	7.2	3.7	-0.3	8.4
12	28	0.0	0	6.7	4.0	-0.7	10.9
12	29	0.0	0	5.2	0.5	-3.9	8.0
12	30	0.0	0	7.4	2.5	0.3	8.1
12	31	0.0	0	6.7	2.9	-1.9	5.0

Appendix G

Topographical Survey



Appendix H

Energy Efficiency Audit

Tramore Landfill & Civic Amenity Site
Energy Audit Report

Client: Waterford County Council,
Civic Offices,
Dungarvan

Carried Out by Waterford Energy Bureau
Civic Offices,
Tankfield,
Tramore,
Co. Waterford

WATERFORD ENERGY BUREAU
Biúro Fuinnimh Phort Láirge

Déisi oc Declán co Bráth

Energy Audit Contents

1. Summary

Waterford Energy Bureau as part of its role for Waterford County Council Environment Dept. has
Carried out an energy audit of the Civic Amenity site / landfill in Tramore. The purpose of the energy
Audit is to meet requirements set out in "Annual Environmental Report" (AER) by the Environmental Protection Agency & meet the Climate Change Strategy of Waterford County Council.

Areas examined during the audit includes;

- To assess the current energy consumption trends of the Civic Amenity Site.
- To examine alternative's energy efficiency technology that could be used to reduce
- energy consumption.
- To examine better means of operation to reduce energy consumption at the Civic Amenity Site.
- To assess the feasibility of installing alternative renewable technology.
- To examine the feasibility of utalising the land fill gas resource.

Items highlighted within the energy audit noted that energy cost savings can be made through improving the operational efficiency of the Civic Amenity Site which includes change in tariff structure & improved operational efficiency. Further savings can be made through the installation of a large wind 3-phase 9 KW wind turbine. The current wind turbine which was installed as part of a display project requires maintenance to ensure that it returns to full operation.

Mechanisms are currently not available to facilitate the utilisation of the landfill gas, the methane volumes
/ concentrations and grid access issues has inhibited the installation of a large scale CHP Plant where by electricity would be sold to the grid & excess heat would be dumped. Other areas that were examined which turned out not to be feasible included the upgrading of methane for inclusion in converted vehicles or for pressurisation & export to the gas grid.

The installation of a three phase wind turbine & improved operational efficiency are the most feasible option to saving energy at the Civic Amenity Site.

2. Electrical Tariff Analysis

The Tramore Landfill is supplied with a low voltage maximum demand electrical tariff, which meets the electrical demand of the whole site including lechate pumping, electrical demand of flare, public lighting & porto cabin electrical demand. The current Maximum Import Capacity of 65 KVA is more than sufficient to meet electrical requirements of the site.

Tramore Landfill Electrical Consumption Analysis							
	Jan - Feb 09	Mar-April 09	May-June 08	July-August 08	Sept- Oct 09	Nov-dec 09	Total
Day Units Consumed High Rate	8950	7717	3026	12350	16250	14921	63214
Day Units Consumed Low Rate	0	0	1274	0	0	0	1274
Night Units	5700	5014	3350	7850	10300	9308	41522
Total Units	14650	12731	7650	20200	26550	24229	106010
MIC	65	65	65	65	65	65	
Maximum Demand	30	30	30	30	30	30	
Day Unit Cost	€1,592	€1,373	€576	€1,712	€2,252	€2,441	€9,946
Night Unit Cost	€445	€341	€228	€546	€716	€726	€3,001
MIC Cost	€285	€285	€285	€285	€285	€285	€1,708
Maximum Demand Cost	€174	€174	€174	€174	€174	€174	€1,046
Section 58 Tax	€15	€0	€0	€0	€0	€0	€15
Watless Units Penalty	€28	€28	€0	€51	€81	€64	€251
Standing Charge	€187	€187	€187	€187	€187	€187	€1,120
VAT 13.5%	€368	€322	€196	€399	€499	€523	€2,307
Total	€3,093	€2,710	€1,645	€3,353	€4,193	€4,400	€19,394

Typical Cost Per KW is € 19,394 / 106010 = € 0.182 per KWh

- The wheel wash & the compost facility are currently inoperable & not expected to be re-operational in the near future due to the land fill being sealed & closure of compost facility.

- The installation of Power Factor Correction equipment will result in annual cost savings of € 251 through elimination of penalties & further savings will be made through improvements in power quality to equipment on the site.

3. *Break Down in Electrical Consumption*

Tramore Landfill Electrical Consumption Breakdown for Office Area						
	Number of Items	***Hours per year***	***Electrical Loading in Watts***	***Total electrical Load KWh.Y***	***% of Total***	***Note***
External Lighting	9	2400	400	8640	***8.15***	metal halide lights
Computers	2	3000	300	1800	***1.70***	
Storage Heaters	3	3000	2000	18000	***16.98***	
Immersion Heaters	1	500	1500	750	***0.71***	
Lighting Internal	10	1250	57	712.5	***0.67***	
Network Connection	1	8760	1000	8760	***8.26***	
Fax Machine	1	8760	60	525.6	***0.50***	
				39188.1	***36.97***	

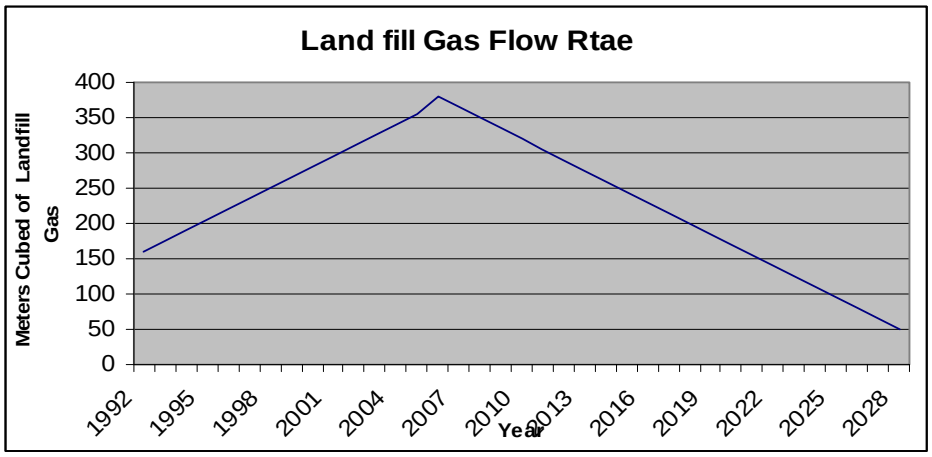
Tramore Landfill Electrical Consumption Breakdown for Office Area						
	Number of Items	***Hours per year***	***Electrical Loading in Watts***	***Total electrical Load KWh.Y***	***% of Total***	***Note***
Equipment Flaring	1	1800	3700	6660	6	
Pumping equipment & Lechate Tank				50162	47	
Miscellaneous	1			10000	9	

Note: Electrical loading of lechate pumps etc, was not known at the time of completion of audit.

4. *Land Fill Gas Potential*

The volume of waste that was disposed at Tramore Landfill since 1977 is estimate at approximately 400,000 tonnes. Recording of quantity disposed at the site started in 2002, which results in records Being an approximate calculation. The land fill opened in 1930 however the material disposed prior to 1977 is regarded as being inert. A pumping trial took place in May 2008, initial flow rates of 300 M3/hr with a majority of gas wells showing methane content of above 50%.

Estimate Gas volumes from the land fill is calculated & highlighted on the chart below.



Landfill Gas Energy utilisation Options

- The installation of a CHP Plant for the exporting of generated electricity to the grid is not feasible as the methane content is both too low and the flow rate too variable to generate electricity using reciprocating engines. The feasibility of increasing the low methane content by CO2 washing and limiting the O2 mix in the engine combustion (allowing for the high O2 content already present in the landfill gas), was examined however this was not feasible. Typical percentages of methane and flow rates to the minimum levels required (50% and 200kW/hour respectively) to support gas engine power generation.

- The capital cost of investing in infrastructure to up grade the land fill gas from its current level of 30%-50% methane to 95% methane for inclusion in specially converted vehicles is not economically feasible as the cost of the kit to up grade the gas including dryers etc. is approximately € 700,000 – € 1,000,000.

- The capital cost of investing in infrastructure to up grade the land fill gas from its current level of 30%-50% methane to 100% methane, which is then pressurised & upgraded for exported into the gas network at an alternative location is economically prohibitive. The approximate cost of such equipment including pressurisation cylinder system is approximately € 900,000 – € 1,200,000.

- The technology that supports the installation of a Micro-CHP unit that would power the land fill site & dump excess capacity onto the grid via the micro renewable program is not feasible as such technology is not available in Ireland.

5. Wind Turbine Installation & upgrade to installation

The installation of a 3-phase wind turbine to power the requirements of the landfill & export any excess electricity generated to the grid represents a credible option as the site location is significantly exposed.

The first 4,000 installations of small-scale wind turbines, photovoltaic, hydro and combined heat and power, will be offered 19 cent per kilowatt hour for the first 3,000 kWh generated per annum, and 9 cent above 3, 000 kWh. For any surplus energy sold back into the grid over the next three years under a five years contract.

Traditionally, the electricity network was designed to accommodate the flow of electricity from large centralised plants to costumers dispersed throughout the country. Micro-generation at local level now introduces two-way flows to the electricity system. Local generators will have the ability to be paid by the ESB for electricity that is surplus to their own requirements and exported. This Government measures includes grant assistance for 40% of the cost of 50 trial units (of up to 50 kW) countrywide. Applications are being accepted by SEI.

It is estimated that setting-up a micro-generated unit costs between € 15,000 and €30,000 for a single-phase unit. A pay-back is estimated on 5 to 10 years period. The initiative could change the nature of electricity generation in Ireland and help reduce the State's €6 billion a year spend on fossil fuels. For a three-phase unit, typical costs for setting-up range from € 40,000-€ 60,000. A pay-back is estimated on 5 to 10 years period. The maximum limit for the three-phase generator is 11kW, while the maximum limit for the single-phase generator is 5.75 kW. The ESB will not charge connection a micro-generator to the ESB network provided that turbine complies with EN50438.

Three Phase Turbine Installation at Civic Amenity Site

Turbine Type	Output per year KWh	Cost	Unit Cost of Electricity displaced	Unit Cost of Electricity exported	Electric Cost Savings	Payback on installation Yrs
Aircon 10 S 9.8 KW	42048	65,000	0.23	0.19	9671.04	7

Note: The unit cost of electricity also includes a factor for vat, & savings made for reduced maximum import capacity & maximum demand.

Recommendations

Tramore Landfill Energy Audit			
Item	Cost	Payback	Note
Change Maximum Import Capacity to match current demand	394	immediate	Reduce the maximum Import Capacity from 65 KVA to 50 KVA will have cost savings, which will be made every 2 months
Rectify Power factor problem within Electrical panel	€600	Annual saving of € 251	The improvements in Power factor will also reduce base loading electrical Consumption
Replace Current wind turbine installation with alternative turbine	€65,000	€ 9671 annual cost saving, will have a resulting payback of 6/7 years	Note: significant wind speed at site however site exposed to sea conditions
Repair Current Wind Turbine Installation	€1,500	1-2 yrs	Note: wind turbine installation is powering 6 containers via battery storage
Purchase Electricity in deregulated electrical market	7-10 % electrical cost savings	immediate	Item Currently being implemented
Replace light bulbs with high pressure sodium bulbs which use 50% of electrical demand of the site	€ 500	1-2 yrs	

Appendix I

Borehole Summary

Name	BH1/1	BH2	BH8		BH5
Nominal Type	GW + L	GW	GW		GW
Total Depth (m)	4.5	4.2	7.7		3.95
Strata (m)	Made ground: fill/clay with traces of rubble (0-1.7) Made ground; domestic refuse (1.7-3.7) Made ground: firm brown clay with traces of rubbish (3.7-4.2) Firm brown sandy gravelly clay: (4.2-4.5)	Made ground: hardbore fill (0-0.5) Made ground; loose mixture of gravel and rubble with fill (0.5-1.0) Made Ground: soft black sandy silt with domestic refuse (1.0-1.7) Soft/loose mixture of silt and gravel: (1.7-2.5) medium dense well graded silty gravel	topsoil: (0-0.3) Soft grey brown sandy silty clay: (0.3-1.2) Firm grey brown sandy clay with some gravel: (1.2-1.9) Stiff to very stiff brown silty sandy gravelly clay with cobbles and boulders: (1.9-7.7)		Made ground; clay and sand fill (0-0.8) Made ground: medium dense silty sand with black domestic refuse (0.8-1.8) Made ground: firm to stiff light brown gravelly clay with traces of reduse (1.8-2.9) Very stiff light brown gravelly clay (2.9-3.95)
Response zone (m)	0.80m to 4.0m	none given	refers to installation sheet		not given
Designation based on drill record	Leachate	Leachate			
Depth as measured by EPA May 2006	4	8.5	7.2		

Name	BH9	10A	RC4	RC5	RC6A
Nominal Type	GW	GW	GW	GW	L
Total Depth (m)	8.7	13	15.3	25	9
Strata (m)	Made ground: grey silty clay with wood, paper and plastic (0-0.4) Firm grey brown sandy clay with some gravel (0.4-2.2 Stiff to very stiff brown silty sandy gravelly clay with cobbles and boulders (2.2-7.4 Hard brown silty laminated clay with frequent cob	Made ground : stiff brown silty gravelly clay with concrete, brick and cobbles (0-1.3) Made ground: brick, ash, wood, plastic, paper and steel (1.3-4.2) Soft grey very silty sandy clay with shells (4.2-10.2) Large limestone cobbles and boulders (11.8-13.	open hole (0-9.7 gravel (9.7-11.7 Siltstone (11.7-15.3	Overburden (0-20 Siltstone (20-25)	Made ground light brown clay with gravel, cobbles and concrete (0-1) Made ground: black silty clay with gravel and plastic (1-3.2) Firm light brown grey gravelly clay with cobbles (3.2-7) Light brown clay with gravel and abundant cobbles (7-8.3) Light bro
Response zone (m)			12 to 14 m	21 to 24.5	3 to 9
Designation based on drill record			GW	GW	Leachate
Depth as measured by EPA May 2006	8.4	3.5	15.5		7

Name	LT01	LT04B	GW01	BH 7B	GW02
Nominal Type	Leachate	Leachate	GW	leachate	GW
Total Depth (m)	5.3	6.7	10	8	10
Strata (m)	Made ground: Gravelly clay with cobbles.Fill (0-1.5) Made ground; Landfill(1.5-5.0) Made ground: Obstruction on wood and cobbles (5.0-5.3)	Made ground: Gravelly clay with cobbles.Fill(0-1.6) Made ground; Landfill (1.6-6.7)	Sand and Gravel: (0-1.0) silty sandy gravelly clay: (1.0-2.5) Sand with pockets of silty clay and shells: (2.5-10.0)	Made ground; gravelly clay with cobbles and boulders (0-1.6) Made ground:Landfill (1.6-8)	Sand and gravel (0-1.0) Silty sandy gravelly clay (1.0-2.5) Sand with occasional pockets of silty clay and shells (2.5-10.0)
Response zone (m)	1.0m to 5.3m	2.0m-6.7m	9.0m-10.0m	5.4m to 8.0m	9.0m - 10.0m
Designation based on drill record	Leachate	Leachate	Groundwater	Leachate	Groundwater

Name	GW03	GW04	GW05A	GW06	GW07
Nominal Type	GW	GW	GW	GW	GW
Total Depth (m)	10	8	4.1	10.5	11
Strata (m)	Sand and gravel (0-1.0) Silty sandy gravelly Clay(1.0-1.5) Sand with occasional pockets of silty clay and shells (2.5-10.0)	Gravelly clay with cobbles and boulders (0-7.9) Obstruction(7.9-8.0)	Gravelly Clay with cobbles and boulders (0-4.10)	Made Ground: Turf over topsoil (0-0.1) Made Ground: Grey clay with cobbles (0.1-2.0)Grey sandy silt (4.0-10.5)	Made ground: Turf over topsoil (0-0.1) Made ground: Brown clay with cobbles (0.1-0.6) Made Ground: Grey clay with cobbles(0.6-2.5) Made Ground: Landfill (2.5-3.6) Grey Sandy silt (3.6-11.0)
Response zone (m)	2.0m-10.0m	1.0m-8.0m	1.0m-4.10m	1.0m-10.5m	1.0m-11.0m
Designation based on drill record	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater

Name	GW08
Nominal Type	Groundwater
Total Depth (m)	10
Strata (m)	Made ground: Turf over topsoil(0-0.1) Made ground; Brown Clay with cobbles(0.1-1.4) Made ground: Landfill (2.0-3.6)Grey sandy silt (3.6-8.8)Brown gravelly clay(8.8-10)
Response zone (m)	1.0m to 10.0m
Designation based on drill record	Groundwater

Appendix J

Management Structure

Management Structure of Waterford County Council

County Manager Mr Ray O' Dwyer

⇩

Director of Services

Environment & Planning Mr. Brian White

⇩

Senior Engineer Mr. Gabriel Hynes

⇩

Senior Executive Engineer Mr. Jimmy Mansfield

⇩

2 Executive Scientific Officer **Executive Engineer** (Deputy Manager) **Environmental Consultants**

Mr. Paul Carroll Ms. Aoife O Flaherty MCOS

⇩

Landfill Manager

Mr. David Regan

⇩ ⇩

Caretaker **Deputy Caretaker**

Mr. Anthony Shanahan Mr. Pat Jacob

Appendix K

Pollutant Release Transfer Register (PRTR)

Environmental Protection Agency

AER Returns Worksheet

Version 1.1.04

REFERENCE YEAR	2008

1. FACILITY IDENTIFICATION

Parent Company Name	Waterford County Council
Facility Name	Tramore Waste Disposal Site
PRTR Identification Number	W0075
Licence Number	W0075-02

Waste or IPPC Classes of Activity

No.	class_name
4.2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
3.4	Surface impoundment, including placement of liquid or sludge discards into pits, ponds or lagoons.
3.12	Repackaging prior to submission to any activity referred to in a preceding paragraph of this Schedule.
3.13	Storage prior to submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where the waste concerned is produced.
4.3	Recycling or reclamation of metals and metal compounds.
4.4	Recycling or reclamation of other inorganic materials.
4.9	Use of any waste principally as a fuel or other means to generate energy.
4.10	The treatment of any waste on land with a consequential benefit for an agricultural activity or ecological system.
4.11	Use of waste obtained from any activity referred to in a preceding paragraph of this Schedule.
4.12	Exchange of waste for submission to any activity referred to in a preceding paragraph of this Schedule.

Address 1	Tramore Intake & Tramore Burrows
Address 2	Tramore
Address 3	Co. Waterford
Address 4	
Country	Ireland
Coordinates of Location	361400.000
River Basin District	IESE
NACE Code	382
Main Economic Activity	Waste treatment and disposal
AER Returns Contact Name	David Regan
AER Returns Contact Email Address	doregan@waterfordcoco.ie
AER Returns Contact Position	Executive Technician
AER Returns Contact Telephone Number	058 22063
AER Returns Contact Mobile Phone Number	086 8307065
AER Returns Contact Fax Number	058 45606
Production Volume	0.0
Production Volume Units	0
Number of Installations	0
Number of Operating Hours in Year	2145
Number of Employees	0
User Feedback/Comments	
Web Address	www.waterfordcoco.ie

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name

4.1 RELEASES TO AIR

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR				
POLLUTANT			METHOD	
			Method Used	
No. Annex II	Name	M/C/E	Method Code	Designation or Description
01	Methane (CH4)	C	OTH	USEPA Landgem model version 3.02
03	Carbon dioxide (CO2)	C	OTH	USEPA Landgem model version 3.02
07	Non-methane volatile organic compounds (NMVOC)	C	OTH	USEPA Landgem model version 3.02

* 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				
POLLUTANT			METHOD	
			Method Used	
No. Annex II	Name	M/C/E	Method Code	Designation or Description

* 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				
POLLUTANT			METHOD	
			Method Used	
Pollutant No.	Name	M/C/E	Method Code	Designation or Description

* 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: Tramore Waste Disposal Site

Please enter summary data on the quantities of methane flared and / or utilised			Method Used	
	T (Total) kg/Year	**M/C/E**	**Method Code**	**Designation or Description**
Total estimated methane generation (as per site model)	1017000.0	C	OTH	USEPA Landgem model version 3.02
Methane flared	503415.0	C	OTH	Assumed 50% capture and 9
Methane utilised in engine/s	0.0			
Net methane emission (as reported in Section A above)	513585.0	C	OTH	Assumed 50% capture and 9

	QUANTITY		
Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
513585.0	513585.0	0.0	0.0
2790000.0	2790000.0	0.0	0.0
43710.0	43710.0	0.0	0.0

	QUANTITY		
Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
0.0	0.0	0.0	0.0

	QUANTITY		
Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year

4.2 RELEASES TO WATERS

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwat

RELEASES TO WATERS				
POLLUTANT				
			Method Used	
No. Annex II	Name	M/C/E	Method Code	Designation or Description
17	Arsenic and compounds (as As)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
18	Cadmium and compounds (as Cd)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
79	Chlorides (as Cl)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
19	Chromium and compounds (as Cr)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
20	Copper and compounds (as Cu)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
82	Cyanides (as total CN)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
35	Dichloromethane (DCM)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
83	Fluorides (as total F)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
40	Halogenated organic compounds (as AOX)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
23	Lead and compounds (as Pb)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
21	Mercury and compounds (as Hg)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
22	Nickel and compounds (as Ni)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
69	Organotin compounds (as total Sn)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
12	Total nitrogen	E	Estimate	Product of measured average leachate concentration (AS AMMONIA) and calculated leachate flow
76	Total organic carbon (TOC) (as total C or COD/3)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
54	Trichlorobenzenes (TCBs)(all isomers)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow

			QUANTITY			
	Method Used					
M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.152	0.152	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.0	0.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	9823.0	9823.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.79	0.79	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.15	0.15	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.0	0.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.0	0.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	56.3	56.3	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.0	0.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.0	0.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.0	0.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.52	0.52	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.0	0.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration (AS AMMONIA) and calculated leachate flow	3594.0	3594.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	78.9	78.9	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	0.0	0.0	0.0	0.0
E	Estimate	Product of measured average leachate concentration and calculated leachate flow	1.59	1.59	0.0	0.0
			0.0	0.0	0.0	0.0

24	Zinc and compounds (as Zn)	E	Estimate	Product of measured average leachate concentration and calculated leachate flow

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

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO WATERS				
POLLUTANT				
			Method Used	
No. Annex II	Name	M/C/E	Method Code	Designation or Description
62	Benzene	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
68	Naphthalene	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
73	Toluene	E	Estimate	Product of measured average leachate concentration and calculated leachate flow
78	Xylenes	E	Estimate	Product of measured average leachate concentration and calculated leachate flow

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

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

RELEASES TO WATERS				
POLLUTANT				
			Method Used	
Pollutant No.	Name	M/C/E	Method Code	Designation or Description

1.59	1.59	0.0	0.0
0.0	0.0	0.0	0.0

QUANTITY			
Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
0.002	0.002	0.0	0.0
0.002	0.002	0.0	0.0
0.01	0.01	0.0	0.0
0.084	0.084	0.0	0.0

QUANTITY			
Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0

4.3 RELEASES TO WASTEWATER OR SEWER

SECTION A : PRTR POLLUTANTS

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					
POLLUTANT		METHOD			
			Method Used		
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1
					0.0

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

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

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					
POLLUTANT		METHOD			
			Method Used		
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1
					0.0

QUANTITY		
T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
0.0	0.0	0.0

QUANTITY		
T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
0.0	0.0	0.0

4.4 RELEASES TO LAND

SECTION A : PRTR POLLUTANTS

RELEASES TO LAND					
POLLUTANT		METHOD			
			Method Used		
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1
					0.0

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

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

RELEASES TO LAND					
POLLUTANT		METHOD			
			Method Used		
Pollutant No.	Name	M/C/E	Method Code	Designation or Description	Emission Point 1
					0.0

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	QUANTITY	
	T (Total) KG/Year	A (Accidental) KG/Year
	0.0	0.0

	QUANTITY	
	T (Total) KG/Year	A (Accidental) KG/Year
	0.0	0.0

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

Transfer Destination	European Waste Code	Hazardous	Quantity T/Year	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment
						M/C/E	Method Used	
Within the Country	17 02 02	No	3.28	Flat Glass	R5	M	Weighed	Offsite in Ireland
Within the Country	17 04 07	No	14.22	Scrap Mixed Metals	R5	M	Weighed	Offsite in Ireland
Within the Country	17 02 01	No	29.82	Timber	R5	M	Weighed	Offsite in Ireland
Within the Country	17 01 07	No	27.28	Construction Rubble	R5	M	Weighed	Offsite in Ireland
Within the Country	20 03 01	No	126.68	Large household Items such as carpets, linoleum, matresses etc	D1	M	Weighed	Offsite in Ireland
To Other Countries	16 02 11	Yes	2.16	Fridges	R4	M	Weighed	Abroad
To Other Countries	16 02 13	Yes	49.14	Washing Machines, Dryers etc.	R4	M	Weighed	Abroad
To Other Countries	16 02 09	Yes	4.54	Televisions, monitors	R4	M	Weighed	Abroad
To Other Countries	16 02 11	Yes	0.1	Flourescent Lamps	R5	M	Weighed	Abroad
Within the Country	15 01 01	No	57.14	Mixed Dry Recyclables	R3	M	Weighed	Offsite in Ireland
Within the Country	04 02 22	No	1.7	Textiles	R5	M	Weighed	Offsite in Ireland
Within the Country	**13 02 06**	**Yes**	0.8	Waste Engine Oil	R9	M	Weighed	Offsite in Ireland
Within the Country	16 06 01	Yes	0.28	Batteries	R6	M	Weighed	Offsite in Ireland
Within the Country	08 01 21	Yes	1.28	Waste Paint and Varnish	D5	M	Weighed	Offsite in Ireland
Within the Country	16 05 04	Yes	0.14	Aerosols	D5	M	Weighed	Offsite in Ireland

Name and Licence / Permit No. of Recoverer / Disposer / Broker	Address of Recoverer / Disposer / Broker	Name and Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)	Licence / Permit No. of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
Mr. Binman WCP/KK/022(A)/05	Suir Island, Clonmel, Co. Tipperary		
Mr. Binman WCP/KK/022(A)/05	Suir Island, Clonmel, Co. Tipperary		
Mr. Binman WCP/KK/022(A)/05	Suir Island, Clonmel, Co. Tipperary		
Mr. Binman WCP/KK/022(A)/05	Suir Island, Clonmel, Co. Tipperary		
Mr. Binman WCP/KK/022(A)/05	Suir Island, Clonmel, Co. Tipperary		
KMK Metals Recycling - WCP/KK/069(A)/06	Cappincur Industrial Estate, Daingean Road, Tullamore, Co. Offaly	Various International Locations	Not available from carrier
KMK Metals Recycling - WCP/KK/069(A)/06	Cappincur Industrial Estate, Daingean Road, Tullamore, Co. Offaly	Various International Locations	Not available from carrier
KMK Metals Recycling - WCP/KK/069(A)/06	Cappincur Industrial Estate, Daingean Road, Tullamore, Co. Offaly	Various International Locations	Not available from carrier
KMK Metals Recycling - WCP/KK/069(A)/06	Cappincur Industrial Estate, Daingean Road, Tullamore, Co. Offaly	Various International Locations	Not available from carrier
Waterford County Council - EPA Licence 189-1	Materials Recovery Facility, Shandon, Dungarvan, Co. Waterford		
Cookstown Textile Recyclers - ROC 1929 Carrier/Broker	Magherlane Road, Randalstown, Co. Antrim		
ENVA Ireland	Clonmanim Industrial Estate, Portlaoise, Co. Laois	Clonmanim Industrial Estate, Portlaoise, Co. Laois	WCP/KK/059(A)07
ENVA Ireland	Clonmanim Industrial Estate, Portlaoise, Co. Laois	Clonmanim Industrial Estate, Portlaoise, Co. Laois	WCP/KK/059(A)07
ENVA Ireland	Clonmanim Industrial Estate, Portlaoise, Co. Laois	Clonmanim Industrial Estate, Portlaoise, Co. Laois	WCP/KK/059(A)07
ENVA Ireland	Clonmanim Industrial Estate, Portlaoise, Co. Laois	Clonmanim Industrial Estate, Portlaoise, Co. Laois	WCP/KK/059(A)07