WATERFORD COUNTY COUNCIL

COMHAIRLE CHONTAE PHORTLAIRGE

ANNUAL ENVIRONMENTAL REPORT 2012

TRAMORE WASTE DISPOSAL SITE

TRAMORE INTAKE & TRAMORE BURROWS

TRAMORE CO. WATERFORD

Waste Licence Register No. W0075-02

Report Compiled by;
Mr David Regan, Facility Manager, Tramore Landfill
Mr Paul Carroll, Executive Scientific Officer, Adamstown Laboratory

Table of Contents

List of Appendices

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 eleventh 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 2012 to 31st December 2012.

The Civic Amenity Facility at Tramore Landfill was closed indefinitely on 20th November, 2009.

1. Reporting Period

This is the eleventh Annual Environmental Report for the Tramore Landfill Facility, which covers the period 1st January 2012 to 31st December 2012.

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 Facility

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. Calculated Remaining Capacity of the Site

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

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

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

5. Licensed 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. THE CIVIC AMENITY SITE WAS CLOSED INDEFINITELY ON 20th NOVEMBER, 2009

6. Environmental-Monitoring

INTRODUCTION

This report is a compilation of environmental monitoring carried out on behalf of Waterford County Council at Tramore Landfill, principally during the period January 2012 to December 2012.

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) and leachates (Ammonia).

[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.

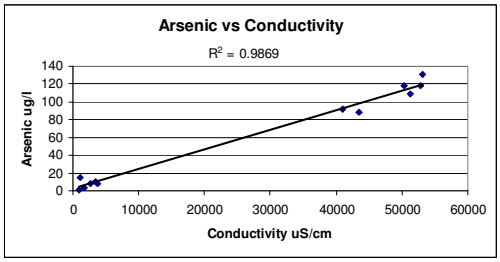
Table 1. Typical polyatomic interference – extract from Varian ICP-MS Application note 32.

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	$^{32}S\ ^{16}O_2$, $^{32}S_2$, $^{36}Ar\ ^{14}N_2$, $^{40}Ar\ ^{23}Na\ ^{1}H$, $^{40}Ar\ ^{24}Mg$

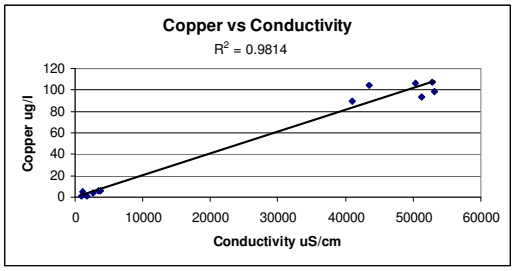
Examination of the Q2 2006 results of metals analysis from Tramore landfill provides evidence for such interference. Using conductivity as a proxy measure of salinity, it can be seen – see figures 1a-d - that there is a direct and strong correlation between salinity and measured metal concentration for

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.

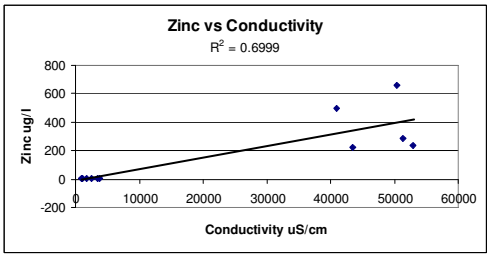
Thus the reported results for these metals in saline samples (conductivity > 5000 us/cm) are unreliable and should be disregarded.



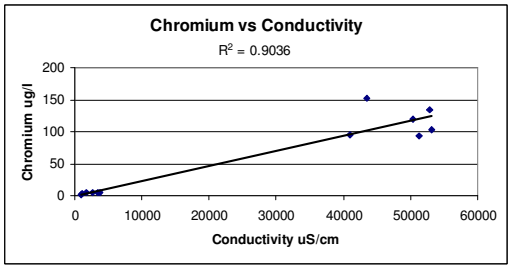
1a



1b



1c



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 by the EPA Kilkenny laboratory personnel in each quarter of 2012.

Results are presented in tables 7.1.1 to 7.1.4, 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, 2009), 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 sites S1 to S4 have varying degrees of brackishness, while sites SW5 and SW6 are saline.

pH and temperature are normal at all sites over the monitoring period and fall within relevant quality standards.

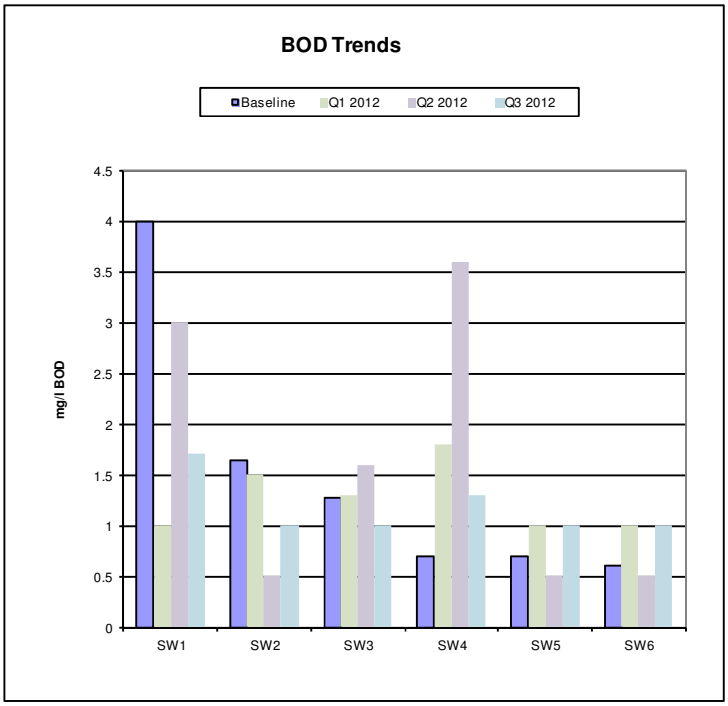
Dissolved oxygen levels were generally satisfactory at all the sites. The suspended solids levels seem quite high at times at many of the sampling stations, and this may be due to silt/sand entrainment in the samples, as the BOD values do not indicate the presence of significant amounts of organic matter.

Ammonia and BOD were elevated at times at site SW1 though a deceasing trend was evident. Apparently elevated ammonia at all surface water sites in Q4 is most likely due to saline interference in the test.

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 Trends 2012

BOD was generally low at all the surface water sites. There was a slight elevation at SW4 in Q2, likely due to algal activity. BOD was not reported for Q4.

7.1.3 Discussion

The results of analysis indicate an improvement at SW1 with regards to organic matter and nutrients. It is known that an off-site storm-water discharge discharges to SW1. A constructed wetland was installed in 2011 in order to attenuate contamination at this location. There is no indication of any effect from the landfill on the surface water sites.

Table 7.1.1 Tramore Landfill Surface Water Monitoring Q1 2012

EntityName	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore
StationName	SW1	SW2	SW3	SW4	SW5	SW6
StationLocalCode	1	2	3	4	5	6
SamplePurpose	Landfill SW quarterly	Landfill SW quarterly	Landfill SW quarterly	Landfill SW quarterly	Landfill SW quarterly	Landfill SW quarterly
SampleLabCode	1204SW010602	1204SW020602	1204SW030602	1204SW040602	1204SW050602	1204SW060602
SampleDate	06/02/2012	06/02/2012	06/02/2012	06/02/2012	06/02/2012	06/02/2012
Ammonium(NH4)	0.12	0.16	0.11	0.05	BLD	BLD
BOD	1	1.5	1.3	1.8	BLD	BLD
Chemical Oxygen Demand	29	NT	NT	NT	NT	NT
Chloride	191	NT	NT	NT	NT	NT
Conductivity @ 25°C	1226	NT	NT	NT	NT	NT
Dissolved Oxygen % Saturation	129	102	97	106	100	100
pH	8.1	8.3	8	8.1	8	8
Suspended Solids	51	NT	24	17	15	13
Temperature	9.6	10.4	9.9	8.9	9.5	9.2

Table 7.1.2 Surface Water Monitoring Q2 2012

StationName	SW1	SW2	SW3	SW4	SW5	SW6	Water Quality Standards (Surface Water Regs 2009 and Bathing Water Regs 2008)	Comment	Environmental significance
SampleDate	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012			
Ammonium(NH4)	0.18	0.02	0.05	0.02	0.02	0.02		Slightly elevated at SW1 (non-landfill influence)	None given dilution available
BOD	3	BLD	1.6	3.6	BLD	BLD	4 (Transitional)	Satisfactory at all sites	None
Chemical Oxygen Demand	34	NT	NT	NT	NT	NT		Satisfactory where measured	None
Chloride	179	NT	NT	NT	NT	NT		SW1 freshwater	None
Conductivity @ 25°C	1018	NT	NT	NT	NT	NT		SW1 freshwater	None
Dissolved Oxygen % Saturation	126	110	97.9	150.9	101	102	70-130% (Transitional) 80-120% (Coastal)	Elevated at SW4, likely algal activity	None
pH	8.2	7.9	8.1	8.7	8	8.1		Elevated at SW4, likely algal activity	None
Suspended Solids	12	9	50	20	17	11		Slightly elevated at SW3, reflecting muddy conditions at this high velocity tidal area.	None
Temperature	15.1	13.7	10.8	12.2	10.4	10.3		Normal range	None

Table 7.1.3 Tramore Landfill Surface Water Monitoring Q3 2012

EntityName	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	WATER QUALITY STANDARDS SURFACE WATER REGS 2009 AND BATHING WATER REGS 2008	COMMENT	ENVIRONMENTAL SIGNIFICANCE
StationName	SW1	SW2	SW3	SW4	SW5	SW6			
StationLocalCode	1	2	3	4	5	6			
SamplePurpose	ndfill SW quarte	ndfill SW quarte	ndfill SW quarte	ndfill SW quarte	ndfill SW quarte	ndfill SW quarte			
SampleLabCode	1250trasw12208	1250trasw22208	1250trasw32208	1250trasw42208	12350trasw52208	1250trasw62208			
SampleDate	22/08/2012	22/08/2012	22/08/2012	22/08/2012	22/08/2012	22/08/2012			
Ammonium(NH4)	0.02	0.01	0.01	0.01	0.01	0.01		Low levels	none
BOD	1.7	1	1	1.3	1	1	4	Low levels	none
Chemical Oxygen Dem	NT	NT	NT	NT	NT	NT			
Chloride	302	NT	NT	NT	NT	NT			
Conductivity @ 25°C	1517	NT	NT	NT	NT	NT			
Dissolved Oxygen % Saturation	131	119	112	140	119	113	70-130% TRANSITIONAL 80-120 COASTAL	Slightly elevated likely due to algal activity	Possible diurnal variations
pH	8.1	8.2	8.2	8.4	8.1	8.1		Normal range	none
Suspended Solids	<3	11	12	29	26	36		possible saline interference in test	None
Temperature	19.2	17	17.2	18	16	16.3		Normal range	none

Table 7.1.4 Tramore Landfill Surface Water Monitoring Q4 2012

EntityName	Tramore	Tramore	Tramore	Tramore	WATER QUALITY STANDARDS SURFACE WATER REGS	COMMENT	ENVIRONMENTAL SIGNIFICANCE
StationName	SW1	SW3	SW4	SW5			
SampleDate	13/11/2012	13/11/2012	13/11/2012	13/11/2012			
Ammonium(NH4)	1.2	0.95	0.34	0.7		Low levels	none
BOD	NT	NT	NT	NT	4		
Chemical Oxygen Demand		NT	NT	NT			
Chloride	169	12840	10838	14710			
Conductivity @ 25°C	1040	NT	NT	NT			
ssolved Oxygen % Saturat	91	98	108	99	70-130% TRANSITIONAL 80-120 COASTAL	Normal levels	None
pH	7.9	8	8.1	8.1		Normal range	none
Suspended Solids	5	30	27	24		Possible saline interference in test	None
Temperature		11.8	12	11.8		Normal range	none

7.2.2. Groundwater

7.2.1 INTRODUCTION

Samples were taken at sites BH2, BH5, BH8, BH9, RC4, RC5, RC6a, GW2, GW5.

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

Table 7.2.1 . 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 tables 7.2.2 to 7.2.5, 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 can interfere with some of the tests, (*ammonia, arsenic, copper).* Accordingly interpretation of test results for some parameters must bear this in mind.

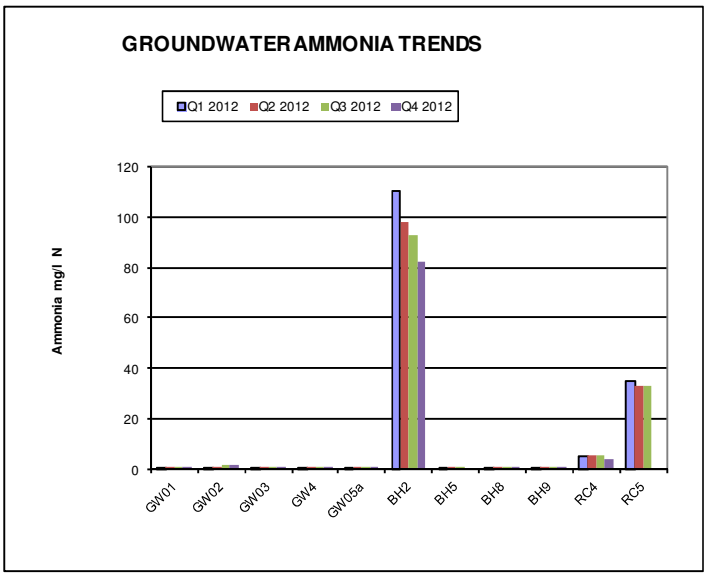
Conductivity values were elevated in many of the boreholes, reflecting significant saline intrusion at this estuarine site. A discussion of the extent of saline intrusion is beyond the scope of this environmental report, however detailed studies[2] of saline intrusion into these boreholes was carried 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.

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 2012

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

Results for 2012 were similar to baseline monitoring in most boreholes, though an increase at BH2 since baseline measurement was evident, likely due to waste degradation activity and concentration of leachate due to landfill capping.

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 somewhat impacted by leachate from the landfill, as evidenced by elevated ammonia and iron levels at BH2, and RC4, though drilling records indicate that BH2 is characteristic of a leachate rather than groundwater borehole. RC5 is distant from the municipal landfill, but adjacent to an historic land-filled area, which is likely to be the source of the ammonia in this borehole. This is the subject of further investigation.

Heavy metals, List I/II Organics, and phenols were low at all boreholes throughout the monitoring period.

Table 7.2.2 Tramore Landfill Groundwater Monitoring Q1 2012

EntityName	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore			
StationName	BH2	BH5	BH8	BH9	GW1	GW2	GW3	GW4	GW5	RC4	RC5			
StationLocalCode	2	15	8	9	11	12	13	4	5	3	25			
SamplePurpose	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	landfill GW quarterly	GROUNDWATER QUALITY STANDARDS SI No. 9, 2010	COMMENTS	ENVIRONMENTAL SIGNIFICANCE
SampleLabCode	1204bh020702	1204 bh50602	1204bh80702	1204BH90702	1204GW01060 2	1204GW02060 2	1204GW03060 2	1204GW40702	1204GW5A0702	1204RC40702	1204RCG06 02			
SampleDate	07/02/2012	06/02/2012	07/02/2012	07/02/2012	06/02/2012	06/02/2012	06/02/2012	07/02/2012	07/02/2012	07/02/2012	06/02/2012			
Ammonia(N)	110	BLD	0.1	0.26	0.09	0.36	0.08	0.02	0.07	4.8	35	0.175 Nominal action level 100	Evelated levels at BH2 and RC5, likely due to landfill.	None, given dilution factor in receiving environment
Chloride	NT	NT	868	110	NT	NT	NT	134	104	NT	NT	24	Associated with salinity	None
Conductivity @ 25°C	11950	NT	3520	931	NT	NT	NT	1047	1113	NT	NT	800	Conductivity associated with salinity	None
Dissolved Oxygen % Saturation	62	98	27.9	19	86	75	38	38	48	57	37		Moderate levels in many boreholes indicative of reducing conditions	None
Faecal Coliforms	BLD	BLD	BLD	BLD	BLD	BLD	41	BLD	BLD	BLD	BLD		Low levels	None
Iron		440	680	1900	150	1400	1200	910	430	2600	1800		Somewhat elevated levels at many boreholes, possibly derived from landfill	None - no groundwater abstractions in vicility and large dilution available in receiving surface water estuarine environment.
pH	7	7.7	7.3	7.1	7.4	7.3	7.9	7.2	7.3	7.1	6.9		Within normal range	None
Phenols	BLD	BLD	BLD	BLD	BLD	BLD	NT	BLD	BLD	BLD	BLD		Low levels	None
Potassium		380	19	15	92	98	86	11	12	470	250	5	Elevated levels associated with salinity	None
Salinity	6.6	2	1.7	NT	8	8.3	7.3	NT	NT	33.1	31.4		RC4 and RC5 most saline	None
Sodium	NT	9900	560	140	2500	2700	2500	98	180	12000	11000	150	Elevated levels associated with salinity	None
Temperature	12.1	10.9	9.7	11.3	11.4	10.1	7.9	10.5	9.4	11.5	12.1		Within normal range	None
Total Coliforms	8700	9200	41	52	20	74	120	290	1500	BLD	BLD		Moderate levels BH2 and BH5, otherwise low levels.	None
Total Organic Carbon	NT	5.6	NT	NT	13.7	15.1	37.8	NT	NT	NT	5.6		Moderate level GW3	abstractions in vicility and large dilution available in receiving surface water estuarine
Total Oxidised Nitrogen	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	37.5	NT	None

es exceedance of GW standards SI 9, 2010

Denotes exceedance of nominal action level

Table 7.2.3 Tramore Landfill Groundwater Monitoring Q2 2012

EntityName	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Groundwater Threshold Values (GTV)	Comment	Environmental Significance
StationName	BH2	BH5	BH8	BH9	GW1	GW2	GW3	GW4	GW5	RC4	RC5			
SampleDate	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012	14/05/2012			
Ammonium(NH4)	98	0.48	0.11	0.31	0.01	0.67	0.2	0.04	0.04	5.1	33	0.175	Very elevated BH2 and RC5. Also elevated RC4. Most likely source is municipal landfill for BH2 and RC4 and historic landfill for RC5.	None - no groundwater abstractions in vicinity and large dilution available in receiving surface water estuarine environment.
Chloride	NT	NT	672	108	NT	NT	NT	126	99	NT	NT	24	Associated with salinity	None
Conductivity @ 25°C	NT	NT	2850	1368	13950	NT	11900	1032	1075	NT	NT	800	Conductivity associated with salinity from surrounding environment.	None
Dissolved Oxygen % Satura	64.3	90	54.1	41.2	75	94	48	44.6	28.2	50.5	26.2		Moderate levels in many boreholes indicative of oxidative conditions this	None
Faecal Coliforms	BLD	BLD	BLD	52	BLD	BLD	10	BLD	BLD	BLD	BLD		Low levels	None - no groundwater abstractions in vicility and large dilution available in receiving surface water estuarine
Iron	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	None - no groundwater abstractions in vicility and large dilution available in receiving surface water estuarine
pH	7	7.7	7.3	7.3	7.5	7.5	7.3	7.1	7	7.1	7		Within normal range	None
Phenols	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		NT	None
Potassium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	5	NT	None
Salinity	5.7	27.1	1.3	<0.5	7.9	8.7	6.7	<0.3	<0.3	33.1	31		BH5, RC4 and RC5 most saline	None
Sodium	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	150	NT	None
Temperature	12	10.2	11.6	11.3	11.8	10.3	10.9	11.6	11.2	12.5	12.5		Within normal range	None
Total Coliforms	180	BLD	BLD	200	BLD	1300	86	BLD	160	BLD	BLD		Slightly elevated at GW2, over all relatively low.	None - no groundwater abstractions in vicility and large dilution available in receiving surface water estuarine
Total Organic Carbon	145.1	5.3	2.6	5.3	23.1	22.7	128.3	2.3	2.7	3	5.5		Somewhat elevated BH2and GW3.	
Total Oxidised Nitrogen	BLD	BLD	BLD	BLD	0.52	BLD	BLD	1.05	0.3	BLD	BLD	37.5	Low levels	None

Table 7.2.4 Tramore Landfill Groundwater monitoring Q3 2012

EntityName	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Groundwater Threshold Values	Comments	Environmental significance
StationName	BH2	BH5	BH8	BH9	GW1	GW2	GW3	GW4	GW5	RC4	RC5			
Ammonia(N)	93	0.48	0.17	0.37	0.2	1.6	0.2	0.05	0.11	5.4	33	0.175	Very elevated BH2, and RC5. Also elevated RC4. Most likely source is municipal landfill for BH2 and RC4, and historic landfill for RC5.	none - no groundwater abstractions in vicinity and large dilution available in receiving surface water estuarine environment.
Chloride	NT	NT	538	110	NT	NT	NT	127	106	NT	NT	24	Associated with salinity	None
Conductivity @ 25°C	NT	NT	NT	915	NT	NT	NT	1017	1076	NT	NT	800	Associated with salinity	None
Dissolved Oxygen % Saturation	55	72	88	20	84	93.6	57	32	47	52	33		Moderate levels	None
Faecal Coliforms	BLD	24000	BLD	61	31	620	120	BLD	20	BLD	<5		Elevated at BH5, may be local contamination. Moderate levels elsewhere.	Unlikely to affect bathing water.
Iron	**11000**	**2400**	**5700**	**5500**	**11000**	**21000**	**60000**	**5900**	**6700**	**3100**	5400		Very elevated at BH2, GW1, GW2 and GW3. Most likely source municipal landfill. Moderately elevated at other boreholes.	none - no groundwater abstractions in vicinity and large dilution available in receiving surface water estuarine environment.
pH	6.9	7.3	7.3	6.8	7.5	7.3	7	7.2	7.2	7.1	7		Normal range	None
Phenols	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD	BLD		Not detected	None
Potassium	100	240	5.5	5.1	47	52	53	BLD	5.5	290	140	5	Associated with salinity	None
Salinity	6.2	27.2	1.1	NT	6.6	7.7	7.1	NT	NT	33	31		Associated with salinity	None
Sodium	1000	4800	220	91	1600	1800	1200	64	210	4900	6200	150	Associated with salinity	None
Temperature	14.7	16.7	14.6	14.3	14.4	15.6	17.1	14.2	15.1	14	13.8		Normal range	None
Total Coliforms	1100	24000	790	360	2200	24000	150	470	240	BLD	10		Elevated at BH5, may be local contamination. Moderate levels elsewhere.	Unlikely to affect bathing water.
Total Organic Carbon	16.6	6	2.9	3.5	16.8	13.3	54.9	2.5	4.8	3.8	6.7		Elevated at GW3	none - no groundwater abstractions in vicinity and large dilution available in receiving surface water estuarine environment.
Total Oxidised Nitrogen	BLD	BLD	BLD	BLD	0.42	BLD	BLD	0.71	0.21	BLD	BLD	37.5	Low levels	None

Table 7.2.5 Tramore Landfill Groundwater monitoring Q4 2012

EntityName	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Tramore	Groundwater Threshold Values	Comments	Environmental significance
StationName	BH2	BH8	BH9	GW1	GW2	GW3	GW4	GW5	GW6	GW7	RC4			
SampleDate	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012	12/11/2012			
Ammonia(N)	82	0.49	0.35	0.51	1.2	0.4	0.06	0.07	2.6	10	4.1	0.175	Very elevated BH2. Also elevated GW7 and RC4. Most likely source is municipal landfill.	None - no groundwater abstractions in vicinity and large dilution available in receiving surface water estuarine environment.
Chloride	1525	3399	495	1790	3451	3451	98	157	273	216	8221	24	Associated with salinity	None
Conductivity @ 25°C	6820	11920	2120	7090	1285	1374	1043	989	2090	1806	5110	800	Associated with salinity	None
Dissolved Oxygen % Saturation	53	75	14	51	63	58	32	33	12	18	NT		Moderate levels	None
Faecal Coliforms	BLD	BLD	BLD	160	52	1200	BLD	10	BLD	20	NT		Moderate levels	Unlikely to affect bathing water.
Iron	4100	1100	1700	3200	20000	25000	5900	2100	12000	7500	NT		Very elevated at GW2 , GW3 and GW6. Most likely source municipal landfill. Moderately elevated at other boreholes.	None - no groundwater abstractions in vicinity and large dilution available in receiving surface water estuarine environment.
pH	6.8	7.2	7	7.4	7.1	7.1	7.1	7.1	6.7	6.8	7.1		Normal range	None
Phenols	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		Not tested	N/A
Potassium	130	46	11	60	83	84	BLD	BLD	9.6	20	NT	5	Associated with salinity	None
Salinity	3.7	6.7	<0.9	3.8	7.3	7.8	NT	NT	<0.9	NT	NT		Associated with salinity	None
Sodium	650	1300	240	1000	1700	1800	78	60	99	89	NT	150	Associated with salinity	None
Temperature	13.3	12.2	12.4	12	11.7	10.9	12.2	12.3	12.5	12.7	12.6		Normal range	None
Total Coliforms	24192	660	1600	16000	4000	3900	1500	1500	1600	110	NT		Elevated at BH2 and GW1, may be local contamination. Moderate levels elsewhere.	Unlikely to affect bathing water.
Total Organic Carbon	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT	NT		Not tested	N/A
Total Oxidised Nitrogen	BLD	BLD	BLD	0.3	BLD	BLD	BLD	1.99	BLD	BLD	BLD	37.5	Low levels	None

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 7.3.1. 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 7.3.2 to 7.3.5, 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

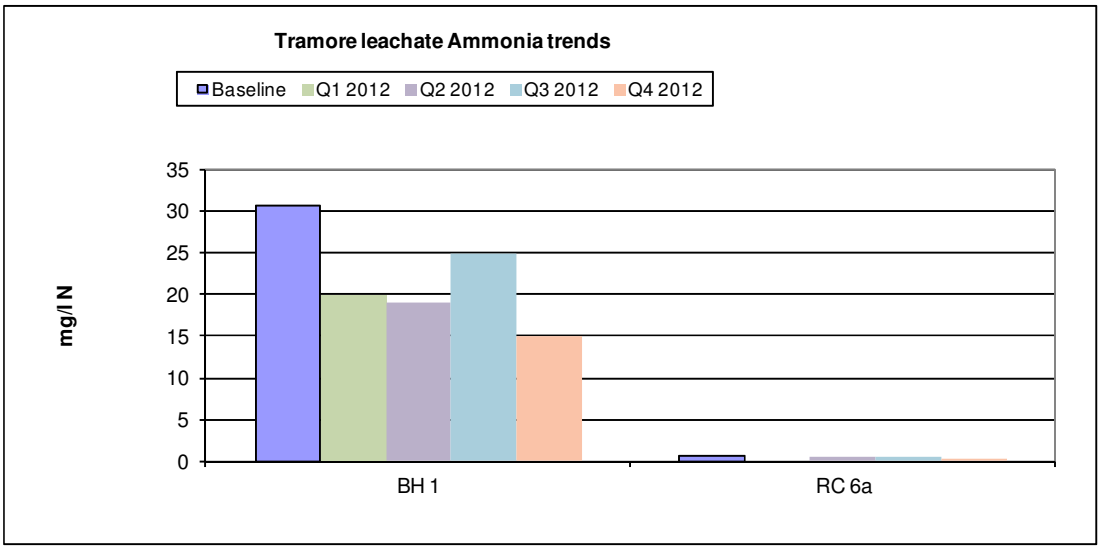


Fig 7.3.1 Leachate ammonia levels 2012

Many of the leachate boreholes were dry as a result of landfill capping and thus were not sampled in 2012. BH1/1 showed a slight decline in ammonia concentration during 2012.

Table 7.3.2 Tramore Landfill Leachate Monitoring Q1 2012

EntityName	Tramore	Tramore	Tramore	Tramore	**Comments**	**Environmental Significance**
StationName	BH1/1	BH7b	LT1	LT3a		
SamplePurpose	LANDFILL LEACHATE QUARTERLY	LANDFILL LEACHATE QUARTERLY	LANDFILL LEACHATE QUARTERLY	LANDFILL LEACHATE QUARTERLY		
SampleLabCode	1204BH110602A	1204bh7b0702	1204lt10702	1204lt3a0702		
SampleDate	06/02/2012	07/02/2012	07/02/2012	07/02/2012		
Ammonium(NH4)	20	31	180	1700	Levels generally within range expected for municipal landfill leachate. LT3a highest.	Some elevation of ammonia levels in adjacent groundwaters possible, but - given the dilution available in the wider environment (>1/30,000) no wider environmental effect is expected.
BOD	NT	48	20	135	Relatively low all sites	None given available dilution.
Chloride	276	201	446	NT	Relatively low all sites measured	None
Conductivity @ 25°C	2210	2410	5060	23870	Reflects possible saline intrusion LT3a	
pH	7	6.6	6.8	7.5	Normal range	None
Total Oxidised Nitrogen	BLD	NT	NT	NT	Low at BH 1/1, only site measured.	None

Table 7.3.3 Tramore Landfill Leachate Monitoring Q2 2012

StationName	BH1/1	RC6a	**Comments**	**Environmental Significance**
SampleDate	14/05/2012	14/05/2012		
Ammonium(NH4)	19	0.48	Levels generally within range expected for municipal landfill leachate.	Some elevation of ammonia levels in adjacent groundwaters possible, but - given the dilution available in the wider environment (>1/30,000) no wider environmental effect is expected.
BOD	NT	NT	NT	None given available dilution.
Chemical Oxygen Demand	NT	NT	NT	None given available dilution.
Chloride	251	112	Relatively low all sites measured	None
Conductivity @ 25°C	2130	1078	Relatively low all sites measured	
pH	6.7	7.1	Normal range	None
Total Oxidised Nitrogen	BLD	<0.2	Low all sites measured.	None

Table 7.3.4 Tramore Landfill Leachate Monitoring Q3 2012

EntityName	Tramore	Tramore	Comments	Environmental Significance
StationName	BH1/1	RC6a		
SampleDate	21/08/2012	21/08/2012		
Ammonium(NH4)	25	0.53	Range as generally expected for leachate	None given available dilution
BOD	NT	NT		
Chemical Oxygen Dema	NT	NT		
Chloride	259	120	Associated with saline intrusion	None
Conductivity @ 25°C	2100	1067	Associated with saline intrusion	None
pH	6.9	7.3	Normal range	None
Total Oxidised Nitroger	BLD	BLD	None detected	None

Table 7.3.5 Tramore Landfill Leachate Monitoring Q4 2012

EntityName	Tramore	Tramore	Comments	Environmental Significance
StationName	BH1/1	RC6a		
SampleDate	12/11/2012	12/11/2012		
Ammonium(NH4)	15	0.4	Range low for leachate	None given available dilution
BOD	NT	NT		
Chemical Oxygen Demand	NT	NT		
Chloride	190	139	Associated with saline intrusion	None
Conductivity @ 25°C	1808	1061	Associated with saline intrusion	None
pH	6.8	7.3	Normal range	None
Total Oxidised Nitrogen	BLD	BLD	None detected	None

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 minor fluctuations in levels in BH7, LT1, and LT2. LT 4 and LT5 were dry most of 2012.

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 2012

Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7b	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	04/01/2012	DR	0.7				1.2					1.1	0.2	0.6	1.7	Dry	Dry	-	-	-	-	-	-	-	-
2	12/01/2012	DR	0.6				1.2					1	0.1	0.6	1.7	Dry	Dry								
3	19/01/2012	DR	0.8				1.2					1.1	0.1	0.6	1.7	Dry	Dry								
4	24/01/2012	DR	0.8				1.2					1.1	0.1	0.6	1.7	Dry	Dry								
5	31/01/2012	DR	0.9	1.3		0.6	1.4	1.4	1.7	0.6	0.3	1	0.2	0.5	1.7	Dry	Dry	0.3	1	0.1		0.1			
6	09/02/2012	DR	0.6				1					1	0.2	0.6	1.7	Dry	Dry								
7	17/02/2012	DR	0.6				1					0.9	0.2	0.6	1.7	Dry	Dry								
8	23/02/2012	DR	0.7	1.3		0.6	1	1.4	1.7	0.6	0.3	1	0.2	0.5	1.9	Dry	Dry	0.3	1	0.1		0.1			
9	29/02/2012	DR	0.6				1					0.9	0.2	0.6	1.7	Dry	Dry								
10	06/03/2012	DR	0.6				1					0.9	0.2	0.6	1.7	Dry	Dry								
11	16/03/2012	DR	0.6				1					0.9	0.2	0.6	1.7	Dry	Dry								
12	20/03/2012	DR	0.5	1.3		0.6	0.9	1.4	1.7	0.6	0.3	0.9	0.1	0.6	1.7	Dry	Dry	0	0.7	0.2		0.1			
13	29/03/2012	AOF	0.6				1					0.9	0.2	0.6	1.7	Dry	Dry								
Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7b	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

na No Access

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

Height of LT5 & BH2 adjusted in Oct 2008

Height of all monitoring wells within Landfill area adjusted from 02/05/09 onwards due to replacement of well platforms and borewell covers

Table 4.2 Tramore Landfill Leachate &Groundwater Levels Q2 2012

Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7b	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	02/04/2012	DR	0.6				0.8					1	0.2	0.6	1.7	Dry	Dry	-	-	-	-	-	-	-	-
15	12/04/2012	DR	0.6				0.8					1	0.2	0.5	1.7	Dry	Dry								
16	16/04/2012	DR	0.5				0.8					0.9	0.2	0.5	1.7	Dry	Dry								
17	24/04/2012	DR	0.6	1.3		0.6	0.8	1.4	1.7	0.6	0.3	0.9	0.1	0.6	1.8	Dry	Dry								
18	04/05/2012	DR	0.5				0.8					0.9	0.2	0.5	1.7	Dry	Dry								
19	08/04/2012	DR	0.5				0.8					0.9	0.2	0.5	1.7	Dry	Dry								
20	14/05/2012	DR	0.7				1					0.8	0.2	0.6	1.7	Dry	Dry								
21	24/05/2012	DR	0.5	1.3		0.6	0.9	1.4	1.6	0.6	0.1	0.7	0.2	0.5	1.7	Dry	Dry								
22	28/05/2012	DR	0.5				1					0.9	0.1	0.5	1.7	Dry	Dry								
23	06/06/2012	DR	0.9				1					1	0.1	0.6	2	Dry	Dry								
24	15/06/2012	AOF	0.8				1.2					0.9	0.1	0.5	1.9	Dry	Dry								
25	20/06/2012	DR	0.8				1.2					0.9	0.1	0.5	2	Dry	Dry								
26	27/06/2012	DR	0.8	1.2		0.5	1.2	1.5	1.8	0.8	0.1	0.9	0.1	0.6	1.9	Dry	Dry								
Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7b	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
	na No Access																								
Heights of monitoring wells were adjusted from 07/03/08 onwards due to updated GPS locations																									
Height of LT5 & BH2 adjusted in Oct 2008																									
Height of all monitoring wells within Landfill area adjusted from 02/05/09 onwards due to replacement of well platforms and borewell covers																									

Table 4.3 Tramore Landfill Leachate & Groundwater Levels Q3 2012

Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7b	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	04/07/2012	DR	0.9				1.4					1.1	0.1	0.6	1.9	Dry	Dry	-	-	-	-	-	-	-	-
28	10/07/2012	DR	0.8				1.4					0.9	0.2	0.6	1.9	Dry	Dry								
29	16/07/2012	DR	0.8				1.2					1	0.2	0.6	1.9	Dry	Dry								
30	27/07/2012	DR	0.8	1.2		0.5	1	1.5	1.7	0.6	0.1	1	0.1	0.5	1.9	Dry	Dry	1.1	1.9	1.1		1.5			
31	02/08/2012	DR	0.9	1.2		0.5	1.1	1.5	1.7	0.5	0.2	0.9	0.1	0.5	1.9	Dry	Dry	0.2	0.9	0.1		0.1			
32	06/08/2012	DR	0.9				1					1	0.1	0.5	1.9	Dry	Dry								
33	15/08/2012	DR	1				1					1	0.2	0.5	2.2	Dry	Dry								
34	20/08/2012	DR	0.8				1.2					1	0.1	0.5	2	Dry	Dry								
35	27/08/2012	LA	0.6				1.2					1	0.1	0.5	1.9	Dry	Dry								
36	07/09/2012	DR	0.6				1.2					1	0.2	0.5	1.9	Dry	Dry								
37	12/09/2012	DR	0.5				1.1					1	0.2	0.5	1.9	Dry	Dry								
38	17/09/2012	DR	0.5				1.1					1	0.3	0.5	2.1	Dry	Dry								
39	26/09/2012	DR	0.4	1		0.5	1.1	1.4	1.5	1.2	0.2	1	0.2	0.5	2.1	Dry	Dry	0.1	0.9	0.1		0.1			
Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7b	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

na No Access

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

Height of LT5 & BH2 adjusted in Oct 2008

Height of all monitoring wells within Landfill area adjusted from 02/05/09 onwards due to replacement of well platforms and borewell covers

Table 4.4 Tramore Landfill Leachate & Groundwater Levels Q4 2012

Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7b	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	01/10/2012	DR	0.4				1.1					1	0.2	0.5	2.1	Dry	Dry	-	-	-	-	-	-	-	-
41	09/10/2012	DR	0.5	0.9		0.5	1.1	1.3	1.7	0.9	0.2	0.9	0.2	0.5	2	Dry	Dry	0.1	0.9	0.1		0.1			
42	19/10/2012	DR	0.6				0.9					0.9	0.2	0.5	2	Dry	Dry								
43	26/10/2012	DR	0.6				0.9					0.9	0.2	0.5	2	Dry	Dry								
44	02/11/2012	DR	0.9				0.9					0.9	0.1	0.5	1.9	Dry	Dry								
45	08/11/2012	DR	0.9				0.9					0.9	0.1	0.5	1.8	Dry	Dry								
46	14/11/2012	DR	0.8				0.9					0.9	0.1	0.5	1.9	Dry	Dry								
47	22/11/2012	DR	0.7				0.9					1	0.1	0.5	1.9	Dry	Dry								
48	26/11/2012	DR	0.7	1.2		0.4	1	1.3	1.6	0.9	0.2	1	0.1	0.5	2	Dry	Dry	0.1	0.9	0.1		0.1			
49	03/12/2012	DR	0.7				0.9					1	0.1	0.5	1.9	Dry	Dry								
50	14/12/2012	DR	0.6	1.2		0.4	1	1.3	1.6	1	0.2	1	0.1	0.5	2	Dry	Dry	0.1	0.9	0.1		0.1			
51	20/12/2012	DR	0.8				1					1.1	0.1	0.5	2	Dry	Dry								
52	28/12/2012	DR	0.7				1					1	0.1	0.5	2	Dry	Dry								
Week No	Date	Operator	BH 1/1	BH 2	BH4A	BH 5	BH 7b	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

na No Access

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

Height of LT5 & BH2 adjusted in Oct 2008

Height of all monitoring wells within Landfill area adjusted from 02/05/09 onwards due to replacement of well platforms and borewell covers

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 7.5.1 to 7.5.4 and figure 7.5.1.

Key parameter – methane

Methane is a product of the breakdown of biodegradable material in the landfill. The methane levels detected during 2012 are presented in figs. 7.5.1a and 7.5.1b below.

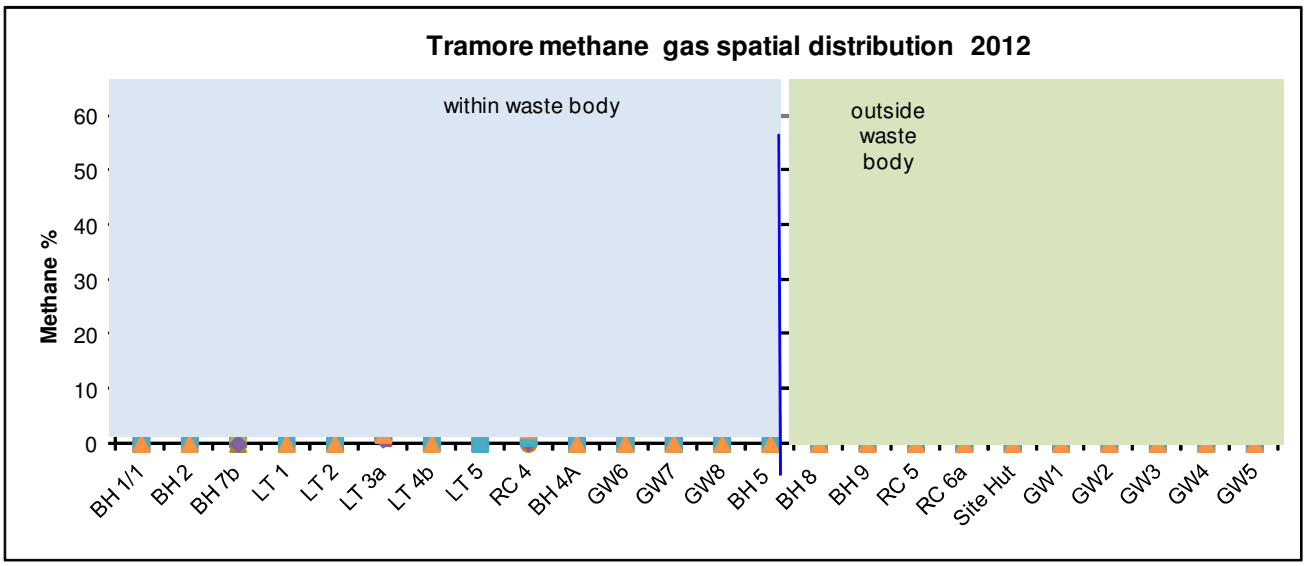


Fig 7.5.1a Methane spatial distribution 2012

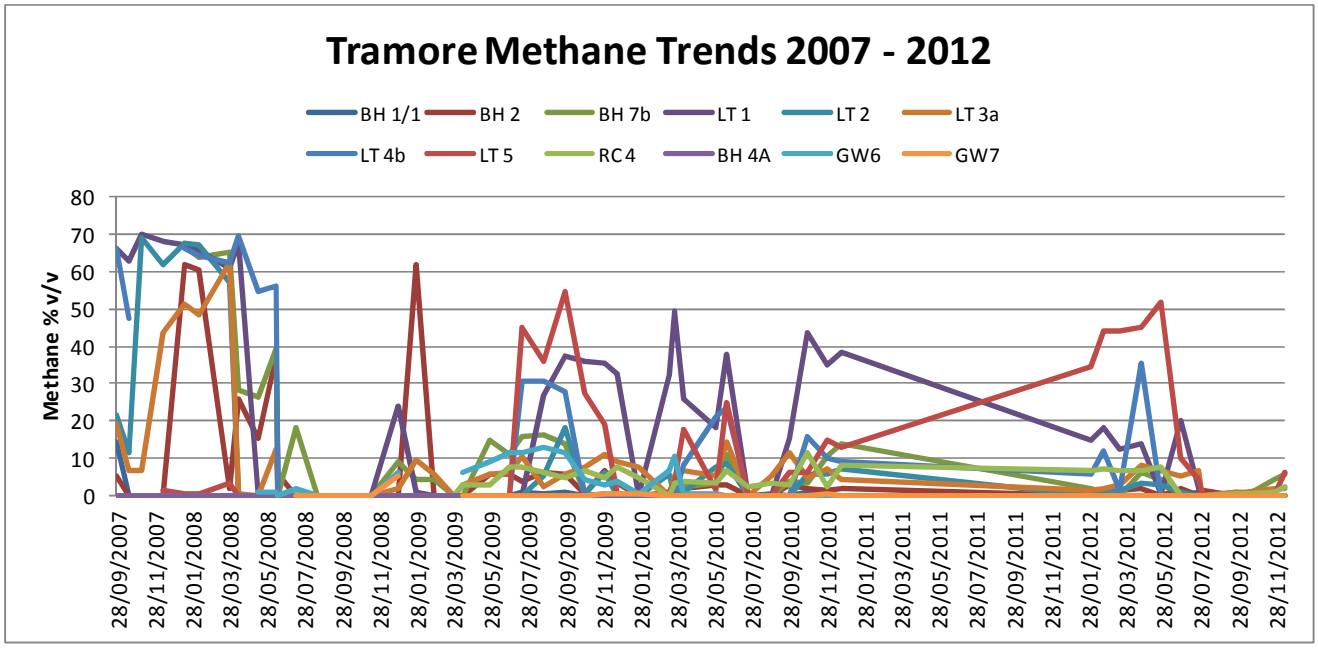


Fig 7.5.1b Methane temporal trends 2007 - 2012

7.5.3 Discussion

Spatial distribution (Fig 7.5.1a): Methane, consistent with the breakdown or organic waste, was present in some boreholes within the landfill area at levels up to 6.2% v/v (in LT5). This was lower than in previous two quarters. There was no landfill gas detected in the site building or at boreholes outside the waste body area.

Temporal trends (fig 7.5.1b): There was decrease in measured methane towards the end of the year. In general, across the landfill, there is a trend of decreasing methane since 2007, and further monitoring will indicate ongoing trends.

Table 7.5.1 Gas Levels Q1 2012

Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7B	BH 8	BH 9	RC 4	RC 5	RC 6A	LT1	LT2	LT3A	LT4B	LT5	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
1	04/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.6 1011	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	12/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1017																							
3	19/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1018																							
4	24/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1017																							
5	31/01/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1034	0 0 20.9 1036	0 0 20.9 1036	0 0 20.9 1036	0 0 20.9 1036	2.1 1.0 20.1 1036	0 0 20.9 1036	0 0 20.4 1036	6.5 2.1 16.4 1036	0 0 20.9 1036	0 0 20.9 1036	15.0 7.8 15.7 1034	0 0 20.9 1034	1.5 0.8 20.3 1036	5.7 2.7 18.2 1036	34.5 17.5 4.9 1034	0 0 20.9 1036	0 0 20.9 1036	0 0 20.9 1036	0 0 20.9 1034	0 0 20.9 1034	0 0 20.9 1036	0 0 20.9 1036	0 0 20.9 1036
6	09/02/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1035																							
7	17/02/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1024																							
8	23/02/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1023	0 0 20.9 1023	1.0 0.5 20.7 1023	0 0 20.9 1023	0 0 20.9 1023	0.8 0.8 20.4 1023	0 0 20.9 1023	0 0 20.9 1023	7.1 3.1 15.8 1023	0 0 20.9 1023	0 0 20.9 1023	18.2 13.7 9.7 1023	0.3 0.4 20.6 1023	1.7 0.8 20.4 1023	11.8 5.7 17.0 1023	44.2 21.8 6.4 1023	0 0 20.9 1023	0 0 20.9 1023	0 0 20.9 1023	0 0 20.9 1023	0 0 20.9 1023	0 0 20.9 1023	0 0 20.9 1023	0 0 20.9 1023
9	29/02/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1024																							
10	06/03/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1024																							
11	16/03/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1030																							
12	20/03/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1031	0 0 20.9 1031	1.2 0.6 20.1 1031	0 0 20.9 1031	0 0 20.9 1031	0 0 20.9 1031	0 0 20.9 1031	0.5 0.3 20.7 1031	6.8 3.0 16.5 1031	0 0 20.9 1031	0 0 20.9 1031	12.5 9.0 13.4 1031	1.4 1.3 19.8 1031	2.8 1.3 19.8 1031	1.3 0.2 19.8 1031	44.2 21.8 6.5 1031	0 0 20.9 1031	0 0 20.9 1031	0 0 20.9 1031	0 0 20.9 1031	0 0 20.9 1031	0 0 20.9 1031	0 0 20.9 1031	0 0 20.9 1031
13	29/03/2012	AOF	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1026																							
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**	**LT1**	**LT2**	**LT3A**	**LT4A**	**LT5**	**GW1**	**GW2**	**GW3**	**GW4**	**GW5**	**GW6**	**GW7**	**GW8**

Table 7.5.2 Gas Levels Q2 2012

Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7B	BH 8	BH 9	RC 4	RC 5	RC 6A	LT1	LT2	LT3A	LT4B	LT5	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
14	02/04/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1018																							
15	12/04/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1018																							
16	16/04/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1017																							
17	24/04/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 996	0 0 20.9 996	2.1 1.2 20.3 996	0 0 20.9 996	0 0 20.9 996	6.2 3.1 19.2 996	0 0 20.9 996	0.5 0.3 20.7 996	6.8 3.0 16.5 996	0 0 20.9 996	0 0 20.9 996	14.1 11.2 11.4 996	3.1 2.8 18.3 996	7.9 3.8 18.8 996	35.5 25.4 0.6 996	45.3 23.1 3.2 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996	0 0 20.9 996
18	04/05/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1001																							
19	08/05/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1010																							
20	14/05/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1012																							
21	24/05/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025	4.1 1.9 19.4 1025	0 0 20.9 1025	0 0 20.9 1025	7.6 3.8 16.4 1025	0 0 20.9 1025	0 0 20.9 1025	0.5 0.3 20.6 1025	2.7 1.5 19.3 1025	6.5 2.9 18.8 1025	0 0 20.9 1025	52.0 24.7 3.9 1025	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025	0 0 20.9 1025
22	28/05/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1015																							
23	06/06/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1021																							
24	15/06/2012	AOF	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1003																							
25	20/06/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1017																							
26	27/06/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1015	0 0 20.9 1015	2.0 1.1 20.2 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0.2 0.6 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	20.2 15.3 6.7 1015	0.7 0.6 19.9 1015	5.2 3.2 19.0 1015	0 0 20.9 1015	10.0 14.5 1.5 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015	0 0 20.9 1015
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**	**LT1**	**LT2**	**LT3A**	**LT4A**	**LT5**	**GW1**	**GW2**	**GW3**	**GW4**	**GW5**	**GW6**	**GW7**	**GW8**

Table 7.5.3 Gas Levels Q3 2012

Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7B	BH 8	BH 9	RC 4	RC 5	RC 6A	LT1	LT2	LT3A	LT4B	LT5	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
27	04/07/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1006	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
28	10/07/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1011																							
29	16/07/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1014																							
30	27/07/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1010	1.1 1.0 19.8 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	2.1 0.9 19.7 1010	0 0 20.9 1010	6.9 3.1 18.5 1010	0 0 20.9 1010	4.1 3.2 16.6 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010	0 0 20.9 1010
31	02/08/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1007	0 0 20.9 1007	1.2 0.7 20.0 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007	0 0 20.9 1007
32	06/08/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1012																							
33	15/08/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 992																							
34	20/08/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1018																							
35	27/08/2012	LA	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1019																							
36	07/09/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1025																							
37	12/09/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1005																							
38	17/09/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1006																							
39	26/09/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0.7 0.4 19.9 995	0 0 20.9 995	0 0 20.9 995	0.2 0.7 19.2 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	1.1 1.9 19.4 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995	0 0 20.9 995
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**	**LT1**	**LT2**	**LT3A**	**LT4A**	**LT5**	**GW1**	**GW2**	**GW3**	**GW4**	**GW5**	**GW6**	**GW7**	**GW8**

Table 7.5.4 Gas Levels Q4 2012

Week No	Date	Operator	Gas	Site Hut	BH 1/1	BH 2	BH 4A	BH 5	BH 7B	BH 8	BH 9	RC 4	RC 5	RC 6A	LT 1	LT 2	LT 3A	LT 4B	LT 5	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
40	01/10/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1007	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
41	09/10/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0.3 0.9 19.1 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0.8 1.6 19.6 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014	0 0 20.9 1014
42	19/10/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1006																							
43	26/10/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1017																							
44	02/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 989																							
45	08/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1019																							
46	14/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1026																							
47	22/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1001																							
48	26/11/2012	DR	CH_4, CO_2, O_2 Air Pressure	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	4.2 3.1 14.9 1011	0 0 20.9 1011	0 0 20.9 1011	1.1 2.3 17.2 1011	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	1.7 1.5 18.8 1011	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 0 20.9 1011	0 0 20.9 1011	0 0 20.9 1011	0 0 20.9 1011
49	03/12/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1001																							
50	14/12/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	5.8 4.2 11.0 987	0 0 20.9 987	0 0 20.9 987	2.5 1.4 17.0 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	1.7 1.5 18.8 987	0 0 20.9 987	6.2 4.5 11.6 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987	0 0 20.9 987
51	20/12/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1002																							
52	28/12/2012	DR	CH_4, CO_2, O_2 Air Pressure	0 0 20.9 1011																							
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**

7.6 NOISE

7.6.1 Introduction

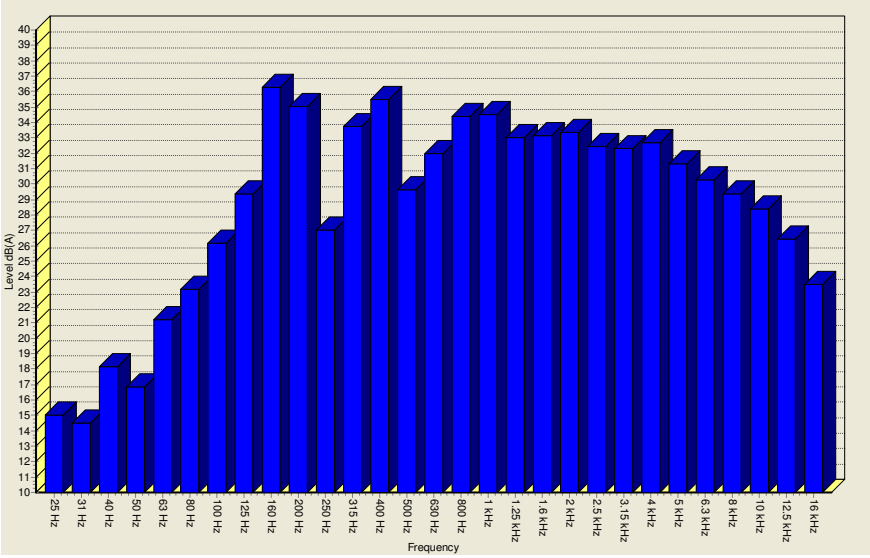
Daytime noise levels were recorded on 13/4/12 at two locations at Tramore Landfill Site, B1 and B2, as specified in the licence monitoring schedule D. These locations are shown in appendix 1. There are limits of 55 dB Leq(30) daytime, and 45 dB Leq(30) night-time imposed as a condition of the licence.
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 7.6.1, below.

7.6.2 Summary of Results / Discussion

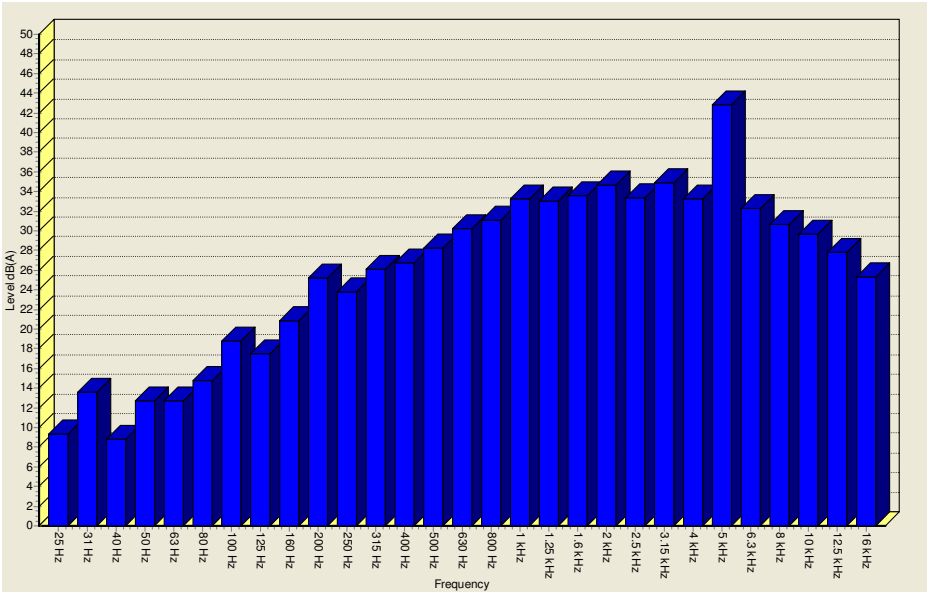
Site	*Date of Monitoring*	*Time of commencement of monitoring*	*L(A)eq[30mins]dB*
B1	13/4/12	11.18	52.7
B2	13/4/12	12.05	44.8

Table 7.6.1 Summary of noise measurements at Tramore landfill 18/5/11.

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) 13/4/12



B2 1/3 Octave Noise Analysis, (A weighting) 13/4/12

Frequency analysis at sites B1 and B2 indicated a broad range of frequencies, consistent with a variety of noise sources, such as wind and machinery and traffic. Some low frequency noise, of unknown origin but perhaps the noise from the seashore, at location B1 was evident. A single tone at 5hz at B2 was detected, source unknown.

7.6.a DUST MONITORING

Dust deposition was measured at monitoring sites B1 and B2 over a 27 day period 13/4/12 to 9/5/12 at locations B1 and B2, using the Bergerhoff gauge method.

Results are presented in table below.

Dust Monitoring Tramore Landfill

Monitoring interval.			13/04/2012 to 09/05/2012	
No Of Days			27	
Location	Weight 1	Weight 2	No of Days	Deposition Rate mg/sq. m/day
B1	0.3316	0.3319	27	5.1
B2	0.3337	0.3344	27	11.8

Dust deposition levels were low at 5.1 to 11.8 mg/m2/day. This is negligible compared to a general nuisance dust deposition limit of 350 mg/m2/day.

7.7 ANALYSIS OF ESTUARINE BENTHIC MACROFAUNA

7.7.1 CHEMICAL ANALYSIS

7.7.1.1 METHODS

Shellfish samples – cockles (*Ceracostaderma edule*) and mussels (*Mytilis edulis*) were taken from the backstrand, within 200 metres of the landfill, on 7/12/2011.

Approximately 50 adult individuals of each type were sampled along the sampling zone, figure 7.8.1. These individuals were mixed well and a subset of 15 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 Laboratory Services, Cork. QUASIMEME[3] reference materials were processed with the samples. Only results which satisfied the QUASIMEME criteria for accuracy are included in this report.

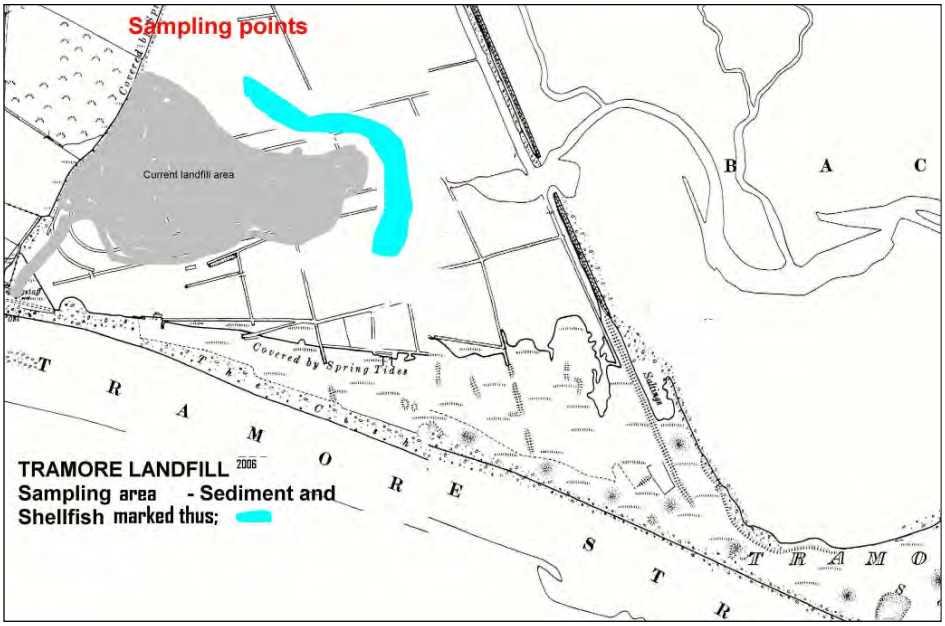


Fig 7.8.1. Tramore backstrand shellfish and sediment sampling areas

[3] Quality Assurance of Information in Maritime Environment Monitoring

7.7.1.2 RESULTS

Results of analysis are presented in table 1.

Table 7.8.1. Trace metal concentrations in shellfish samples from Tramore inner backstrand, December 2011 mg/Kg wet weight

PARAMETER **mg/Kg wet weight ***	**Cockle flesh** ***Cardium edule***	**Mussel flesh** ***Mytilis edulis***	**Shellfish Quality Standards ***	
	December 2011	**December 2011**	EU Regulation 221/2002/EC	SI No. 268 of 2006
Arsenic	2.8	4.4		5.6
Cadmium	0.098	0.279	1	0.93
Lead	0.294	0.465	1.5	1.4
Zinc	40.5	49.9		744

7.7.1.3 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.
The EC (Quality of shellfish waters) Regulations, SI No. 268 of 2006 contains guidelines values for heavy metals in shellfish flesh. These standards are specified as dry weight and corresponding wet weight values have been calculated for inclusion in table 7.8.1 above.

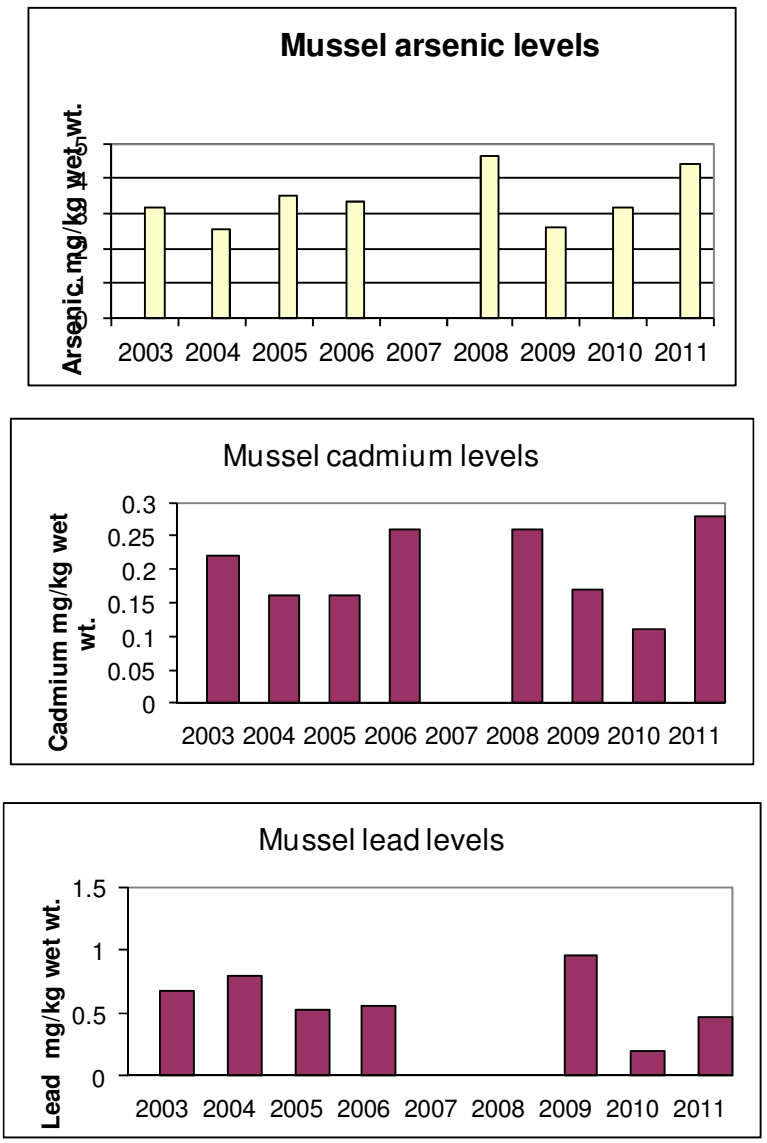
Discussion

The metals levels in mussel and cockle samples from Tramore backstrand in December 2011 complied with EU and national shellfish quality standards.

7.7.1.4 TRENDS AND COMPARISON WITH PREVIOUS RESULTS

The results obtained for mussels and cockles in the 2011 survey are presented in figure 7.7.2 below for comparison with previous results for this site.

Figure 7.7.2 Metal concentrations in mussels in Tramore backstrand for years 2003 to 2011



7.7.1.5 Discussion

Results for 2011 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.

7.7.1.6 COMPARISON WITH OTHER SITES

Trace metal concentrations in mussel samples from Tramore inner backstrand are compared in table 7.8.2 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 7.7.2. 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			
	07 December 2011	Mean of 4 samples	Mean of 4 samples	Mean	90% ile	Max
Arsenic	4.43	3.6	2.6			
Cadmium	0.28	0.3	0.25	**0.15**	**0.2**	**0.35**
Chromium	0.93	4	1.4	**0.18**	**0.33**	**0.66**
Copper	NR	2.2	2.9	**1.39**	**1.57**	**1.97**
Lead	0.47	1.3	2.1	**0.23**	**0.52**	**0.85**
Zinc	49.98	15.6	25.4	**15.69**	**19.1**	**27**

7.7.1.7 Discussion

Metals levels recorded in Tramore backstrand mussels in December 2011 were similar to that found at other estuarine and coastal sites around the country.

7.7.2 MICROBIOLOGICAL ANALYSIS

7.7.2.1 Methods

Samples of cockles and mussels were collected as described in section 7.8.1.1 above. Testing of intervalvular fluids for faecal coliforms was carried out atWaterford County Council Adamstown Laboratory. Results are compared with EC (Quality of Shellfish Waters) Regulations No. 268 of 2006, schedule 4.

7.7.2.2 Results

Sample	Faecal coliforms per 100 mls	EC (Quality of Shellfish Waters) Regulations No. 268 of 2006
Tramore backstrand Cockles	<100	≤300 per 100 mls in intervalvular liquid
Tramore backstrand Mussels	<100	

7.7.2.3 Discussion

The faecal coliform counts in cockles and mussels intervalvular liquid were in compliance with regulatory guidelines.

7.8.2. Sediment.

7.8.2.1 Introduction

A composite sample of sediment (approx 2 kg) was taken on 7/12/11 at ten sampling points along a sampling zone adjacent to Tramore landfill, see fig 7.8.1 above. 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 powdered 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 2010	Sediment Quality Standards			
			Baseline *	Threshold **	ERL ***	Proposed Irish sediment guidance levels ****
Arsenic	mg/Kg dry wt.	5.8				
Cadmium	mg/Kg dry wt.	<0.5	0.5	1.5	5	1
Chromium	mg/Kg dry wt.	21.5	5	50	80	100
Copper	mg/Kg dry wt.	9.85	5	50	70	50
Iron	mg/Kg dry wt.	15,975				
Lead	mg/Kg dry wt.	13				50
Zinc	mg/Kg dry wt.	55.8	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	2011	2010	2008	2006	2005	2004	2003	2002	1998	2001	2004
Arsenic	mg/kg dry wt	5.8	8.5	6.1	4.96	5.2	5.2	7.1	5.6		8	10
Cadmium	mg/kg dry wt	<0.5	0.2	<0.5	0.063	0.1	<0.44	<0.04	0.123	0.42	0.04	0.3
Chromium	mg/kg dry wt	21.5	27.5	16.4	16.4	14.3				65.6	35	31
Copper	mg/kg dry wt	9.85	2.1	10.6	6.98	8.1	10.7	8.6	5.4	11	9.8	13
Iron	mg/kg dry wt	15975	15245	13094	12,880	9721	13106	14048	15500		17466	24689
Lead	mg/kg dry wt	13	14.7	19.4	9.6	11.3	14.5	11	15.1		26	20
Manganese	mg/kg dry wt		258	242	225	215	263	398	270		622	385
Zinc	mg/kg dry wt	55.8	54.8	52.6	41.2	34	48.5	35	51.4	55.3	141	83

7.8.2.5 Discussion

December 2011 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.

7.9 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, with elevated ammonia and iron. However heavy metals and organic concentrations are low at all boreholes. Groundwater outside the landfill site was generally satisfactory.

Leachate quality was as expected for a landfill accepting mainly domestic and inert waste. Heavy metal and organic content were low. Based on chemical analysis, and available dilution, no significant environmental effect from landfill leachate is expected. Leachate boreholes appear to be drying up, most likely as an effect of landfill capping.

No noise nuisance was indicated during the annual noise survey.

The metal concentrations and microbial quality 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. Monitoring results indicate that the landfill is having no significant impact on adjacent sediment and shellfish.

The environmental monitoring carried out during 2012 indicates that the landfill had no detrimental impact on the surrounding environment.

7.10 Ecological Report and Survey

An Ecological Report and Survey is included in Appendix G

8. Topographic Survey

As there was little or no works carried out within the body of the landfill during the reporting period is was felt that it was not necessary to carry out a further topographical survey from that previously submitted. The licensee will formally apply to the Agency to have the requirement to have a topographical survey carried out on an annual basis changed. The most recent topographic survey is included in this report. This is attached in Appendix F

9. Slope Stability Assessment

As no significant works were carried out on the main landfill body during the reporting period there was no significant slope slippage in 2012. The licensee will formerly apply to the Agency to have the frequency at which the Slope Stability Assessment carried out reduced. The most recent Assessment (2010) is included in Appendix M

10. Proposed Development of the Facility and Timescales for such development

a) Landfill Capping and Restoration

A Closure Restoration and Aftercare Plan was sent to the EPA during 2009 and capping was completed in 2009.

b) Landfill Gas Management

Under condition 3.12.1 of the Waste Licence "infrastructure for the active collection and flaring of landfill gas has been installed at the facility. The flare compound is 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. The permanent flare was installed in April 2009. Gas field balancing is now carried out at regular intervals and a telemetry system to alert the licensee of flare irregularities has also been installed. The licensee has now reached an agreement with the flare manufacturers Uniflare Ltd to carry out monitoring of the flare unit in accordance with Condition 6.1 and Schedule C.1.2 of the licence. Details of Flare Monitoring and Landfill Gas Survey for the reporting period are included in Appendix L

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. These wells are now connected and pumping trials began in early 2009. A leachate

tank was installed which collects leachate pumped from these wells. This leachate will be transported to Tramore Waste Water Treatment Plant. Leachate levels, which were generally low appear to have been reduced further 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. Leachate will be brought to the Tramore Waste Water Treatment plant under agreement in accordance with Condition No. 5.8.1 of the facility licence.

Details of the volume of leachate removed from the site during the reporting period can be found in Appendix I

12. Report on Development works undertaken during the Reporting Period

Remediation of Landfill

Works carried out on remediation during the reporting period consisted mainly of snagging works in relation to the leachate abstraction system. The contract handover to the licensee has now been finalised as remediation works capping works are complete. Maintenance agreement for both the Flare compound and Leachate system are now in place.

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 Johnstown Castle weather station is collected for the facility on a daily basis. (Appendix E).

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 2008 for the previous year's Objectives and Targets).*

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. There has been an increase in unauthorised dumping in and around the site boundaries since the closure of the Civic Amenity site but our litter wardens have remained on top of this. In a further effort to prevent these occurrences it is now proposed to relocate the bottle banks and clothes banks at the site entrance and to close the access roadway to the public. Additional CCTV cameras have been installed at the facility entrance to serve as a deterrent to unauthorised dumping in this area and have been successful in this regard.

3. Periodically 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, had none or only trace levels of methane and carbon dioxide (<1%). The parameters specified in Condition 6 and Schedule C of the licence had been exceeded periodically at Borehole GW07 in 2009 as this borehole has been drilled through landfill material. However this has not been an issue during the current reporting period.
4. 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.
5. There is a comprehensive set of records for 2005, 2006, 2007, 2008, 2009, 2010, 2011 and 2012 held at the Facility Office.
6. No emergency or significant complaint occurred on site during the reporting period
7. A Closure Restoration and Aftercare plan has been approved by the Agency, and works were completed in April 2009 along with Gas Management and Leachate Management.

15. 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 ongoing 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. As the Civic Amenity Facility has now been enclosed indefinitely the licensee will endeavour to identify other means of funding the facility.

16. Reported Incidents and Complaints Summary

16.1 Incidents

With regard to Condition 11.3 of the issued licence no incidents took place during the reporting period.

16.2 Complaints

No complaints were received during the reporting period.

17. 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 2012 for monitoring was €21,316 and €14,079 for the licence. With regard to the details of financial provisions required under Condition 12.2.1 which are to be set aside in relation to the prevention of environmental damage and in order to underwrite the costs for remedial actions following anticipated events or incidents the licensee will establish, through consultation with the Agency, a timeframe for the provision and value of the required fund.

18. Management and Staffing Structure of the Facility

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

19. 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.

20. Reports on Training of Staff

Both the Facility Manager and Deputy Manager have completed the Fás Waste Management Training Course and Fás Safe Pass program along with the IOSS Safety Managers course.

21. Maintenance Program

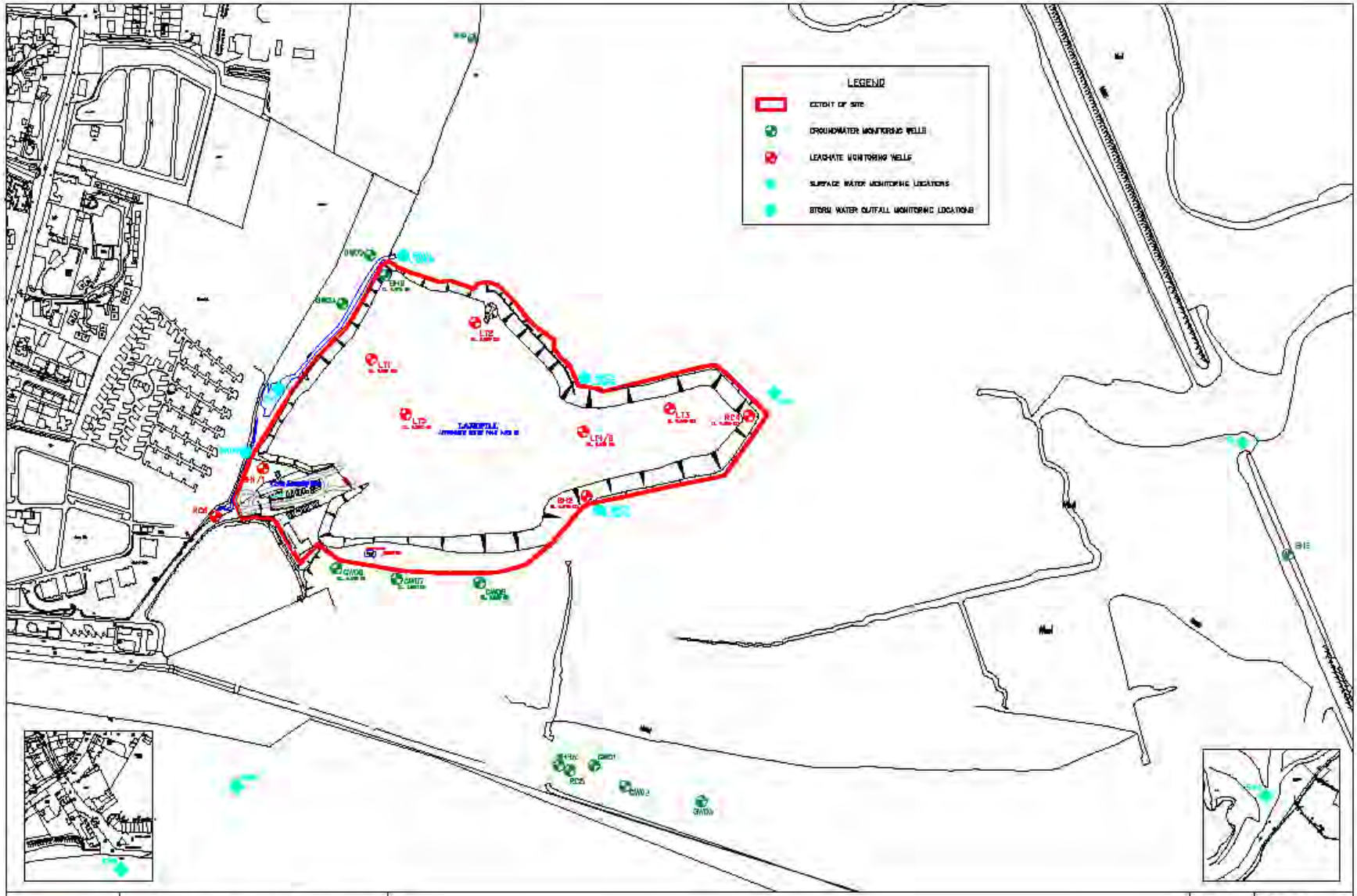
The licensee had adopted an electronic Preventative Maintenance Program (PEMAC by MJM Technologies).This Program covers all aspects of site maintenance and include monitoring and reporting, health and safety, maintenance and all training. All records and schedules are also maintained using the Project Vision maintenance system.

22. Statement of Financial Provisions in Relation to Prevention of Environmental Damage and Remedial Actions

An Environmental Liability Risk Assessment is included in Appendix K

Appendix A

Monitoring Locations



WATERFORD COUNTY COUNCIL
Comhairle Chontae Phort Láirge
Civic Offices, Dunmore Road, Waterford
Tel: 058 22000
Fax: 058 48048

TRAMORE LANDFILL SURFACE WATER MONITORING AND GROUNDWATER/LEACHATE MONITORING WELL LOCATIONS

Drawn by	David Regan
Drawing No.	TLRM 1
Date	December 2010
Scale	Not to Scale

Appendix B

Surface Water Results

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

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Environmental Management And Planning Division, EPA.
Report date: 10/05/12

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

Date collected: 07/02/2012 Date received: 07/02/2012

			Laboratory Ref:	1200569	1200573	1200601
			Type of sample:	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0075-01-SW4	WST-W0075-01-SW2	WST-W0075-01-SW1
			Sampling point:	clear	clear	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	11:20	15:15	15:05
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	07-02-12/05-04-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
F	Temperature	°C		8.9	10.4	9.6
F	Dissolved Oxygen (as %Sat)	% Saturation		106.0	102.0	129.0
F	pH	pH		8.1	8.3	8.1
F	Conductivity @25°C	µS/cm		NM	NM	1226
L	Salinity	‰		14.6	21.2	-
L	Ammonia	mg/l N		0.05	0.16	0.12
L	Chloride	mg/l Cl		-	-	191
L	ortho-Phosphate (as P)	mg/l P		0.04	0.03	<0.01
L	Total Oxidised Nitrogen (as N)	mg/l N		-	nr	NR
L	Biochemical Oxygen Demand	mg/l O2		1.8	1.5	1.0
L	Chemical Oxygen Demand	mg/l O2		-	-	29
L	Fluoride	mg/l F		1.1	1.4	<0.25
L	Sulphate	mg/l SO4		1000	12000	57
L	Suspended Solids	mg/l		17	NM	51
L	Total coliforms	No/100 ml		1200	630	12000
L	E Coli	per 100ml		82	100	<10
L	Aluminium	ug/l		<250	<250	96
L	Antimony	ug/l		<5	<5	<5
L	Arsenic	ug/l		35	58	<5
L	Barium	ug/l		48	63	150
L	Beryllium	ug/l		<5	<5	<5

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	18/04/12

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

Date collected:	06/02/2012	Date received:	06/02/2012

			Laboratory Ref:	1200569	1200570	1200571	1200572	1200573
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0075-01-SW4	WST-W0075-01-SW3	WST-W0075-01-SW5	WST-W0075-01-SW6	WST-W0075-01-SW2
			Sampling point:	clear	clear	clear	clear	clear
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	11:20	12:00	13:30	13:40	15:15
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
F	Temperature	°C		8.9	9.9	9.5	9.2	10.4
F	Dissolved Oxygen (as %Sat)	% Saturation		106.0	97.0	100.0	100.0	102.0
F	pH	pH		8.1	8.0	8.0	8.0	8.3
F	Conductivity @25°C	µS/cm		NM	NM	NM	NM	NM
L	Salinity	‰		14.6	11.4	32.1	32.3	21.2
L	Ammonia	mg/l N		0.05	0.11	<0.01	<0.01	0.16
L	ortho-Phosphate (as P)	mg/l P		0.04	0.03	0.02	0.03	0.03
L	Total Oxidised Nitrogen (as N)	mg/l N		-	nr	nr	nr	nr
L	Biochemical Oxygen Demand	mg/l O2		1.8	1.3	<1.0	<1.0	1.5
L	Fluoride	mg/l F		1.1	0.95	2.5	2.5	1.4
L	Sulphate	mg/l SO4		1000	820	2200	2400	12000
L	Suspended Solids	mg/l		17	24	15	13	NM
L	Total coliforms	No/100 ml		1200	2200	60	100	630
L	E Coli	per 100ml		82	73	<20	62	100
L	Aluminium	ug/l		<250	<250	<250	<250	<250
L	Antimony	ug/l		<5	<5	<5	<5	<5
L	Arsenic	ug/l		35	29	76	79	58
L	Barium	ug/l		48	55	39	41	63
L	Beryllium	ug/l		<5	<5	<5	<5	<5
L	Cadmium	ug/l		<5	<5	<5	<5	<5
L	Calcium	mg/l		240	190	470	500	430
L	Chromium	ug/l		5.9	<5	6.6	7.9	7.4
L	Cobalt	ug/l		<5	<5	<5	<5	<5

			Laboratory Ref:	1200569	1200570	1200571	1200572	1200573
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0075-01-SW4	WST-W0075-01-SW3	WST-W0075-01-SW5	WST-W0075-01-SW6	WST-W0075-01-SW2
			Sampling point:	clear	clear	clear	clear	clear
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	11:20	12:00	13:30	13:40	15:15
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
L	Copper	ug/l		52	26	73	78	59
L	Iron	ug/l		<250	<250	<250	<250	530
L	Lead	ug/l		<5	<5	<5	<5	<5
L	Magnesium	mg/l		600	430	1300	1400	950
L	Manganese	ug/l		<250	<250	<250	<250	<250
L	Mercury	ug/l		<5	<5	<5	<5	<5
L	Molybdenum	ug/l		<5	<5	8.8	9.2	6.3
L	Nickel	ug/l		<5	<5	5	5.4	6.3
L	Potassium	mg/l		220	160	460	500	350
L	Selenium	ug/l		130	100	280	280	210
L	Sodium	mg/l		5400	3900	12000	13000	8800
L	Thallium	ug/l		<5	<5	<5	<5	<5
L	Uranium	ug/l		<5	<5	<5	<5	<5
L	Vanadium	ug/l		47	36	93	100	77
L	Zinc	ug/l		<30	<30	<30	<30	<30

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	29/08/12

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

Date collected:	14/05/2012	Date received:	14/05/2012

			Laboratory Ref:	1202117	1202118	1202119	1202120	1202121	1202122	
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	
			Location code:	WST-W0075-01-SW5	WST-W0075-01-SW6	WST-W0075-01-SW3	WST-W0075-01-SW4	WST-W0075-01-SW1	WST-W0075-01-SW2	
			Sampling point:	Clear	Clear	Clear	Clear	Clear	Clear	
			Sampled by:	DB/JS	DB/JS	DB/JS	DB/JS	DB/JS	DB/JS	
			Time Sampled:	08:55	09:05	09:50	10:30	11:50	13:20	
			Start/End - Dates of Analysis:	14-05-12/21-05-12	14-05-12/21-05-12	14-05-12/21-05-12	06-05-12/20-05-12	14-05-12/21-05-12	14-05-12/21-05-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
F	Temperature	°C		10.4	10.3	10.8	12.2	15.1	13.7	
F	Dissolved Oxygen (as %Sat)	% Saturation		101.0	102.0	97.9	150.9	126.0	110.0	
F	pH	pH		8.0	8.1	8.1	8.7	8.2	7.9	
F	Salinity	‰		34.6	34.8	29.7	31.0	nm	33.0	
F	Conductivity @25°C	µS/cm		nm	nm	nm	nm	1018	nm	
L	Ammonia	mg/l N		0.02	0.02	0.05	0.02	0.18	0.02	
L	Chloride	mg/l Cl		nm	nm	nm	nm	179	nm	
L	Biochemical Oxygen Demand	mg/l O2		<1.0	<1.0	1.6	3.6	3.0	<1.0	
L	Chemical Oxygen Demand	mg/l O2		nm	nm	nm	nm	34	nm	
L	Suspended Solids	mg/l		17	11	50	20	12	9	
L	Total coliforms	No/100 ml		40	40	290	40	530	10	
L	E Coli	per 100ml		<20	<20	20	20	20	<5	

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

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 22/01/13

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

Date collected: 13/11/2012 Date received: 13/11/2012

			Laboratory Ref:	1204941	1204942	
			Type of sample:	Surface Water	Surface Water	
			Location code:	WST-W0075-01-SW	WST-W0075-01-SW4	
			Sampling point:	SW04, no sample,flow too low.		
			Sampled by:	Diarmuid Berry	Diarmuid Berry	
			Time Sampled:	nm	13:30	
			Start/End - Dates of Analysis:	13-11-12/13-11-12		
			Status of results:	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**			
F	Temperature	°C		-	12.0	
F	Dissolved Oxygen (as %Sat)	% Saturation		-	108.0	
F	pH	pH		-	8.1	
F	Salinity	‰		-	27.4	
F	Conductivity @25°C	µS/cm		-	nm	
L	Ammonia	mg/l N		-	0.34	
L	Chloride	mg/l Cl		-	>10838	
L	Biochemical Oxygen Demand	mg/l O2		-	nr	
L	Suspended Solids	mg/l		-	27	
L	Total coliforms	No/100 ml		-	620	
L	E Coli	per 100ml		-	63	

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	22/01/13

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

Date collected:	13/11/2012	Date received:	13/11/2012

			Laboratory Ref:	1204934	1204935	1204936	1204937	1204938	1204939	1204940
			Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
			Location code:	WST-W0075-01-SW5	WST-W0075-01-SW3	WST-W0075-01-SW	WST-W0075-01-SW2	WST-W0075-01-SW02	WST-W0075-01-SW	WST-W0075-01-SW1
			Sampling point:			SW03	no sample tide out		SW01	
			Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
			Time Sampled:	10:40	11:25	12:15	12:20	12:35	12:40	12:50
			Start/End - Dates of Analysis:				13-11-12/13-11-12			
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report
Parameter		Units	Limits							
F	Temperature	°C		11.8	11.8	11.5	-	10.8	11.8	11.4
F	Dissolved Oxygen (as %Sat)	% Saturation		99.0	98.0	86.0	-	85.0	110.0	91.0
F	pH	pH		8.1	8.0	7.6	-	7.5	8.1	7.9
F	Salinity	‰		34.2	27.7	-	-	-	-	-
F	Conductivity @25°C	µS/cm		nm	nm	1164	-	1290	1012	1040
L	Ammonia	mg/l N		0.7	0.95	0.51	-	0.260.277	0.05	1.2
L	Chloride	mg/l Cl		>14710	>12840	271	-	114	783	169
L	Biochemical Oxygen Demand	mg/l O2		nr	nr	nr	-	nr	nr	nr
L	Suspended Solids	mg/l		24	30	6	-	<5	<5	5
L	Total coliforms	No/100 ml		10	1500	9200	-	16000	3700	2800
L	E Coli	per 100ml		<10	280	<10	-	20	<10	86

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

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 22/01/13

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

Date collected: 13/11/2012 Date received: 13/11/2012

			Laboratory Ref:	1204941	1204942	
			Type of sample:	Surface Water	Surface Water	
			Location code:	WST-W0075-01-SW	WST-W0075-01-SW4	
			Sampling point:	SW04, no sample,flow too low.		
			Sampled by:	Diarmuid Berry	Diarmuid Berry	
			Time Sampled:	nm	13:30	
			Start/End - Dates of Analysis:	13-11-12/13-11-12		
			Status of results:	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**			
F	Temperature	°C		-	12.0	
F	Dissolved Oxygen (as %Sat)	% Saturation		-	108.0	
F	pH	pH		-	8.1	
F	Salinity	‰		-	27.4	
F	Conductivity @25°C	µS/cm		-	nm	
L	Ammonia	mg/l N		-	0.34	
L	Chloride	mg/l Cl		-	>10838	
L	Biochemical Oxygen Demand	mg/l O2		-	nr	
L	Suspended Solids	mg/l		-	27	
L	Total coliforms	No/100 ml		-	620	
L	E Coli	per 100ml		-	63	

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	22/01/13

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

Date collected:	13/11/2012	Date received:	13/11/2012

Report number:KK1201935/1

				Laboratory Ref:	1204934	1204935	1204936	1204937	1204938	1204939	1204940
				Type of sample:	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water	Surface Water
				Location code:	WST-W0075-01-SW5	WST-W0075-01-SW3	WST-W0075-01-SW	WST-W0075-01-SW2	WST-W0075-01-SW02	WST-W0075-01-SW	WST-W0075-01-SW1
				Sampling point:			SW03	no sample tide out		SW01	
				Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
				Time Sampled:	10:40	11:25	12:15	12:20	12:35	12:40	12:50
				Start/End - Dates of Analysis:				13-11-12/13-11-12			
				Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report
Parameter		Units	Limits								
F	Temperature	°C			11.8	11.8	11.5	-	10.8	11.8	11.4
F	Dissolved Oxygen (as %Sat)	% Saturation			99.0	98.0	86.0	-	85.0	110.0	91.0
F	pH	pH			8.1	8.0	7.6	-	7.5	8.1	7.9
F	Salinity	‰			34.2	27.7	-	-	-	-	-
F	Conductivity @25°C	µS/cm			nm	nm	1164	-	1290	1012	1040
L	Ammonia	mg/l N			0.7	0.95	0.51	-	0.260.277	0.05	1.2
L	Chloride	mg/l Cl			>14710	>12840	271	-	114	783	169
L	Biochemical Oxygen Demand	mg/l O2			nr	nr	nr	-	nr	nr	nr
L	Suspended Solids	mg/l			24	30	6	-	<5	<5	5
L	Total coliforms	No/100 ml			10	1500	9200	-	16000	3700	2800
L	E Coli	per 100ml			<10	280	<10	-	20	<10	86

Appendix C

Ground Water Results

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	18/04/12

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

Date collected:	06/02/2012	Date received:	06/02/2012

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
F	Depth of Borehole	m		4.4	3.9	24.4	6.3	6.3	1.3	
F	Water Level	m		2.1	2.6	21.8	4.4	5.3	1.3	
F	Temperature	°C		10.9	10.0	12.1	11.4	10.1	7.9	
F	Dissolved Oxygen (as %Sat)	% Saturation		98.0	46.0	37.0	86.0	75.0	38.0	
F	pH	pH		7.7	7.0	6.9	7.4	7.3	7.0	
F	Conductivity @25°C	µS/cm		-	2210	NM	NM	NM	NM	
L	Salinity	‰		27.0	NM	31.4	8.0	8.3	7.3	
L	Ammonia	mg/l N		<0.01	20	35	0.09	0.36	0.08	
L	Chloride	mg/l Cl		-	276	-	-	-	-	
L	ortho-Phosphate (as P)	mg/l P		0.06	<0.01	<0.01	0.14	0.07	0.08	
L	Total Oxidised Nitrogen (as N)	mg/l N		-	<0.20	-	-	-	-	
L	Fluoride	mg/l F		4	0.29	<0.25	<0.25	<0.25	<0.25	
L	Sulphate	mg/l SO4		1900	47	160	520	550	420	
L	Total Organic Carbon	mg/l C		5.6	9.1	5.6	13.7	15.1	37.8	
L	Total coliforms	No/100 ml		9200	<10	<10	20	74	120	
L	E Coli	per 100ml		<10	<10	<10	<10	<10	41	
L	1,1,1,2-Tetrachloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1,1-Trichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1,2,2-Tetrachloroethane	µg/l		<1	<1	<1	<1	<1	<1	
L	1,1,2-Trichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	1,2,3-Trichlorobenzene	µg/l		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
L	1,2,3-Trichloropropane	µg/l		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	
L	1,2,4-Trichlorobenzene	µg/l		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
L	1,2,4-Trimethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dibromo-3-Chloropropane	µg/l		<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	
L	1,2-Dibromoethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3,5-Trimethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,4-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	2,2-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	2-Chlorotoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	4-Chlorotoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	4-Isopropyltoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Benzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromochloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromodichloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromoform	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromomethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	c-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	c-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Carbon Tetrachloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Chlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Chloroform	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dibromochloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dibromomethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dichlorodifluoromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dichloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Ethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Hexachlorobutadiene	µg/l		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
L	Isopropylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	m,p-Xylene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Naphthalene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	n-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	n-Propylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	o-Xylene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	sec-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Styrene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	t-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	t-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	tert-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Tetrachloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	Toluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Trichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Trichlorofluoromethane	µg/l		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	
L	Vinyl Chloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Aluminium	ug/l		<250	<250	<250	<250	<250	140	
L	Antimony	ug/l		5.1	<5	<5	<5	<5	5.2	
L	Arsenic	ug/l		70	<5	73	17	17	17	
L	Barium	ug/l		310	1700	410	640	400	130	
L	Beryllium	ug/l		<5	<5	<5	<5	<5	<5	
L	Cadmium	ug/l		<5	<5	<5	<5	<5	<5	
L	Calcium	mg/l		530	260	590	370	460	330	
L	Chromium	ug/l		11	<5	6.2	3.7	<5	<5	
L	Cobalt	ug/l		<5	<5	12	<5	<5	6.4	
L	Copper	ug/l		59	<5	62	15	16	16	
L	Iron	ug/l		440	4100	1800	150	1400	1200	
L	Lead	ug/l		<5	<5	<5	<5	<5	<5	
L	Magnesium	mg/l		1100	41	1200	290	320	230	
L	Manganese	ug/l		<250	1100	850	39	620	73	
L	Mercury	ug/l		<5	<5	<5	<5	<5	<5	
L	Molybdenum	ug/l		8.1	<5	<5	<5	<5	<5	
L	Nickel	ug/l		8.1	<5	10	13	13	9	
L	Potassium	mg/l		380	34	250	92	98	86	
L	Selenium	ug/l		250	<5	270	62	62	58	

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**							
L	Sodium	mg/l		9900	180	11000	2500	2700	2500	
L	Thallium	ug/l		<5	<5	<5	<5	<5	<5	
L	Uranium	ug/l		3.7	<5	6.1		<5	<5	
L	Vanadium	ug/l		73	<5	82	31	27	26	
L	Zinc	ug/l		<30	<30	<30	<30	<30	<30	

Comments:

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

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

Signed: PP _____ Date: 18/Apr/2012

Caroline Bowden, Regional Chemist

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

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Environmental Management And Planning Division, EPA.
Report date: 10/05/12

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

Date collected: 07/02/2012 Date received: 07/02/2012

				Laboratory Ref:	1200564	1200602	1200607
				Type of sample:	Groundwater	Groundwater	Groundwater
				Location code:	WST-W0075-01-BH1/1	WST-W0075-01-BH2	WST-W0075-01-BH8
				Sampling point:	clear	clear	muddy
				Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
				Time Sampled:	12:40	12:30	16:05
				Start/End - Dates of Analysis:	06-02-12/05-04-12	07-02-12/14-02-12	07-02-12/05-04-12
				Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**				
F	Depth of Borehole	m			3.9	6.9	7.1
F	Water Level	m			2.6	3.2	6.2
F	Temperature	°C			10.0	12.1	9.7
F	Dissolved Oxygen (as %Sat)	% Saturation			46.0	62.0	27.9
F	pH	pH			7.0	7.0	7.3
F	Conductivity @25°C	µS/cm			2210	11950	3520
L	Salinity	‰			NM	6.6	1.7
L	Ammonia	mg/l N			20	110	0.1
L	Chloride	mg/l Cl			276	-	868
L	ortho-Phosphate (as P)	mg/l P			<0.01	0.02	<0.01
L	Total Oxidised Nitrogen (as N)	mg/l N			<0.20	NR	-
L	Fluoride	mg/l F			0.29	<0.25	<0.25
L	Sulphate	mg/l SO4			47	8.1	1500
L	Total Organic Carbon	mg/l C			9.1	-	-
L	Total coliforms	No/100 ml			<10	8700	41
L	E Coli	per 100ml			<10	<10	<10
L	1,1,1,2-Tetrachloroethane	µg/l			<0.5	<0.5	<0.5
L	1,1,1-Trichloroethane	µg/l			<0.5	<0.5	<0.5
L	1,1,2,2-Tetrachloroethane	µg/l			<1	<1	<1
L	1,1,2-Trichloroethane	µg/l			<0.5	<0.5	<0.5
L	1,1-Dichloroethane	µg/l			<0.5	<0.5	<0.5

				Laboratory Ref:	1200564	1200602	1200607
				Type of sample:	Groundwater	Groundwater	Groundwater
				Location code:	WST-W0075-01-BH1/1	WST-W0075-01-BH2	WST-W0075-01-BH8
				Sampling point:	clear	clear	muddy
				Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
				Time Sampled:	12:40	12:30	16:05
				Start/End - Dates of Analysis:	06-02-12/05-04-12	07-02-12/14-02-12	07-02-12/05-04-12
				Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**				
L	1,1-Dichloroethene	µg/l			<0.5	<0.5	<0.5
L	1,1-Dichloropropene	µg/l			<0.5	<0.5	<0.5
L	1,2,3-Trichlorobenzene	µg/l			<0.4	<0.4	<0.4
L	1,2,3-Trichloropropane	µg/l			<0.6	<0.6	<0.6
L	1,2,4-Trichlorobenzene	µg/l			<0.4	<0.4	<0.4
L	1,2,4-Trimethylbenzene	µg/l			<0.5	<0.5	<0.5
L	1,2-Dibromo-3-Chloropropane	µg/l			<1.3	<1.3	<1.3
L	1,2-Dibromoethane	µg/l			<0.5	<0.5	<0.5
L	1,2-Dichlorobenzene	µg/l			<0.5	<0.5	<0.5
L	1,2-Dichloroethane	µg/l			<0.5	<0.5	<0.5
L	1,2-Dichloropropane	µg/l			<0.5	<0.5	<0.5
L	1,3,5-Trimethylbenzene	µg/l			<0.5	<0.5	<0.5
L	1,3-Dichlorobenzene	µg/l			<0.5	<0.5	<0.5
L	1,3-Dichloropropane	µg/l			<0.5	<0.5	<0.5
L	1,4-Dichlorobenzene	µg/l			<0.5	<0.5	<0.5
L	2,2-Dichloropropane	µg/l			<0.5	<0.5	<0.5
L	2-Chlorotoluene	µg/l			<0.5	<0.5	<0.5
L	4-Chlorotoluene	µg/l			<0.5	<0.5	<0.5
L	4-Isopropyltoluene	µg/l			<0.5	<0.5	<0.5
L	Benzene	µg/l			<0.5	<0.5	<0.5
L	Bromobenzene	µg/l			<0.5	<0.5	<0.5
L	Bromochloromethane	µg/l			<0.5	<0.5	<0.5
L	Bromodichloromethane	µg/l			<0.5	<0.5	<0.5
L	Bromoform	µg/l			<0.5	<0.5	<0.5
L	Bromomethane	µg/l			<0.5	<0.5	<0.5
L	c-1,2-Dichloroethene	µg/l			<0.5	<0.5	<0.5
L	c-1,3-Dichloropropene	µg/l			<0.5	<0.5	<0.5
L	Carbon Tetrachloride	µg/l			<0.5	<0.5	<0.5
L	Chlorobenzene	µg/l			<0.5	<0.5	<0.5
L	Chloroform	µg/l			<0.5	<0.5	<0.5
L	Dibromochloromethane	µg/l			<0.5	<0.5	<0.5
L	Dibromomethane	µg/l			<0.5	<0.5	<0.5
L	Dichlorodifluoromethane	µg/l			<0.5	<0.5	<0.5
L	Dichloromethane	µg/l			<0.5	<0.5	<0.5
L	Ethylbenzene	µg/l			<0.5	<0.5	<0.5
L	Hexachlorobutadiene	µg/l			<0.1	<0.1	<0.1
L	Isopropylbenzene	µg/l			<0.5	<0.5	<0.5
L	m,p-Xylene	µg/l			<0.5	<0.5	<0.5
L	Naphthalene	µg/l			<0.5	<0.5	<0.5
L	n-Butylbenzene	µg/l			<0.5	<0.5	<0.5

			Laboratory Ref:	1200564	1200602	1200607
			Type of sample:	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-BH1/1	WST-W0075-01-BH2	WST-W0075-01-BH8
			Sampling point:	clear	clear	muddy
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry
			Time Sampled:	12:40	12:30	16:05
			Start/End - Dates of Analysis:	06-02-12/05-04-12	07-02-12/14-02-12	07-02-12/05-04-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
L	n-Propylbenzene	µg/l		<0.5	<0.5	<0.5
L	o-Xylene	µg/l		<0.5	<0.5	<0.5
L	sec-Butylbenzene	µg/l		<0.5	<0.5	<0.5
L	Styrene	µg/l		<0.5	<0.5	<0.5
L	t-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5
L	t-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5
L	tert-Butylbenzene	µg/l		<0.5	<0.5	<0.5
L	Tetrachloroethene	µg/l		<0.5	<0.5	<0.5
L	Toluene	µg/l		<0.5	<0.5	<0.5
L	Trichloroethene	µg/l		<0.5	<0.5	<0.5
L	Trichlorofluoromethane	µg/l		<0.6	<0.6	<0.6
L	Vinyl Chloride	µg/l		<0.5	<0.5	<0.5
L	Aluminium	ug/l		<250	-	340
L	Antimony	ug/l		<5	-	<5
L	Arsenic	ug/l		<5	-	<5
L	Barium	ug/l		1700	-	440
L	Beryllium	ug/l		<5	-	<5
L	Cadmium	ug/l		<5	-	<5
L	Calcium	mg/l		260	-	170
L	Chromium	ug/l		<5	-	<5
L	Cobalt	ug/l		<5	-	<5
L	Copper	ug/l		<5	-	<5
L	Iron	ug/l		4100	-	680
L	Lead	ug/l		<5	-	<5
L	Magnesium	mg/l		41	-	65
L	Manganese	ug/l		1100	-	<250
L	Mercury	ug/l		<5	-	<5
L	Molybdenum	ug/l		<5	-	<5
L	Nickel	ug/l		<5	-	<5
L	Potassium	mg/l		34	-	19
L	Selenium	ug/l		<5	-	13
L	Sodium	mg/l		180	-	560
L	Thallium	ug/l		<5	-	<5
L	Uranium	ug/l		<5	-	<5
L	Vanadium	ug/l		<5	-	7.6
L	Zinc	ug/l		<30	-	<30

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	18/04/12

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

Date collected:	06/02/2012	Date received:	06/02/2012

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
F	Depth of Borehole	m		4.4	3.9	24.4	6.3	6.3	1.3	
F	Water Level	m		2.1	2.6	21.8	4.4	5.3	1.3	
F	Temperature	°C		10.9	10.0	12.1	11.4	10.1	7.9	
F	Dissolved Oxygen (as %Sat)	% Saturation		98.0	46.0	37.0	86.0	75.0	38.0	
F	pH	pH		7.7	7.0	6.9	7.4	7.3	7.0	
F	Conductivity @25°C	µS/cm		-	2210	NM	NM	NM	NM	
L	Salinity	‰		27.0	NM	31.4	8.0	8.3	7.3	
L	Ammonia	mg/l N		<0.01	20	35	0.09	0.36	0.08	
L	Chloride	mg/l Cl		-	276	-	-	-	-	
L	ortho-Phosphate (as P)	mg/l P		0.06	<0.01	<0.01	0.14	0.07	0.08	
L	Total Oxidised Nitrogen (as N)	mg/l N		-	<0.20	-	-	-	-	
L	Fluoride	mg/l F		4	0.29	<0.25	<0.25	<0.25	<0.25	
L	Sulphate	mg/l SO4		1900	47	160	520	550	420	
L	Total Organic Carbon	mg/l C		5.6	9.1	5.6	13.7	15.1	37.8	
L	Total coliforms	No/100 ml		9200	<10	<10	20	74	120	
L	E Coli	per 100ml		<10	<10	<10	<10	<10	41	
L	1,1,1,2-Tetrachloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1,1-Trichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1,2,2-Tetrachloroethane	µg/l		<1	<1	<1	<1	<1	<1	
L	1,1,2-Trichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	1,2,3-Trichlorobenzene	µg/l		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
L	1,2,3-Trichloropropane	µg/l		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	
L	1,2,4-Trichlorobenzene	µg/l		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
L	1,2,4-Trimethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dibromo-3-Chloropropane	µg/l		<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	
L	1,2-Dibromoethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3,5-Trimethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,4-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	2,2-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	2-Chlorotoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	4-Chlorotoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	4-Isopropyltoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Benzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromochloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromodichloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromoform	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromomethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	c-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	c-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Carbon Tetrachloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Chlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Chloroform	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dibromochloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dibromomethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dichlorodifluoromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dichloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Ethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Hexachlorobutadiene	µg/l		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
L	Isopropylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	m,p-Xylene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Naphthalene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	n-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	n-Propylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	o-Xylene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	sec-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Styrene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	t-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	t-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	tert-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Tetrachloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	Toluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Trichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Trichlorofluoromethane	µg/l		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	
L	Vinyl Chloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Aluminium	ug/l		<250	<250	<250	<250	<250	140	
L	Antimony	ug/l		5.1	<5	<5	<5	<5	5.2	
L	Arsenic	ug/l		70	<5	73	17	17	17	
L	Barium	ug/l		310	1700	410	640	400	130	
L	Beryllium	ug/l		<5	<5	<5	<5	<5	<5	
L	Cadmium	ug/l		<5	<5	<5	<5	<5	<5	
L	Calcium	mg/l		530	260	590	370	460	330	
L	Chromium	ug/l		11	<5	6.2	3.7	<5	<5	
L	Cobalt	ug/l		<5	<5	12	<5	<5	6.4	
L	Copper	ug/l		59	<5	62	15	16	16	
L	Iron	ug/l		440	4100	1800	150	1400	1200	
L	Lead	ug/l		<5	<5	<5	<5	<5	<5	
L	Magnesium	mg/l		1100	41	1200	290	320	230	
L	Manganese	ug/l		<250	1100	850	39	620	73	
L	Mercury	ug/l		<5	<5	<5	<5	<5	<5	
L	Molybdenum	ug/l		8.1	<5	<5	<5	<5	<5	
L	Nickel	ug/l		8.1	<5	10	13	13	9	
L	Potassium	mg/l		380	34	250	92	98	86	
L	Selenium	ug/l		250	<5	270	62	62	58	

			Laboratory Ref:	1200563	1200564	1200565	1200566	1200567	1200568	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH5	WST-W0075-01-BH1/1	WST-W0075-01-RC5	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	
			Sampling point:	clear	clear	clear	clear	Darkish	dark	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:00	12:40	14:00	14:15	14:20	14:55	
			Start/End - Dates of Analysis:	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	06-02-12/05-04-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**							
L	Sodium	mg/l		9900	180	11000	2500	2700	2500	
L	Thallium	ug/l		<5	<5	<5	<5	<5	<5	
L	Uranium	ug/l		3.7	<5	6.1		<5	<5	
L	Vanadium	ug/l		73	<5	82	31	27	26	
L	Zinc	ug/l		<30	<30	<30	<30	<30	<30	

Comments:

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

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

Signed: PP _____ Date: 18/Apr/2012

Caroline Bowden, Regional Chemist

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	18/04/12

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

Date collected:	07/02/2012	Date received:	07/02/2012

			Laboratory Ref:	1200602	1200603	1200604	1200605	1200606	1200607	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	WST-W0075-01-GW5a	WST-W0075-01-GW4	WST-W0075-01-BH9	WST-W0075-01-BH8	
			Sampling point:	clear	slightly cloudy	muddy	GW4A-muddy	muddy	muddy	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:30	12:55	14:40	15:20	15:45	16:05	
			Start/End - Dates of Analysis:	07-02-12/14-02-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
F	Depth of Borehole	m		6.9	15.5	4.3	8.1	7	7.1	
F	Water Level	m		3.2	10.9	2.7	6.9	5.6	6.2	
F	Temperature	°C		12.1	11.5	9.4	10.5	11.3	9.7	
F	Dissolved Oxygen (as %Sat)	% Saturation		62.0	57.0	48.0	38.0	19.0	27.9	
F	pH	pH		7.0	7.1	7.3	7.2	7.1	7.3	
F	Conductivity @25°C	µS/cm		11950	nm	1113	1047	931	3520	
L	Salinity	‰		6.6	33.1	-	-	-	1.7	
L	Ammonia	mg/l N		110	4.8	0.07	0.02	0.26	0.1	
L	Chloride	mg/l Cl		-	-	104	134	110	868	
L	ortho-Phosphate (as P)	mg/l P		0.02	<0.01	<0.01	<0.01	<0.01	<0.01	
L	Total Oxidised Nitrogen (as N)	mg/l N		NR	NR	-	-	-	-	
L	Fluoride	mg/l F		<0.25	0.98	<0.25	<0.25	<0.25	<0.25	
L	Sulphate	mg/l SO4		8.1	2200	65	40	24	1500	
L	Total coliforms	No/100 ml		8700	<10	1500	290	52	41	
L	E Coli	per 100ml		<10	<10	<10	<10	<10	<10	
L	1,1,1,2-Tetrachloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1,1-Trichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1,2,2-Tetrachloroethane	µg/l		<1	<1	<1	<1	<1	<1	
L	1,1,2-Trichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,1-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2,3-Trichlorobenzene	µg/l		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	

			Laboratory Ref:	1200602	1200603	1200604	1200605	1200606	1200607	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	WST-W0075-01-GW5a	WST-W0075-01-GW4	WST-W0075-01-BH9	WST-W0075-01-BH8	
			Sampling point:	clear	slightly cloudy	muddy	GW4A-muddy	muddy	muddy	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:30	12:55	14:40	15:20	15:45	16:05	
			Start/End - Dates of Analysis:	07-02-12/14-02-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	1,2,3-Trichloropropane	µg/l		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	
L	1,2,4-Trichlorobenzene	µg/l		<0.4	<0.4	<0.4	<0.4	<0.4	<0.4	
L	1,2,4-Trimethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dibromo-3-Chloropropane	µg/l		<1.3	<1.3	<1.3	<1.3	<1.3	<1.3	
L	1,2-Dibromoethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichloroethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,2-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3,5-Trimethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,3-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	1,4-Dichlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	2,2-Dichloropropane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	2-Chlorotoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	4-Chlorotoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	4-Isopropyltoluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Benzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromochloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromodichloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromoform	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Bromomethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	c-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

			Laboratory Ref:	1200602	1200603	1200604	1200605	1200606	1200607	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	WST-W0075-01-GW5a	WST-W0075-01-GW4	WST-W0075-01-BH9	WST-W0075-01-BH8	
			Sampling point:	clear	slightly cloudy	muddy	GW4A-muddy	muddy	muddy	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:30	12:55	14:40	15:20	15:45	16:05	
			Start/End - Dates of Analysis:	07-02-12/14-02-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	c-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Carbon Tetrachloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Chlorobenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Chloroform	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dibromochloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dibromomethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dichlorodifluoromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Dichloromethane	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Ethylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Hexachlorobutadiene	µg/l		<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	
L	Isopropylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	m,p-Xylene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Naphthalene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	n-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	n-Propylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	o-Xylene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	sec-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Styrene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	t-1,2-Dichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	t-1,3-Dichloropropene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	tert-Butylbenzene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Tetrachloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Toluene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	

			Laboratory Ref:	1200602	1200603	1200604	1200605	1200606	1200607	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	WST-W0075-01-GW5a	WST-W0075-01-GW4	WST-W0075-01-BH9	WST-W0075-01-BH8	
			Sampling point:	clear	slightly cloudy	muddy	GW4A-muddy	muddy	muddy	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:30	12:55	14:40	15:20	15:45	16:05	
			Start/End - Dates of Analysis:	07-02-12/14-02-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	Trichloroethene	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Trichlorofluoromethane	µg/l		<0.6	<0.6	<0.6	<0.6	<0.6	<0.6	
L	Vinyl Chloride	µg/l		<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	
L	Aluminium	ug/l		-	150	180	460	1200	340	
L	Antimony	ug/l		-	<5	<5	<5	<5	<5	
L	Arsenic	ug/l		-	85	<5	<5	<5	<5	
L	Barium	ug/l		-	230	200	220	270	440	
L	Beryllium	ug/l		-	<5	<5	<5	<5	<5	
L	Cadmium	ug/l		-	<5	<5	<5	<5	<5	
L	Calcium	mg/l		-	610	130	130	89	170	
L	Chromium	ug/l		-	7.7	<5	2	<5	<5	
L	Cobalt	ug/l		-	8.4	<5	<5	<5	<5	
L	Copper	ug/l		-	71	<5	<5	<5	<5	
L	Iron	ug/l		-	2600	430	910	1900	680	
L	Lead	ug/l		-	<5	<5	<5	<5	<5	
L	Magnesium	mg/l		-	1300	32	29	31	65	
L	Manganese	ug/l		-	6100	940	310	1100	<250	
L	Mercury	ug/l		-	<5	<5	<5	<5	<5	
L	Molybdenum	ug/l		-	<5	<5	<5	<5	<5	
L	Nickel	ug/l		-	9.4	<5	3	<5	<5	
L	Potassium	mg/l		-	470	12	11	15	19	
L	Selenium	ug/l		-	300	<5	<5	<5	13	
L	Sodium	mg/l		-	12000	180	98	140	560	

			Laboratory Ref:	1200602	1200603	1200604	1200605	1200606	1200607	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH2	WST-W0075-01-RC4	WST-W0075-01-GW5a	WST-W0075-01-GW4	WST-W0075-01-BH9	WST-W0075-01-BH8	
			Sampling point:	clear	slightly cloudy	muddy	GW4A-muddy	muddy	muddy	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	12:30	12:55	14:40	15:20	15:45	16:05	
			Start/End - Dates of Analysis:	07-02-12/14-02-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	07-02-12/05-04-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**							
L	Thallium	ug/l		-	<5	<5	<5	<5	<5	
L	Uranium	ug/l		-	8.1	<5	<5	<5	<5	
L	Vanadium	ug/l		-	97	9.8	5.7	6.5	7.6	
L	Zinc	ug/l		-	150	<30	<30	<30	<30	

Comments:

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

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

Signed: PP

Caroline Bowden, Regional Chemist

Date: 18/Apr/2012

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	29/08/12

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

Date collected:	14/05/2012	Date received:	14/05/2012

			Laboratory Ref:	1202113	1202114	1202115	1202116	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-BH9	WST-W0075-01-BH8	WST-W0075-01-GW5a	WST-W0075-01-GW4	
			Sampling point:	Muddy	Brown	Brown	Brown	
			Sampled by:	DB/JS	DB/JS	DB/JS	DB/JS	
			Time Sampled:	12:00	12:25	14:30	14:40	
			Start/End - Dates of Analysis:	14-05-12/21-05-12	14-05-12/21-05-12	14-05-12/21-05-12	14-05-12/21-05-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**					
F	Depth of Borehole	m		7	7.1	4.3	8	
F	Water Level	m		5.5	6.1	3	7	
F	Temperature	°C		11.3	11.6	11.2	11.6	
F	Dissolved Oxygen (as %Sat)	% Saturation		41.2	54.1	28.2	44.6	
F	pH	pH		7.3	7.3	7.0	7.1	
F	Conductivity @25°C	µS/cm		1368	2850	1075	1032	
F	Salinity	‰		0.5	1.3	0.3	0.3	
L	Ammonia	mg/l N		0.31	0.11	0.04	0.04	
L	Chloride	mg/l Cl		108	672	99	126	
L	Total Oxidised Nitrogen (as N)	mg/l N		<0.20	<0.20	0.3	1.05	
L	Total Organic Carbon	mg/l C		5.3	2.6	2.7	2.3	
L	Total coliforms	No/100 ml		200	<10	160	<10	
L	E Coli	per 100ml		52	<10	<10	<10	

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

Test Report

Report of: Analysis of landfill site sample(s)
Report to: Waterford County Council
Report date: 29/08/12

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

Date collected: 15/05/2012 Date received: 15/05/2012

			Laboratory Ref:	1202143	1202144	1202145
			Type of sample:	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-BH1/1	WST-W0075-01-BH2	WST-W0075-01-RC4
			Sampling point:	Clear	Clear	Clear
			Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
			Time Sampled:	10:40	11:30	11:50
			Start/End - Dates of Analysis:	15-05-12/23-05-12	15-05-12/21-05-12	15-05-12/21-05-12
			Status of results:	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**			
F	Depth of Borehole	m		3.9	6.9	15.5
F	Water Level	m		2.6	3.7	12.7
F	Temperature	°C		10.2	12.0	12.5
F	Dissolved Oxygen (as %Sat)	% Saturation		28.0	64.3	50.5
F	pH	pH		6.7	7.0	7.1
F	Conductivity @25°C	µS/cm		2130	nm	nm
F	Salinity	‰		0.9	5.7	33.1
L	Ammonia	mg/l N		19	98	5.1
L	Chloride	mg/l Cl		251	NR	NR
L	Nitrite (as N)	mg/l N		NM	-	-
L	ortho-Phosphate (as P)	mg/l P		NM	-	-
L	Total Oxidised Nitrogen (as N)	mg/l N		<0.20	<0.20	<0.20
L	Total Organic Carbon	mg/l C		11.2	145.1	3.0
L	E Coli	per 100ml		<10	<10	<10
L	Total coliforms	No/100 ml		52	180	<10

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	29/08/12

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

Date collected:	14/05/2012	Date received:	14/05/2012

Report number:KK1200759/1

			Laboratory Ref:	1202107	1202108	1202109	1202110	1202111	1202112	
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	
			Location code:	WST-W0075-01-RC6a	WST-W0075-01-BH5	WST-W0075-01-GW2	WST-W0075-01-GW3	WST-W0075-01-GW1	WST-W0075-01-RC5	
			Sampling point:	Sediment	Clear	Grey	Lot of mud	Grey	Clear	
			Sampled by:	DB/JS	DB/JS	DB/JS	DB/JS	DB/JS	DB/JS	
			Time Sampled:	09:25	09:55	10:20	10:45	11:10	11:20	
			Start/End - Dates of Analysis:	14-05-12/21-05-12	14-05-12/21-05-12	14-05-12/21-05-12	14-05-12/21-05-12	14-05-12/21-05-12	14-05-12/21-05-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
	Parameter	Units	Limits							
F	Depth of Borehole	m		5	4.4	6.3	2.6	6.3	24.4	
F	Water Level	m		3.9	2.1	5.3	1.3	4.6	21.9	
F	Temperature	°C		10.9	10.2	10.3	10.9	11.8	12.5	
F	Dissolved Oxygen (as %Sat)	% Saturation		37.5	90.0	94.0	48.0	75.0	26.2	
F	pH	pH		7.1	7.7	7.5	7.3	7.5	7.0	
F	Conductivity @25°C	µS/cm		1078	nm	nm	11900	13950	nm	
F	Salinity	‰		nm	27.1	8.7	6.7	7.9	31.0	
L	Ammonia	mg/l N		0.48	0.02	0.67	0.2	0.01	33	
L	Chloride	mg/l Cl		112	NR	NR	NR	NR	nr	
L	Total Oxidised Nitrogen (as N)	mg/l N		<0.20	<0.20	<0.20	<0.20	0.52	<0.20	
L	Total Organic Carbon	mg/l C		4.5	5.3	22.7	128.3	23.1	5.5	
L	Total coliforms	No/100 ml		31	<10	1300	86	<10	<10	
L	E Coli	per 100ml		<10	<10	<10	10	<10	<10	

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	22/01/13

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

Date collected:	12/11/2012	Date received:	12/11/2012

			Laboratory Ref:	1204892	1204893	1204894	1204895	1204896
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-BH2	WST-W0075-01-BH9	WST-W0075-01-GW5	WST-W0075-01-GW4	WST-W0075-01-BH8
			Sampling point:	Clear	muddy brown	muddy sandy brown	sandy brown	sandy brown
			Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
			Time Sampled:	12:00	12:50	13:00	13:05	13:45
			Start/End - Dates of Analysis:	12-11-12/18-01-13	12-11-12/18-01-13	12-11-12/18-01-13	12-11-12/18-01-13	12-11-12/18-01-13
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**
Parameter		**Units**	**Limits**					
F	Depth of Borehole	m		6.9	7	8	4.3	7.1
F	Water Level	m		3.8	5.9	7.2	3.2	6.9
F	Temperature	°C		13.3	12.4	12.3	12.2	12.2
F	Dissolved Oxygen (as %Sat)	% Saturation		53.0	14.0	33.0	32.0	75.0
F	Salinity	‰		3.7	0.9	-	-	6.7
L	pH	pH		6.8	7.0	7.1	7.1	7.2
L	Conductivity @25°C	µS/cm		6820	2120	989	1043	11920
L	Ammonia	mg/l N		82	0.35	0.07	0.06	0.49
L	Chloride	mg/l Cl		1525	495	157	98	>3398.640
L	Total Oxidised Nitrogen (as N)	mg/l N		<0.20	<0.20	1.99	<0.20	<0.20
L	Total coliforms	No/100 ml		>24192	1600	1500	1500	660
L	E Coli	per 100ml		<10	<10	10	<10	<10
L	Iron	ug/l		4100	1700	2100	5900	1100
L	Potassium	mg/l		130	11	<0.5	<0.5	46
L	Sodium	mg/l		650	240	60	78	1300

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	22/01/13

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

Date collected:	12/11/2012	Date received:	12/11/2012

			Laboratory Ref:	1204885	1204886	1204887	1204888	1204889	1204890	1204891
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	WST-W0075-01-GW06	WST-W0075-01-GW07	WST-W0075-01-GW8	WST-W0075-01-BH1/1
			Sampling point:	Brown	Brown	Brown	Black	Black	no tubing-no sample	Clear
			Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
			Time Sampled:	10:00	10:05	10:15	10:30	10:45	11:10	11:30
			Start/End - Dates of Analysis:						12-11-12/12-11-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report
Parameter		Units	Limits							
F	Depth of Borehole	m		6.3	6.3	2.6	6.7	8.1	-	3.9
F	Water Level	m		5.5	6	1.8	4.8	7.3	-	2
F	Temperature	°C		12.0	11.7	10.9	12.5	12.7	-	11.5
F	Dissolved Oxygen (as %Sat)	% Saturation		51.0	63.0	58.0	12.0	18.0	-	27.0
F	pH	pH		7.4	7.1	7.1	6.7	6.8	-	6.8
F	Conductivity @25°C	µS/cm		7090	1285	1374	2090	1806	-	1808
F	Salinity	‰		3.8	7.3	7.8	0.9	-	-	-
L	Ammonia	mg/l N		0.51	1.2	0.4	2.6	10	-	15
L	Chloride	mg/l Cl		1790	>3451	>3451	273	216	-	190
L	Total Oxidised Nitrogen (as N)	mg/l N		0.3	<0.20	<0.20	<0.20	<0.20	-	<0.20
L	Total Organic Carbon	mg/l C		nm	nm	nm	nm	nm	-	nm
L	Total coliforms	No/100 ml		16000	4000	3900	1600	110	-	6900
L	E Coli	per 100ml		160	52	1200	<10	20	-	<10
L	Iron	ug/l		3200	20000	25000	12000	7500	-	17000
L	Potassium	mg/l		60	83	84	9.6	20	-	22
L	Sodium	mg/l		1000	1700	1800	99	89	-	92

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	22/01/13

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

Date collected:	12/11/2012	Date received:	12/11/2012

			Laboratory Ref:	1204892	1204893	1204894	1204895	1204896
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-BH2	WST-W0075-01-BH9	WST-W0075-01-GW5	WST-W0075-01-GW4	WST-W0075-01-BH8
			Sampling point:	Clear	muddy brown	muddy sandy brown	sandy brown	sandy brown
			Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
			Time Sampled:	12:00	12:50	13:00	13:05	13:45
			Start/End - Dates of Analysis:	12-11-12/18-01-13	12-11-12/18-01-13	12-11-12/18-01-13	12-11-12/18-01-13	12-11-12/18-01-13
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report
Parameter		Units	Limits					
F	Depth of Borehole	m		6.9	7	8	4.3	7.1
F	Water Level	m		3.8	5.9	7.2	3.2	6.9
F	Temperature	°C		13.3	12.4	12.3	12.2	12.2
F	Dissolved Oxygen (as %Sat)	% Saturation		53.0	14.0	33.0	32.0	75.0
F	Salinity	‰		3.7	0.9	-	-	6.7
L	pH	pH		6.8	7.0	7.1	7.1	7.2
L	Conductivity @25°C	µS/cm		6820	2120	989	1043	11920
L	Ammonia	mg/l N		82	0.35	0.07	0.06	0.49
L	Chloride	mg/l Cl		1525	495	157	98	>3398.640
L	Total Oxidised Nitrogen (as N)	mg/l N		<0.20	<0.20	1.99	<0.20	<0.20
L	Total coliforms	No/100 ml		>24192	1600	1500	1500	660
L	E Coli	per 100ml		<10	<10	10	<10	<10
L	Iron	ug/l		4100	1700	2100	5900	1100
L	Potassium	mg/l		130	11	<0.5	<0.5	46
L	Sodium	mg/l		650	240	60	78	1300

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	22/01/13

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

Date collected:	12/11/2012	Date received:	12/11/2012

			Laboratory Ref:	1204885	1204886	1204887	1204888	1204889	1204890	1204891
			Type of sample:	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater	Groundwater
			Location code:	WST-W0075-01-GW1	WST-W0075-01-GW2	WST-W0075-01-GW3	WST-W0075-01-GW06	WST-W0075-01-GW07	WST-W0075-01-GW8	WST-W0075-01-BH1/1
			Sampling point:	Brown	Brown	Brown	Black	Black	no tubing-no sample	Clear
			Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
			Time Sampled:	10:00	10:05	10:15	10:30	10:45	11:10	11:30
			Start/End - Dates of Analysis:						12-11-12/12-11-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report
Parameter		Units	Limits							
F	Depth of Borehole	m		6.3	6.3	2.6	6.7	8.1	-	3.9
F	Water Level	m		5.5	6	1.8	4.8	7.3	-	2
F	Temperature	°C		12.0	11.7	10.9	12.5	12.7	-	11.5
F	Dissolved Oxygen (as %Sat)	% Saturation		51.0	63.0	58.0	12.0	18.0	-	27.0
F	pH	pH		7.4	7.1	7.1	6.7	6.8	-	6.8
F	Conductivity @25°C	µS/cm		7090	1285	1374	2090	1806	-	1808
F	Salinity	‰		3.8	7.3	7.8	0.9	-	-	-
L	Ammonia	mg/l N		0.51	1.2	0.4	2.6	10	-	15
L	Chloride	mg/l Cl		1790	>3451	>3451	273	216	-	190
L	Total Oxidised Nitrogen (as N)	mg/l N		0.3	<0.20	<0.20	<0.20	<0.20	-	<0.20
L	Total Organic Carbon	mg/l C		nm	nm	nm	nm	nm	-	nm
L	Total coliforms	No/100 ml		16000	4000	3900	1600	110	-	6900
L	E Coli	per 100ml		160	52	1200	<10	20	-	<10
L	Iron	ug/l		3200	20000	25000	12000	7500	-	17000
L	Potassium	mg/l		60	83	84	9.6	20	-	22
L	Sodium	mg/l		1000	1700	1800	99	89	-	92

Appendix D

Leachate Results

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	18/04/12

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

Date collected:	07/02/2012	Date received:	07/02/2012

Report number:KK1200219/1

			Laboratory Ref:	1200608	1200609	1200610	1200611	1200612	1200613	
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	
			Location code:	WST-W0075-01-BH7b	WST-W0075-01-LT3a	WST-W0075-01-LT4B/B	WST-W0075-01-LT2	WST-W0075-01-LT1	WST-W0075-01-LT5	
			Sampling point:	black	black	dry, no sample	dry, no sample	brown	dry, no sample	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:55	13:10	13:30	13:35	13:45	13:55	
			Start/End - Dates of Analysis:	07-02-12/05-04-12	07-02-12/14-02-12	07-02-12/07-02-12	07-02-12/07-02-12	07-02-12/05-04-12	07-02-12/07-02-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
F	Depth of Borehole	m		7.5	NM	-	-	7.5	-	
F	Leachate Level	m		0.3	NM	-	-	2.3	-	
F	Temperature	°C		12.6	12.2	-	-	14.4	-	
F	pH	pH		6.6	7.5	-	-	6.8	-	
F	Conductivity @25°C	µS/cm		2410	23870	-	-	5060	-	
L	Ammonia	mg/l N		31	1700	-	-	180	-	
L	Chloride	mg/l Cl		201	-	-	-	446	-	
L	ortho-Phosphate (as P)	mg/l P		<0.01	4.5	-	-	<0.01	-	
L	Biochemical Oxygen Demand	mg/l O2		48.0	135.0	-	-	20.0	-	
L	Chemical Oxygen Demand	mg/l O2		370	1930	-	-	210	-	
L	Fluoride	mg/l F		2	9.6	-	-	0.39	-	
L	Sulphate	mg/l SO4		<2.5	17	-	-	7	-	
L	Total coliforms	No/100 ml		>20000	nr	-	-	>20000	-	
L	E Coli	per 100ml		63	<10	-	-	<10	-	
L	1,1,1,2-Tetrachloroethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,1,1-Trichloroethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,1,2,2-Tetrachloroethane	µg/l		<1	<1	-	-	<1	-	
L	1,1,2-Trichloroethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,1-Dichloroethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,1-Dichloroethene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,1-Dichloropropene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,2,3-Trichlorobenzene	µg/l		<0.4	<0.4	-	-	<0.4	-	
L	1,2,3-Trichloropropane	µg/l		<0.6	<0.6	-	-	<0.6	-	

			Laboratory Ref:	1200608	1200609	1200610	1200611	1200612	1200613	
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	
			Location code:	WST-W0075-01-BH7b	WST-W0075-01-LT3a	WST-W0075-01-LT4B/B	WST-W0075-01-LT2	WST-W0075-01-LT1	WST-W0075-01-LT5	
			Sampling point:	black	black	dry, no sample	dry, no sample	brown	dry, no sample	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:55	13:10	13:30	13:35	13:45	13:55	
			Start/End - Dates of Analysis:	07-02-12/05-04-12	07-02-12/14-02-12	07-02-12/07-02-12	07-02-12/07-02-12	07-02-12/05-04-12	07-02-12/07-02-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	1,2,4-Trichlorobenzene	µg/l		<0.4	<0.4	-	-	<0.4	-	
L	1,2,4-Trimethylbenzene	µg/l		<0.5	6	-	-	3.4	-	
L	1,2-Dibromo-3-Chloropropane	µg/l		<1.3	<1.3	-	-	<1.3	-	
L	1,2-Dibromoethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,2-Dichlorobenzene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,2-Dichloroethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,2-Dichloropropane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,3,5-Trimethylbenzene	µg/l		<0.5	1.9	-	-	<0.5	-	
L	1,3-Dichlorobenzene	µg/l		<0.5	<0.5	-	-	0.5	-	
L	1,3-Dichloropropane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	1,4-Dichlorobenzene	µg/l		<0.5	<0.5	-	-	0.5	-	
L	2,2-Dichloropropane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	2-Chlorotoluene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	4-Chlorotoluene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	4-Isopropyltoluene	µg/l		<0.5	80	-	-	2.1	-	
L	Benzene	µg/l		1.8	1.4	-	-	3.7	-	
L	Bromobenzene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Bromochloromethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Bromodichloromethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Bromoform	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Bromomethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	c-1,2-Dichloroethene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	c-1,3-Dichloropropene	µg/l		<0.5	<0.5	-	-	<0.5	-	

			Laboratory Ref:	1200608	1200609	1200610	1200611	1200612	1200613	
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	
			Location code:	WST-W0075-01-BH7b	WST-W0075-01-LT3a	WST-W0075-01-LT4B/B	WST-W0075-01-LT2	WST-W0075-01-LT1	WST-W0075-01-LT5	
			Sampling point:	black	black	dry, no sample	dry, no sample	brown	dry, no sample	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:55	13:10	13:30	13:35	13:45	13:55	
			Start/End - Dates of Analysis:	07-02-12/05-04-12	07-02-12/14-02-12	07-02-12/07-02-12	07-02-12/07-02-12	07-02-12/05-04-12	07-02-12/07-02-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	Carbon Tetrachloride	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Chlorobenzene	µg/l		<0.5	<0.5	-	-	0.6	-	
L	Chloroform	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Dibromochloromethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Dibromomethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Dichlorodifluoromethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Dichloromethane	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Ethylbenzene	µg/l		0.8	7.7	-	-	<0.5	-	
L	Hexachlorobutadiene	µg/l		<0.1	<0.1	-	-	<0.1	-	
L	Isopropylbenzene	µg/l		<0.5	0.8	-	-	1.5	-	
L	m,p-Xylene	µg/l		0.9	10	-	-	1.1	-	
L	Naphthalene	µg/l		<0.5	0.8	-	-	<0.5	-	
L	n-Butylbenzene	µg/l		<0.5	<0.5	-	-	0.5	-	
L	n-Propylbenzene	µg/l		<0.5	0.7	-	-	0.6	-	
L	o-Xylene	µg/l		1.1	8.1	-	-	0.6	-	
L	sec-Butylbenzene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Styrene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	t-1,2-Dichloroethene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	t-1,3-Dichloropropene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	tert-Butylbenzene	µg/l		<0.5	<0.5	-	-	0.9	-	
L	Tetrachloroethene	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Toluene	µg/l		11	56	-	-	<0.5	-	
L	Trichloroethene	µg/l		<0.5	<0.5	-	-	<0.5	-	

			Laboratory Ref:	1200608	1200609	1200610	1200611	1200612	1200613	
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	
			Location code:	WST-W0075-01-BH7b	WST-W0075-01-LT3a	WST-W0075-01-LT4B/B	WST-W0075-01-LT2	WST-W0075-01-LT1	WST-W0075-01-LT5	
			Sampling point:	black	black	dry, no sample	dry, no sample	brown	dry, no sample	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:55	13:10	13:30	13:35	13:45	13:55	
			Start/End - Dates of Analysis:	07-02-12/05-04-12	07-02-12/14-02-12	07-02-12/07-02-12	07-02-12/07-02-12	07-02-12/05-04-12	07-02-12/07-02-12	
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	
Parameter		Units	Limits							
L	Trichlorofluoromethane	µg/l		<0.6	<0.6	-	-	<0.6	-	
L	Vinyl Chloride	µg/l		<0.5	<0.5	-	-	<0.5	-	
L	Aluminium	ug/l		840	-	-	-	130	-	
L	Antimony	ug/l		<5	-	-	-	<5	-	
L	Arsenic	ug/l		34	-	-	-	6.9	-	
L	Barium	ug/l		1800	-	-	-	2300	-	
L	Beryllium	ug/l		<5	-	-	-	<5	-	
L	Cadmium	ug/l		<5	-	-	-	<5	-	
L	Calcium	mg/l		270	-	-	-	350	-	
L	Chromium	ug/l		10	-	-	-	9.8	-	
L	Cobalt	ug/l		<5	-	-	-	<5	-	
L	Copper	ug/l		17	-	-	-	<5	-	
L	Iron	ug/l		65000	-	-	-	40000	-	
L	Lead	ug/l		<5	-	-	-	<5	-	
L	Magnesium	mg/l		52	-	-	-	91	-	
L	Manganese	ug/l		3800	-	-	-	1900	-	
L	Mercury	ug/l		<5	-	-	-	<5	-	
L	Molybdenum	ug/l		<5	-	-	-	<5	-	
L	Nickel	ug/l		12	-	-	-	5.7	-	
L	Potassium	mg/l		60	-	-	-	190	-	
L	Selenium	ug/l		8.7	-	-	-	13	-	
L	Sodium	mg/l		150	-	-	-	390	-	
L	Thallium	ug/l		<5	-	-	-	<5	-	

			Laboratory Ref:	1200608	1200609	1200610	1200611	1200612	1200613	
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	
			Location code:	WST-W0075-01-BH7b	WST-W0075-01-LT3a	WST-W0075-01-LT4B/B	WST-W0075-01-LT2	WST-W0075-01-LT1	WST-W0075-01-LT5	
			Sampling point:	black	black	dry, no sample	dry, no sample	brown	dry, no sample	
			Sampled by:	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	Jim McGarry	
			Time Sampled:	11:55	13:10	13:30	13:35	13:45	13:55	
			Start/End - Dates of Analysis:	07-02-12/05-04-12	07-02-12/14-02-12	07-02-12/07-02-12	07-02-12/07-02-12	07-02-12/05-04-12	07-02-12/07-02-12	
			Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
Parameter		**Units**	**Limits**							
L	Uranium	ug/l		<5	-	-	-	<5	-	
L	Vanadium	ug/l		9.2	-	-	-	10	-	
L	Zinc	ug/l		1100	-	-	-	650	-	

Comments:

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

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

Signed: PP

Caroline Bowden, Regional Chemist

Date: 18/Apr/2012

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	29/08/12

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

Date collected:	14/05/2012	Date received:	14/05/2012

Report number:KK1200762/1

				Laboratory Ref:	1202123	1202124	1202125	1202126	1202127	1202128	
				Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	
				Location code:	WST-W0075-01-LT3a	WST-W0075-01-LT4B/B	WST-W0075-01-BH7b	WST-W0075-01-LT1	WST-W0075-01-LT2	WST-W0075-01-LT5	
				Sampling point:	Dry, no sample	Dry, no sample	Dry, no sample	Dry, no sample	Dry, no sample	unable to get sample as no tubing in borehole	
				Sampled by:	DB/JS	DB/JS	DB/JS	DB/JS	DB/JS	DB/JS	
				Time Sampled:	13:30	13:35	13:40	13:42	13:45	13:55	
				Start/End - Dates of Analysis:	14-05-12/14-05-12	14-05-12/14-05-12	14-05-12/14-05-12	14-05-12/14-05-12	14-05-12/14-05-12	14-05-12/14-05-12	
				Status of results:	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	**Final Report**	
L	Time sampled				13:30						

Comments:

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

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

Signed: PP _____ Date: 29/Aug/2012

Caroline Bowden, Regional Chemist

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	22/01/13

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

Date collected:	12/11/2012	Date received:	12/11/2012

			Laboratory Ref:	1204897	1204898	1204899	1204900	1204901	1204902	1204903
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-RC6a	WST-W0075-01-RC4	WST-W0075-01-LT3a	WST-W0075-01-LT2	WST-W0075-01-LT4B/B	WST-W0075-01-LT5	WST-W0075-01-LT1
			Sampling point:	brown	clear	Dry, no sample	Dry, no sample	Dry, no sample	Dry, no sample	Dry, no sample
			Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
			Time Sampled:	11:30	12:15	12:30	12:35	12:37	12:39	12:45
			Start/End - Dates of Analysis:	12-11-12/28-11-12	12-11-12/18-11-12	12-11-12/12-11-12	12-11-12/12-11-12	12-11-12/12-11-12	12-11-12/12-11-12	12-11-12/12-11-12
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report
	Parameter	Units	Limits							
F	Depth of Borehole	m		5	15.5	-	-	-	-	-
F	Leachate Level	m		4	12.1	-	-	-	-	-
F	Temperature	°C		12.6	12.6	-	-	-	-	-
L	pH	pH		7.3	7.1	-	-	-	-	-
L	Conductivity @25°C	µS/cm		1061	5110	-	-	-	-	-
L	Ammonia	mg/l N		0.4	4.1	-	-	-	-	-
L	Chloride	mg/l Cl		139	>8221	-	-	-	-	-
L	Total Oxidised Nitrogen (as N)	mg/l N		<0.20	<0.20	-	-	-	-	-
L	Chemical Oxygen Demand	mg/l O2		31	840	-	-	-	-	-
L	Biochemical Oxygen Demand	mg/l O2		1.6	<1.0	-	-	-	-	-

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

Test Report

Report of:	Analysis of landfill site sample(s)
Report to:	Waterford County Council
Report date:	22/01/13

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

Date collected:	12/11/2012	Date received:	12/11/2012

			Laboratory Ref:	1204897	1204898	1204899	1204900	1204901	1204902	1204903
			Type of sample:	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate	Leachate
			Location code:	WST-W0075-01-RC6a	WST-W0075-01-RC4	WST-W0075-01-LT3a	WST-W0075-01-LT2	WST-W0075-01-LT4B/B	WST-W0075-01-LT5	WST-W0075-01-LT1
			Sampling point:	brown	clear	Dry, no sample	Dry, no sample	Dry, no sample	Dry, no sample	Dry, no sample
			Sampled by:	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry	Diarmuid Berry
			Time Sampled:	11:30	12:15	12:30	12:35	12:37	12:39	12:45
			Start/End - Dates of Analysis:	12-11-12/28-11-12	12-11-12/18-11-12	12-11-12/12-11-12	12-11-12/12-11-12	12-11-12/12-11-12	12-11-12/12-11-12	12-11-12/12-11-12
			Status of results:	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report	Final Report
	Parameter	Units	Limits							
F	Depth of Borehole	m		5	15.5	-	-	-	-	-
F	Leachate Level	m		4	12.1	-	-	-	-	-
F	Temperature	°C		12.6	12.6	-	-	-	-	-
L	pH	pH		7.3	7.1	-	-	-	-	-
L	Conductivity @25°C	µS/cm		1061	5110	-	-	-	-	-
L	Ammonia	mg/l N		0.4	4.1	-	-	-	-	-
L	Chloride	mg/l Cl		139	>8221	-	-	-	-	-
L	Total Oxidised Nitrogen (as N)	mg/l N		<0.20	<0.20	-	-	-	-	-
L	Chemical Oxygen Demand	mg/l O2		31	840	-	-	-	-	-
L	Biochemical Oxygen Demand	mg/l O2		1.6	<1.0	-	-	-	-	-

Appendix E

Meteorological Data

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/01/2012 00:00	3.8	11.5	10.3	2.9
	02/01/2012 00:00	6.7	12.7	9.0	1.7
	03/01/2012 00:00	6.1	19.5	11.6	4.2
	04/01/2012 00:00	1.0	16.0	10.7	4.7
	05/01/2012 00:00	0.2	17.1	11.8	5.3
	06/01/2012 00:00	0.2	8.5	10.6	3.9
	07/01/2012 00:00	0.0	8.5	10.7	6.3
	08/01/2012 00:00	0.2	6.6	12.1	6.5
	09/01/2012 00:00	0.5	6.0	11.9	7.3
	10/01/2012 00:00	0.8	10.7	9.9	5.0
	11/01/2012 00:00	0.1	11.3	10.5	8.8
	12/01/2012 00:00	0.9	7.1	10.8	4.1
	13/01/2012 00:00	0.2	3.7	7.9	2.7
	14/01/2012 00:00	0.0	10.4	7.5	4.4
	15/01/2012 00:00	0.0	11.5	6.8	5.3
	16/01/2012 00:00	0.0	7.7	7.3	4.6
	17/01/2012 00:00	1.0	10.5	10.2	7.1
	18/01/2012 00:00	2.6	7.4	10.8	6.6
	19/01/2012 00:00	2.9	10.5	8.8	5.1
	20/01/2012 00:00	0.0	13.5	11.9	5.2
	21/01/2012 00:00	0.2	16.5	12.0	6.3
	22/01/2012 00:00	0.0	10.9	9.9	5.4
	23/01/2012 00:00	0.4	5.5	8.9	3.6
	24/01/2012 00:00	2.9	10.3	11.5	6.2
	25/01/2012 00:00	6.5	13.8	10.1	2.1
	26/01/2012 00:00	2.5	11.7	6.3	0.9
	27/01/2012 00:00	0.1	10.2	7.2	1.6
	28/01/2012 00:00	0.3	3.3	6.6	0.9
	29/01/2012 00:00	22.7	5.5	8.9	5.4
	30/01/2012 00:00	5.3	8.8	6.4	4.3
	31/01/2012 00:00	0.1	9.2	5.1	3.2

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/02/2012 00:00	0.0	7.6	4.1	1.4
	02/02/2012 00:00	0.0	4.2	3.4	-1.2
	03/02/2012 00:00	0.0	5.3	6.7	-0.2
	04/02/2012 00:00	8.7	8.7	9.0	5.0
	05/02/2012 00:00	1.5	4.4	7.5	3.1
	06/02/2012 00:00	0.4	2.2	8.0	5.3
	07/02/2012 00:00	0.2	5.4	7.4	2.5
	08/02/2012 00:00	0.0	10.1	5.2	3.3
	09/02/2012 00:00	1.8	7.3	9.4	4.7
	10/02/2012 00:00	3.6	5.9	9.6	6.0
	11/02/2012 00:00	5.4	8.1	6.2	5.1
	12/02/2012 00:00	0.0	5.4	9.7	6.1
	13/02/2012 00:00	0.1	9.2	9.0	4.8
	14/02/2012 00:00	0.0	12.3	9.2	5.7
	15/02/2012 00:00	0.0	9.2	10.4	6.7
	16/02/2012 00:00	0.0	9.3	10.8	5.2
	17/02/2012 00:00	0.0	11.4	11.1	8.2
	18/02/2012 00:00	1.7	14.1	8.8	1.5
	19/02/2012 00:00	0.0	7.8	8.4	1.1
	20/02/2012 00:00	0.7	11.1	8.7	3.2
	21/02/2012 00:00	0.8	14.2	10.5	8.5
	22/02/2012 00:00	6.5	15.6	13.0	9.0
	23/02/2012 00:00	0.0	11.2	13.4	9.7
	24/02/2012 00:00	0.1	6.4	12.2	8.1
	25/02/2012 00:00	0.0	3.6	11.2	3.8
	26/02/2012 00:00	0.2	5.8	9.7	3.1
	27/02/2012 00:00		7.7	10.4	8.4
	28/02/2012 00:00	0.0	5.6	11.7	8.5
	29/02/2012 00:00	0.0	9.1	10.6	8.1

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/03/2012 00:00	0.0	8.1	12.7	9.0
	02/03/2012 00:00	0.0	8.9	9.1	7.8
	03/03/2012 00:00	5.7	9.9	11.1	4.9
	04/03/2012 00:00	0.8	9.7	8.0	0.2
	05/03/2012 00:00	0.0	8.4	9.9	2.5
	06/03/2012 00:00	2.3	10.0	9.8	2.4
	07/03/2012 00:00	4.4	13.7	10.1	3.5
	08/03/2012 00:00	0.1	10.0	11.3	3.1
	09/03/2012 00:00	0.0	11.4	11.9	8.5
	10/03/2012 00:00	0.2	7.0	14.0	7.6
	11/03/2012 00:00	0.0	4.1	13.8	8.1
	12/03/2012 00:00	0.0	3.0	8.5	6.5
	13/03/2012 00:00	0.0	2.4	8.4	5.9
	14/03/2012 00:00	0.0	4.2	7.6	6.2
	15/03/2012 00:00	0.0	6.9	10.7	6.2
	16/03/2012 00:00	5.8	10.3	10.2	6.9
	17/03/2012 00:00	6.1	5.0	9.6	3.3
	18/03/2012 00:00	0.3	8.0	11.2	3.4
	19/03/2012 00:00	0.0	8.6	10.5	2.2
	20/03/2012 00:00	0.0	7.8	11.1	6.9
	21/03/2012 00:00	0.0	5.2	10.0	5.2
	22/03/2012 00:00	5.8	7.8	10.9	5.3
	23/03/2012 00:00	0.2	6.9	11.9	5.9
	24/03/2012 00:00	0.1	8.8	15.1	7.2
	25/03/2012 00:00	0.0	4.5	14.0	8.3
	26/03/2012 00:00	0.1	5.5	13.3	7.2
	27/03/2012 00:00	0.0	5.4	14.1	7.1
	28/03/2012 00:00	0.0	5.3	14.9	6.7
	29/03/2012 00:00	0.0	5.8	18.1	7.5
	30/03/2012 00:00	0.0	6.5	12.1	6.2
	31/03/2012 00:00	0.0	8.5	10.5	5.2

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/04/2012 00:00	0.0	4.4	10.2	4.9
	02/04/2012 00:00	0.3	3.7	9.9	7.0
	03/04/2012 00:00	0.2	10.8	9.9	1.1
	04/04/2012 00:00	2.0	16.9	6.5	0.7
	05/04/2012 00:00	0.0	13.5	7.6	1.9
	06/04/2012 00:00	0.0	7.5	11.6	1.9
	07/04/2012 00:00	0.0	7.1	13.7	8.5
	08/04/2012 00:00	0.3	8.5	12.7	6.9
	09/04/2012 00:00	7.7	11.0	10.5	3.8
	10/04/2012 00:00	0.9	9.5	11.0	1.7
	11/04/2012 00:00	1.8	7.7	12.2	2.6
	12/04/2012 00:00	0.2	6.5	12.3	3.1
	13/04/2012 00:00	0.0	5.6	8.9	3.9
	14/04/2012 00:00	4.5	10.2	9.1	3.1
	15/04/2012 00:00	0.0	6.6	9.4	1.3
	16/04/2012 00:00	6.1	10.0	9.7	4.2
	17/04/2012 00:00	14.8	13.6	10.1	4.6
	18/04/2012 00:00	3.0	10.3	10.9	4.9
	19/04/2012 00:00	1.1	9.3	13.0	3.8
	20/04/2012 00:00	7.6	8.7	11.2	4.2
	21/04/2012 00:00	1.7	10.8	12.4	3.9
	22/04/2012 00:00	2.7	7.3	12.9	4.7
	23/04/2012 00:00	0.2	8.7	11.2	4.9
	24/04/2012 00:00	5.5	5.7	11.0	4.3
	25/04/2012 00:00	16.9	14.6	7.8	5.9
	26/04/2012 00:00	2.5	9.6	9.3	6.4
	27/04/2012 00:00	0.1	10.9	9.7	4.1
	28/04/2012 00:00	0.0	15.1	9.8	3.5
	29/04/2012 00:00	9.4	18.3	7.2	4.5
	30/04/2012 00:00	4.2	14.1	11.6	7.2

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/05/2012 00:00	19.0	12.2	11.1	8.1
	02/05/2012 00:00	0.3	8.4	12.8	7.7
	03/05/2012 00:00	2.2	8.0	10.6	7.5
	04/05/2012 00:00	0.0	8.3	11.0	6.3
	05/05/2012 00:00	0.0	9.5	8.3	2.7
	06/05/2012 00:00	0.0	6.8	9.6	1.4
	07/05/2012 00:00	8.1	11.4	12.7	6.9
	08/05/2012 00:00	0.0	7.6	13.2	7.7
	09/05/2012 00:00	14.9	8.6	9.5	4.9
	10/05/2012 00:00	7.9	8.7	13.0	8.2
	11/05/2012 00:00	1.1	9.2	13.1	5.2
	12/05/2012 00:00	0.1	6.9	13.4	1.6
	13/05/2012 00:00	1.0	13.7	11.8	4.0
	14/05/2012 00:00	0.7	11.2	13.5	5.6
	15/05/2012 00:00	0.0	9.8	13.2	3.0
	16/05/2012 00:00	0.0	5.8	12.4	2.5
	17/05/2012 00:00	0.1	6.4	11.4	7.6
	18/05/2012 00:00	8.5	11.6	11.2	8.3
	19/05/2012 00:00	0.6	9.4	9.7	6.9
	20/05/2012 00:00	0.1	5.1	13.9	6.6
	21/05/2012 00:00	0.0	5.5	15.8	7.6
	22/05/2012 00:00	0.3	5.7	13.9	9.5
	23/05/2012 00:00	0.7	5.6	14.2	11.3
	24/05/2012 00:00	0.0	6.0	16.2	9.5
	25/05/2012 00:00	0.0	9.7	20.1	13.7
	26/05/2012 00:00	0.0	10.9	18.9	12.2
	27/05/2012 00:00	0.0	6.2	17.1	9.6
	28/05/2012 00:00	0.0	7.0	16.4	9.8
	29/05/2012 00:00	0.0	5.1	15.7	9.6
	30/05/2012 00:00	1.1	7.5	16.8	11.5
	31/05/2012 00:00	2.1	7.3	17.0	12.3

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/06/2012 00:00	0.0	5.5	18.4	10.7
	02/06/2012 00:00	21.0	8.7	14.6	10.4
	03/06/2012 00:00	5.7	10.5	13.0	8.5
	04/06/2012 00:00	0.0	6.7	12.7	6.4
	05/06/2012 00:00	7.2	6.5	12.8	9.1
	06/06/2012 00:00	8.0	5.4	15.8	9.5
	07/06/2012 00:00	24.4	9.7	14.6	10.8
	08/06/2012 00:00	9.5	17.7	12.9	9.3
	09/06/2012 00:00	0.0	9.1	15.1	7.2
	10/06/2012 00:00	0.0	3.4	15.6	8.7
	11/06/2012 00:00	0.0	3.6	15.9	9.7
	12/06/2012 00:00	16.6	3.6	14.2	9.2
	13/06/2012 00:00	3.3	4.0	16.6	9.4
	14/06/2012 00:00	12.0	11.0	12.8	10.3
	15/06/2012 00:00	19.4	16.3	12.9	11.5
	16/06/2012 00:00	8.1	12.3	16.2	10.6
	17/06/2012 00:00	0.0	5.6	15.2	8.6
	18/06/2012 00:00	0.0	7.1	15.1	7.2
	19/06/2012 00:00	0.1	6.5	16.0	8.8
	20/06/2012 00:00	13.3	5.2	15.5	9.9
	21/06/2012 00:00	7.8	7.7	15.1	11.7
	22/06/2012 00:00	2.6	13.5	17.0	10.3
	23/06/2012 00:00	4.8	11.3	15.0	10.6
	24/06/2012 00:00	0.1	8.6	18.1	10.2
	25/06/2012 00:00	0.0	5.8	15.7	10.6
	26/06/2012 00:00	5.7	10.2	17.4	12.4
	27/06/2012 00:00	5.7	8.2	16.0	13.5
	28/06/2012 00:00	17.2	10.9	16.1	12.9
	29/06/2012 00:00	0.5	14.0	16.9	12.2
	30/06/2012 00:00	3.3	10.0	15.9	8.4

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/07/2012 00:00	2.6	10.8	15.2	8.5
	02/07/2012 00:00	5.5	10.1	16.3	13.5
	03/07/2012 00:00	6.5	8.8	14.4	13.4
	04/07/2012 00:00	0.4	7.5	16.6	11.7
	05/07/2012 00:00	0.8	5.3	17.3	11.1
	06/07/2012 00:00	29.9	8.3	16.0	10.4
	07/07/2012 00:00	0.1	10.2	18.3	13.0
	08/07/2012 00:00	0.0	7.3	16.8	12.5
	09/07/2012 00:00	2.0	5.4	15.0	10.8
	10/07/2012 00:00	7.4	9.4	18.0	10.2
	11/07/2012 00:00	1.5	7.3	16.6	9.0
	12/07/2012 00:00	5.4	6.4	13.5	7.4
	13/07/2012 00:00	5.0	5.3	14.9	10.8
	14/07/2012 00:00	0.0	7.4	16.6	11.6
	15/07/2012 00:00	0.2	9.7	16.4	10.0
	16/07/2012 00:00	3.7	11.4	20.9	12.2
	17/07/2012 00:00	0.4	11.0	17.4	11.9
	18/07/2012 00:00	7.3	9.9	20.7	11.8
	19/07/2012 00:00	0.0	7.7	17.2	11.2
	20/07/2012 00:00	0.0	4.9	16.7	10.1
	21/07/2012 00:00	0.0	5.9	17.6	8.7
	22/07/2012 00:00	0.4	11.2	16.9	13.0
	23/07/2012 00:00	0.6	11.6	17.3	15.4
	24/07/2012 00:00	3.9	7.6	17.2	15.4
	25/07/2012 00:00	0.3	7.1	18.1	14.3
	26/07/2012 00:00	0.0	5.3	18.8	12.3
	27/07/2012 00:00	0.0	8.4	19.1	10.5
	28/07/2012 00:00	6.2	8.5	17.8	8.3
	29/07/2012 00:00	5.4	7.0	16.5	8.1
	30/07/2012 00:00	5.0	7.5	15.9	8.8
	31/07/2012 00:00	8.0	8.4	16.4	11.9

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/08/2012 00:00	4.6	13.3	17.8	12.6
	02/08/2012 00:00	0.2	8.1	17.5	11.2
	03/08/2012 00:00	33.9	10.3	17.6	13.2
	04/08/2012 00:00	10.7	9.2	17.9	13.0
	05/08/2012 00:00	11.3	4.9	17.9	12.6
	06/08/2012 00:00	0.7	6.5	17.0	11.5
	07/08/2012 00:00	2.1	4.8	16.3	12.4
	08/08/2012 00:00	1.4	2.6	18.8	13.3
	09/08/2012 00:00	0.0	3.2	22.1	13.6
	10/08/2012 00:00	0.0	5.6	20.5	13.2
	11/08/2012 00:00	0.6	7.6	21.3	15.2
	12/08/2012 00:00	7.2	8.2	19.2	15.5
	13/08/2012 00:00	6.0	10.0	19.1	14.3
	14/08/2012 00:00	1.6	7.2	19.2	14.6
	15/08/2012 00:00	17.1	16.6	18.2	14.8
	16/08/2012 00:00	16.2	14.5	18.5	14.6
	17/08/2012 00:00	12.0	9.3	17.4	15.3
	18/08/2012 00:00	0.7	7.1	18.7	14.8
	19/08/2012 00:00	1.5	6.8	17.6	14.4
	20/08/2012 00:00	0.5	9.3	18.8	14.3
	21/08/2012 00:00	1.8	9.1	18.1	11.9
	22/08/2012 00:00	0.8	8.5	18.6	12.0
	23/08/2012 00:00	0.2	5.3	16.9	12.2
	24/08/2012 00:00	14.3	6.5	15.4	12.6
	25/08/2012 00:00	2.7	8.5	18.8	11.7
	26/08/2012 00:00	0.1	8.6	16.5	9.5
	27/08/2012 00:00	30.0	14.0	16.9	12.9
	28/08/2012 00:00	3.3	10.1	17.4	10.6
	29/08/2012 00:00	6.9	11.5	17.0	12.2
	30/08/2012 00:00	0.0	9.8	16.9	10.4
	31/08/2012 00:00	0.0	6.3	16.0	9.5

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/09/2012 00:00	0.0	11.4	17.6	11.2
	02/09/2012 00:00	0.6	6.0	22.4	14.6
	03/09/2012 00:00	0.0	8.4	17.7	13.3
	04/09/2012 00:00	0.1	6.0	19.8	11.4
	05/09/2012 00:00	0.0	5.5	16.6	9.0
	06/09/2012 00:00	0.1	8.1	17.5	8.7
	07/09/2012 00:00	0.1	7.0	18.1	10.6
	08/09/2012 00:00	0.0	6.3	16.4	12.5
	09/09/2012 00:00	2.8	10.4	17.3	13.9
	10/09/2012 00:00	5.2	8.5	16.9	9.7
	11/09/2012 00:00	0.1	10.2	14.5	8.0
	12/09/2012 00:00	0.0	7.6	19.2	7.4
	13/09/2012 00:00	0.0	9.5	17.1	6.3
	14/09/2012 00:00	0.4	9.4	18.2	10.3
	15/09/2012 00:00	0.0	6.5	15.7	10.1
	16/09/2012 00:00	2.3	9.4	17.1	9.2
	17/09/2012 00:00	0.1	8.2	15.2	7.7
	18/09/2012 00:00	0.0	9.5	14.8	7.4
	19/09/2012 00:00	0.0	8.4	15.2	6.7
	20/09/2012 00:00	0.6	8.5	14.9	10.9
	21/09/2012 00:00	0.6	6.9	13.3	7.0
	22/09/2012 00:00	0.0	6.0	13.6	5.9
	23/09/2012 00:00	0.1	8.2	13.2	9.5
	24/09/2012 00:00	0.1	10.4	12.9	8.3
	25/09/2012 00:00	8.9	10.6	11.0	8.1
	26/09/2012 00:00	1.7	12.5	14.9	9.4
	27/09/2012 00:00	0.4	7.6	14.4	7.7
	28/09/2012 00:00	3.4	9.1	14.6	8.3
	29/09/2012 00:00	0.0	9.4	15.5	6.2
	30/09/2012 00:00	5.3	13.3	14.8	12.0

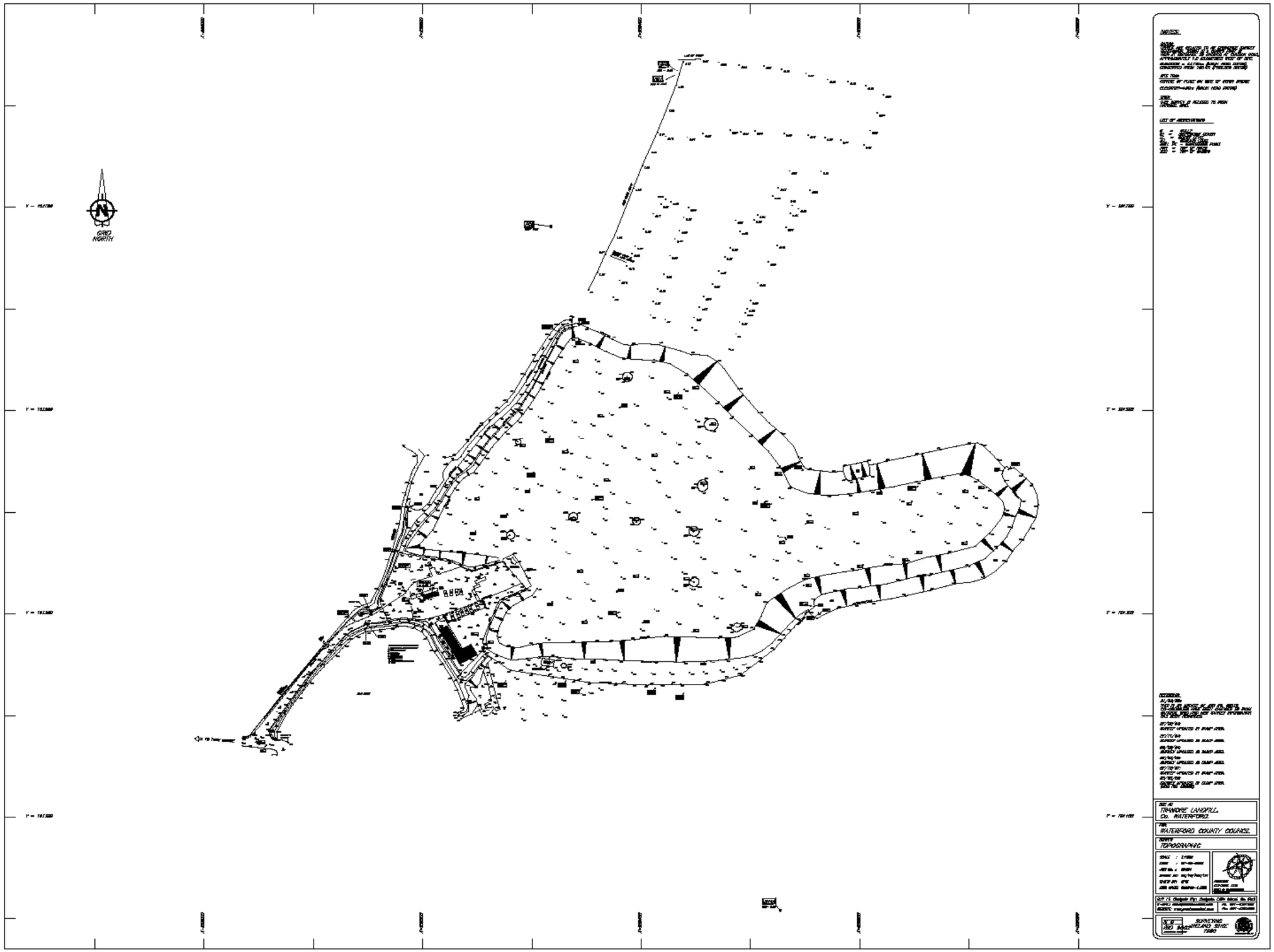
Johnstown Castle, Co. Wexford				
date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
01/10/2012 00:00	0.1	9.8	14.8	10.4
02/10/2012 00:00	6.1	12.2	14.2	8.0
03/10/2012 00:00	1.3	9.6	13.3	6.5
04/10/2012 00:00	8.4	7.5	13.5	5.1
05/10/2012 00:00	0.8	5.0	11.7	8.2
06/10/2012 00:00	0.0	5.8	14.0	5.8
07/10/2012 00:00	0.9	6.9	13.6	6.8
08/10/2012 00:00	14.4	8.9	12.3	10.1
09/10/2012 00:00	0.7	5.3	12.6	11.0
10/10/2012 00:00	6.5	7.7	14.2	11.3
11/10/2012 00:00	3.8	12.2	14.7	6.7
12/10/2012 00:00	0.8	8.3	12.3	5.6
13/10/2012 00:00	0.0	7.2	12.5	4.1
14/10/2012 00:00	1.1	6.9	11.4	3.4
15/10/2012 00:00	7.5	7.1	11.4	7.5
16/10/2012 00:00		10.7	13.7	6.2
17/10/2012 00:00	24.1	17.1	13.2	9.8
18/10/2012 00:00	6.3	8.6	13.4	8.6
19/10/2012 00:00	0.2	3.3	13.6	5.2
20/10/2012 00:00	0.1	4.8	15.0	9.0
21/10/2012 00:00	0.1	4.6	13.7	8.8
22/10/2012 00:00	0.1	5.6	13.4	10.0
23/10/2012 00:00	0.5	6.5	13.3	11.3
24/10/2012 00:00	0.8	11.3	13.2	12.3
25/10/2012 00:00	1.6	11.1	13.6	10.0
26/10/2012 00:00	1.2	13.3	10.2	2.1
27/10/2012 00:00	0.0	9.2	7.5	1.0
28/10/2012 00:00	3.1	10.3	9.4	5.4
29/10/2012 00:00	0.1	7.0	10.2	5.0
30/10/2012 00:00	0.0	8.0	9.5	2.6
31/10/2012 00:00	13.4	9.2	10.2	3.0

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/11/2012 00:00	0.2	10.6	7.8	1.3
	02/11/2012 00:00	0.0	9.1	10.0	2.4
	03/11/2012 00:00	0.6	8.8	8.4	1.1
	04/11/2012 00:00	14.2	11.3	10.2	6.0
	05/11/2012 00:00	2.5	9.9	9.8	3.8
	06/11/2012 00:00	0.0	8.9	11.0	4.4
	07/11/2012 00:00	0.0	9.2	11.5	6.8
	08/11/2012 00:00	0.1	6.8	11.2	7.5
	09/11/2012 00:00	13.0	9.9	10.6	5.6
	10/11/2012 00:00	0.2	6.8	8.6	1.5
	11/11/2012 00:00	2.3	6.7	9.8	1.5
	12/11/2012 00:00	7.4	12.5	12.7	7.1
	13/11/2012 00:00	1.1	14.3	12.2	11.5
	14/11/2012 00:00	0.0	6.0	11.8	10.2
	15/11/2012 00:00	0.0	2.7	11.6	5.6
	16/11/2012 00:00	0.1	3.5	10.2	5.2
	17/11/2012 00:00	0.1	7.1	8.8	2.9
	18/11/2012 00:00	9.6	10.5	11.0	0.4
	19/11/2012 00:00	12.5	16.8	11.9	10.4
	20/11/2012 00:00	4.5	12.0	12.2	7.2
	21/11/2012 00:00	0.8	8.3	11.4	5.9
	22/11/2012 00:00	22.0	13.6	12.0	5.0
	23/11/2012 00:00	0.2	7.6	9.4	3.0
	24/11/2012 00:00	13.6	8.2	8.4	1.8
	25/11/2012 00:00	31.3	7.1	8.9	-0.5
	26/11/2012 00:00	2.8	16.0	7.7	3.4
	27/11/2012 00:00	0.0	13.6	6.7	2.9
	28/11/2012 00:00	0.0	9.3	5.2	1.1
	29/11/2012 00:00	0.0	5.6	5.6	1.6
	30/11/2012 00:00	0.1	3.5	6.2	-0.4

	Johnstown Castle, Co. Wexford				
	date	Rainfall (mm)	Mean Wind speed (kt)	Maximum Temperature (deg. C)	Minimum Temperature (deg. C)
	01/12/2012 00:00	0.1	6.5	6.1	0.8
	02/12/2012 00:00	6.9	6.2	10.2	2.3
	03/12/2012 00:00	0.5	10.1	10.0	2.7
	04/12/2012 00:00	0.6	11.3	6.6	2.0
	05/12/2012 00:00	0.0	8.1	5.1	-1.7
	06/12/2012 00:00	2.6	11.6	7.3	-2.0
	07/12/2012 00:00	0.2	14.3	7.8	2.2
	08/12/2012 00:00	0.0	6.7	8.0	-0.4
	09/12/2012 00:00	0.2	6.8	8.1	2.3
	10/12/2012 00:00	0.1	6.2	6.6	1.2
	11/12/2012 00:00	0.1	5.4	6.3	2.3
	12/12/2012 00:00	0.4	9.7	7.3	2.3
	13/12/2012 00:00	0.1	9.5	8.2	2.9
	14/12/2012 00:00	10.8	13.0	9.6	5.7
	15/12/2012 00:00	0.7	8.7	9.1	6.1
	16/12/2012 00:00	0.4	8.8	10.2	5.6
	17/12/2012 00:00	0.0	10.2	8.8	4.9
	18/12/2012 00:00	0.1	5.7	8.5	3.9
	19/12/2012 00:00	11.3	10.6	10.5	7.9
	20/12/2012 00:00	0.5	5.3	8.8	6.1
	21/12/2012 00:00	5.0	6.9	9.1	3.8
	22/12/2012 00:00	15.6	14.5	11.7	8.6
	23/12/2012 00:00	0.0	11.3	11.5	7.2
	24/12/2012 00:00	7.0	8.7	9.5	6.5
	25/12/2012 00:00	6.4	8.2	8.2	3.6
	26/12/2012 00:00	5.6	11.7	9.9	4.8
	27/12/2012 00:00	9.0	8.7	8.6	4.6
	28/12/2012 00:00	9.8	18.2	11.5	6.8
	29/12/2012 00:00	6.4	12.3	9.9	3.0
	30/12/2012 00:00	0.6	16.1	10.5	3.1
	31/12/2012 00:00	2.6	13.0	10.4	2.8

Appendix F

Topographical Survey


GRID NORTH
TRANMORE LANDFILL
Co. WATERFORD
WATERFORD COUNTY COUNCIL
TOPOGRAPHIC

Appendix G

Ecological Report and Survey

Ecological Survey of Tramore Landfill and Environs

Waterford County Council
Comhairle Chontae Phort Láirge

2012 Reporting Period

TABLE OF CONTENTS

EXECUTIVE SUMMARY

Tramore Landfill site is located to the east of Tramore town at the south-western boundary of the Backstrand. The site encompasses an area of approximately 14 ha. The principal land use around the landfill site is recreational with a caravan and camping park located in Riverstown to the east, the promenade and Tramore Burrows to the south.
The Ecological Study comprised the following elements: habitat and fauna survey, biological survey of Tramore Back Strand, and the assessment of the avian fauna of the area around the landfill.
The dominant habitat on the landfill is amenity grassland. The site was seeded in 2008 and the surface has completely vegetated over. The sloping edge of the site consists of spoil and bare ground. A botanical survey of the site indicates increasing floral diversity of the site since 2008. Wild Asparagus, a vascular plant listed under the Flora Protection Order (1999) was recorded during the June 2011 survey.
Tramore Back Strand continues to be a site of high ornithological importance and recent high counts of Light bellied-Brent Geese would now rank Tramore as being one of the most ten important sites in Ireland for this species. In terms of impacts of the landfill on bird usage of the area the site now attracts less scavenger species such as gulls, hooded crow and rooks and with the establishment of a grassland vegetation cover is providing habitat for birds such as Meadow Pippit and other passerine species. The closure and re-vegetation of the landfill site has now added another 11ha of grassland habitat to the wider site providing feeding and cover along with the dune areas. The now undisturbed nature of the site will also enhance use of the site by birdlife.

1. Introduction

An Ecological Study of Tramore Landfill has been prepared by Waterford County Council, in fulfilment of the requirements of Condition 8.10.1 of the Tramore Landfill waste licence (Reg. No. 75-1) and current licence Reg. No. W0075-02 (2007).
After 60 years of operation, Tramore landfill was closed and capped in 2005. The site operated as an integrated waste management facility until 2010 and is now closed along with the landfill site.
Under the EPA licence ongoing ecological survey and assessment is required involving the following elements;

1. Habitat quality at landfill and environs. Mapping of main habitat types and identification of main flora and fauna present. Interpretation of findings with regard to previous studies.

2. Faunal analysis of the Back Strand. 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 from annual IWeBs counts by Birdwatch Ireland.

1.2 Study Area

Tramore Landfill site is located to the east of Tramore town at the south-western boundary of the Back Strand. The site encompasses an area of approximately 14ha. (Figure 1). The principal land use around the landfill site is recreational with a caravan and camping park located in Riverstown to the east, the promenade and Tramore Burrows to the south.

1.3 Report Format

The results of the 2013 ecological survey are presented in the following sections of this report, separated into the various subject areas as required by the scope of works. Section 2 gives a general site overview, describes areas designated for nature conservation that occur in close proximity to the landfill site and reports on the habitat study undertaken in June 2011. Section 3 presents the results of a faunal analysis of the Back Strand. Section 4 discusses the bird communities recorded at the landfill and reviews data for Tramore Back Strand from the Irish Wetland Bird Survey (I-WeBS).

2.0 TERRESTRIAL ECOLOGY

2.1 General Site Overview

Tramore lies about 13km south of Waterford City and is a popular seaside town with extensive coastal cliffs, bay, dunes and strand.

Tramore Bay is an almost rectangular basin of 1,000 ha. lying between cliffs on either side. The outer extent of the bay is bounded by Newtown Head to the west and Brownstown Head to the East.

Behind a shingle embankment and dune system is an intertidal area known as Tramore Back Strand. The Back Strand is connected to the open sea by a channel known as Rinnashark and dries out completely at low tide to reveal c500 hectares of intertidal sand and mud flats (Figure 1).

Tramore Landfill lies at the inner western reaches of the back strand. The landfill commenced operations in the 1940s and closed on 31st December 2005. The capping procedure has been completed and the site was re-seeded in 2008.

Figure 1. Tramore Bay showing the Back Strand, Dunes and Strand. Landfill site is located to the south west of the Back Strand

Figure 2. Landfill site boundary

2.2 Sites Designated for Nature Conservation

The Tramore Landfill site lies adjacent to areas recognised for their ecological conservation interest. Areas designated under national and/or European law in order to conserve habitats and species of national or international importance include the following:

Proposed Natural Heritage Areas (NHA): a national designation given legal status by the Wildlife (Amendment) Act 2000.

Special Areas of Conservation (SAC): areas considered of international and national importance whose legal basis is the EU Habitats Directive (92/43/EEC), transposed into Irish law through the European Union (Natural Habitats) Regulations, 1997.

Special Protection Areas (SPA) sites of international conservation importance for birds whose legal basis is the EU Birds Directive (79/409/EEC).

Tramore Dunes and Backstrand is a candidate **Special Area of Conservation** (cSAC) under the EU Habitats Directive (92/43/EEC) (Site Code 0671). The site supports several habitats that are listed on Annex I of the Directive including mudflats and sandflats not covered by seawater at low tide (Code 1140). The fixed dunes are listed as a priority habitat under this Directive (Code 2130). Several rare and protected plant species have also been recorded in the area. The SAC site synopsis (National Parks and Wildlife Service) is detailed in Appendix 2.

Tramore Backstrand is designated a **Special Protection Area (SPA)** under the EU Birds Directive (79/409/EEC) (Site Code 27). This designation is in recognition of the importance of this habitat for wintering waterbirds (waders and wildfowl). The SPA covers an area of c367 ha. And a similar area is also designated as a Ramsar site (Wetlands of international importance). The SPA site synopsis (National Parks and Wildlife Service) is detailed in Appendix 3.

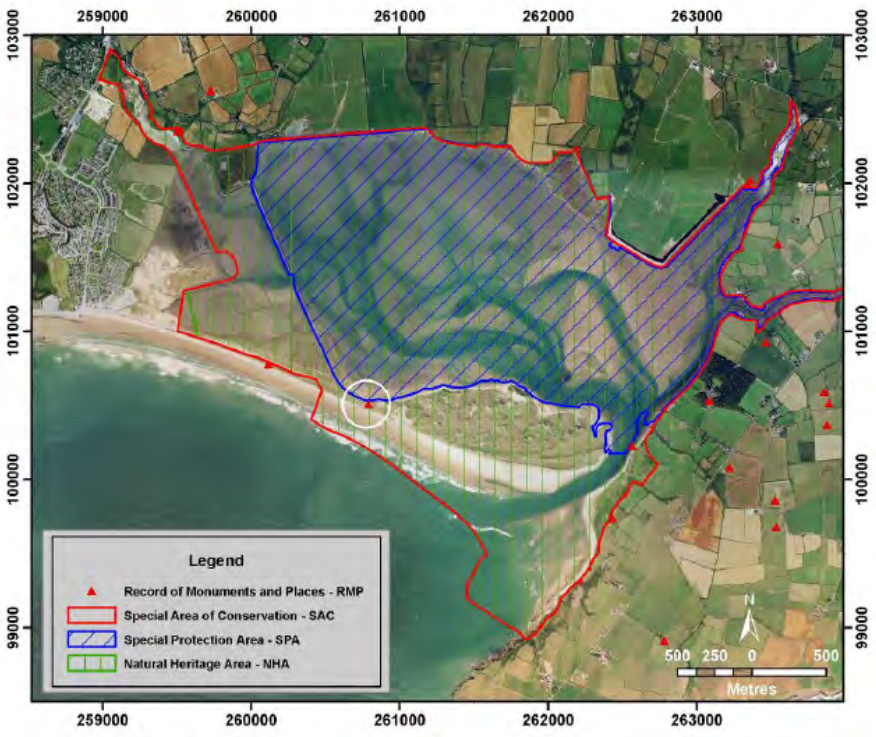


Figure 3. Boundaries of pNHA, cSAC and SPA designations at Tramore Dunes and Backstrand

2.3 Habitat Survey

A site visit to Tramore Landfill in 2013 confirmed the occurrence of four habitat types – buildings and artificial surfaces (BL3), spoil and bare ground (ED2), recolonising bare ground (ED3) and amenity grassland (GA2). The study area comprises the landfill site plus all habitats falling within the surrounding inner Back Strand of Tramore Bay- that area between the seawall at the eastern edge, Tramore Strand and the terrestrial habitats to the north and west.

Overall, the habitat on the landfill cap fits the category amenity grassland (GA2). The site was seeded in 2008 and the surface has completely vegetated over. The sloping edge of the site consists of spoil and bare ground (ED2). A concreted and tarmacadamed area supports the civic amenity site (closed 2010) and is classed as buildings and artificial surfaces (BL3).

The landfill is surrounded by lower saltmarsh (CM1) and littoral sediments (L) with upper saltmarsh (CM2) spoil and bare ground (ED2) and artificial surfaces (BL3) nearby. To the southeast of the site lie fixed dunes (CD3) with small areas of marram dune (CD2) and shingle and gravel banks (CB1) vegetation. To the west of the landfill are a caravan park and an industrial estate surrounded by disturbed ground.

The mudflat and saltmarsh areas surrounding the landfill, as well as the dunes, are included in the designated area of Tramore Dunes and Backstrand SAC and SPA. The habitat map of the area has slightly changed from the previous survey in 2008 (detailed in Figure 3) due to the addition of constructed wetland cells on the eastern edge of the landfill. These were installed in 2011 with the aim of improving treatment of water quality in the environs of the landfill site to intercept existing overflow from Tramore CWW pumping station.

.

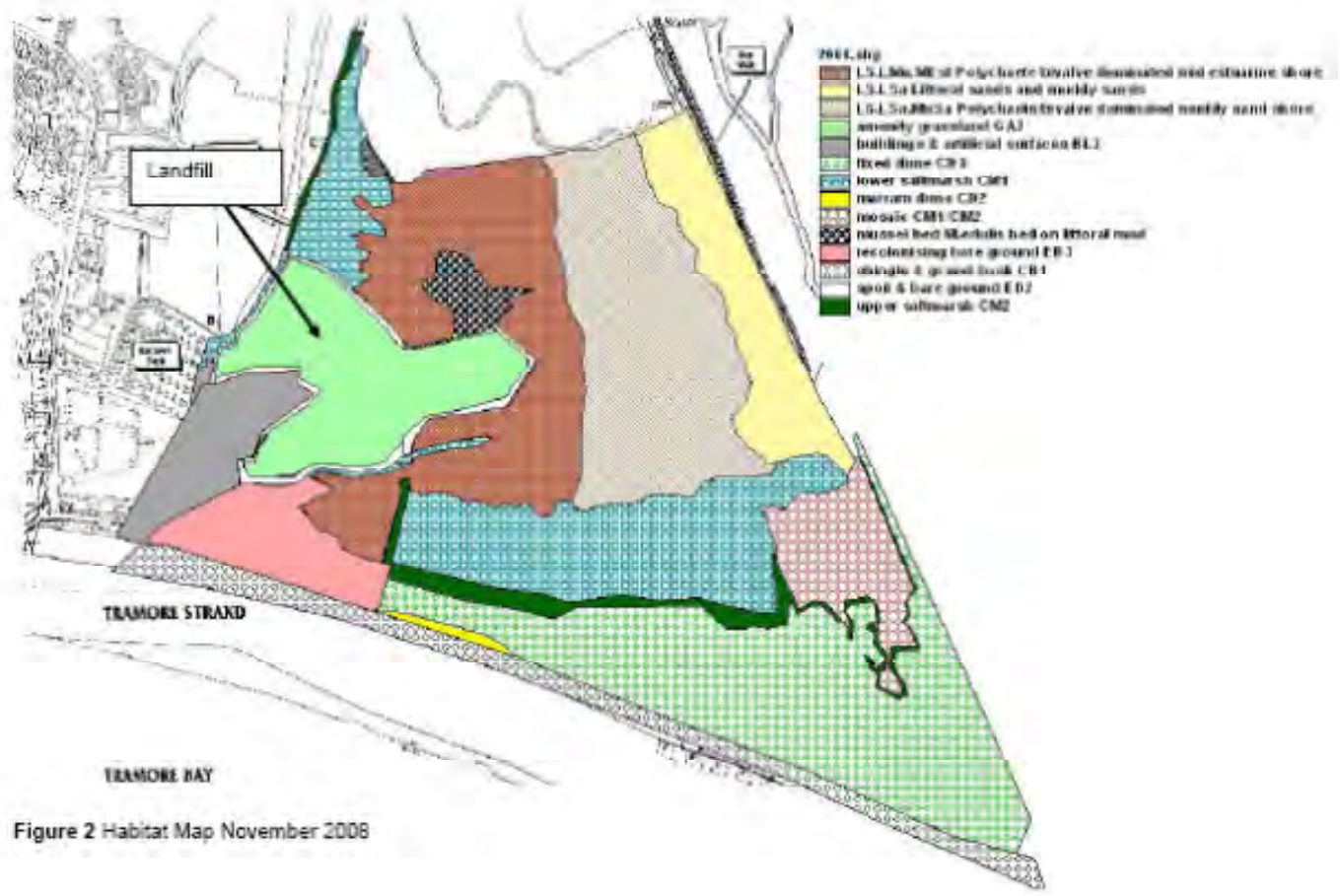


Figure 2 Habitat Map November 2008

Figure 4. Habitat Map of Tramore Landfill site 2008

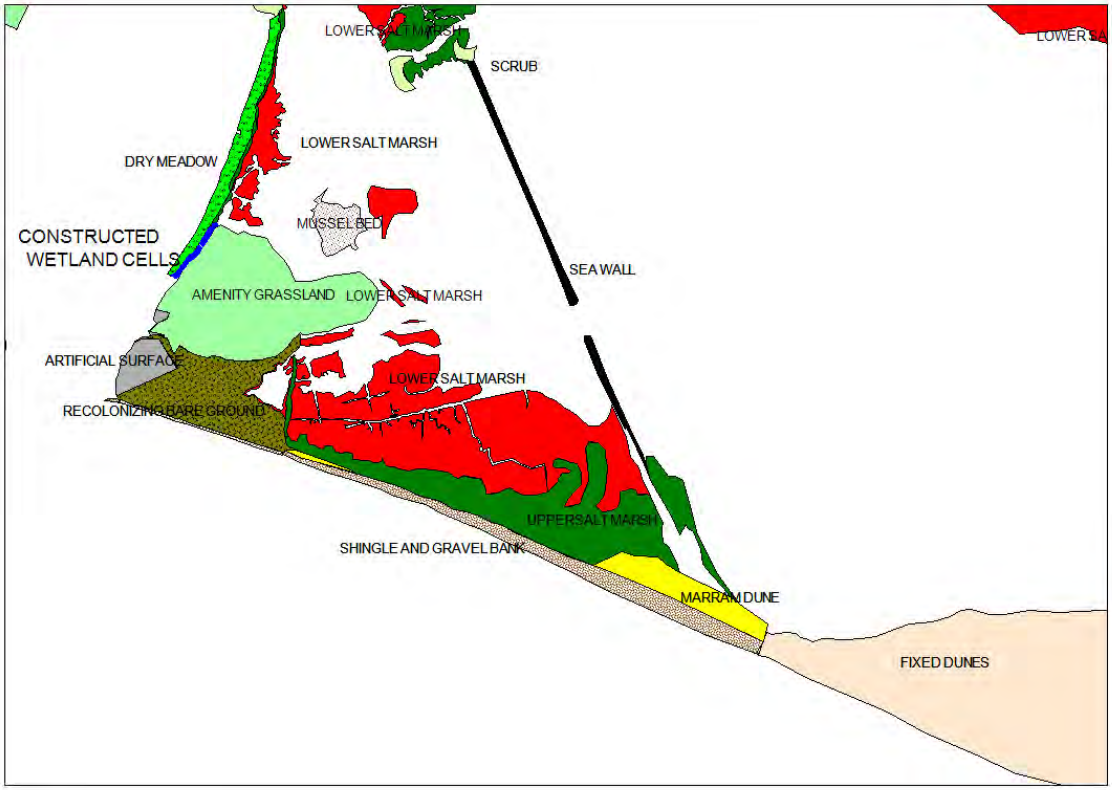


Figure 5. Habitat Map of Tramore landfill site 2013

2.3.1 Landfill Habitats

Amenity Grassland (GA2)

Amenity Grassland now covers the entire landfill cap and is the dominant habitat. Main grassland species are *Agrostis stolonifera* (Common Bent), *Holcus lanatus* (Yorkshire Fog), *Festuca rubra* (Red Fescue), *Anthoxanthum odoratum* (Sweet Vernal Grass), *Alopecurus geniculatus* (Marsh Foxtail), *Lolium Perennae* (Perennial Rye-Grass) and *Bromus hordeaceus* (Soft Brome) with a high occurrence of both Red and White Clover. Other species present include Birds Foot Trefoil, Silverweed, Vetch and Pineappleweed. Table 1 presents a flora species list from 2008 and 2011 and indicates an increase in botanical diversity since the site was seeded in 2008.

Figure 5. Amenity Grassland Habitat Tramore Landfill

Table 1. Flora species list for Tramore Landfill

Latin name	Common Name	2008	2011
Achillea millefolium	Yarrow	x	X
Agrostis stolonifera	Creeping Bent	x	X
Alopecurus geniculatus	Marsh Foxtail		X
Ammophila arenaria	Marram Grass	x	
Anagallis arvensis subsp. arvensis	Scarlet Pimpernel	x	X
Anthoxanthum odoratum	Sweet Vernal-grass		X
Anthyllis vulneraria	Kidney Vetch	x	X
Armeria maritima subsp. maritima	Thrift	x	X
Arrhenatherum elatius	False Oat-Grass	x	X
Aster tripolium	Sea Aster	x	X
Atriplex portulacoides	Sea-purslane	x	X
Atriplex prostrate	Spear-leaved Orache	x	X
Avena fatua	Wild-oat		X

Barbarea verna	American Winter-cress		X
Bellis perennis	Daisy	x	X
Beta vulgaris subsp. maritima	Sea Beet	x	X
Bolboschoenus maritimus	Sea Clubrush	x	
Brassica rapa subsp. campestris	Wild Turnip		X
Brassica napus	Rape	x	
Bromus hordeaceus	Soft-brome		X
Cakile maritime	Sea Rocket	x	
Calystegia sepium subsp. sepium	Hedge Bindweed	x	X
Calystegia soldanella	Sea Bindweed	x	
Capsella bursa-pastoris	Shepherd's Purse	x	
Carex arenaria	Sand Sedge	x	
Carex flacca	Glaucous Sedge		X
Carex otrubae	False Fox-sedge		X
Carex pendula	Pendulous Sedge		X
Centaurea nigra	Common Knapweed	x	X
Cerastium fontanum	Common Mouse-ear	x	X
Cerastium glomeratum	Sticky Mouse-ear		X
Chamerion angustifolium	Rosebay Willowherb	x	X
Chenopodium album agg.	Fat-hen	x	
Cichorium intybus	Chicory		X
Cirsium arvense	Creeping Thistle	x	X
Cirsium vulgare	Spear Thistle	x	X
Cochlearia anglica	English Scurvygrass		X
Cochleria officinale	Common Scurvygrass	x	
Convovulvus arvensis	Field Bindweed	x	
Coronopus didymus	Lesser Swine-cress		X
Crepis capillaries	Smooth Hawk's-beard		X
Crithmum maritimum	Rock Samphire	x	
Crocosmia x crocosmiiflora	Montbretia (C. aurea x pottsii)	x	X
Cymbalaria muralis subsp. muralis	Ivy-leaved Toadflax	x	X
Dactylis glomerata	Cock's foot	x	
Daucus carota subsp. carota	Wild Carrot	x	X
Dipsacus fullonum	Wild Teasel		X
Elytrigia juncea	Sand Couch	x	
Elytrigia repens	Common Couch	x	X
Epilobium ciliatum	American Willowherb		X
Epilobium hirsutum	Great Willowherb		X
Epilobium montanum	Broad-leaved Willowherb	x	X
Epilobium obscurum	Short-fruited Willowherb		X
Epilobium parviflorum	Hoary Willowherb		X
Equisetum arvense	Field Horsetail		X
Equisetum telmateia	Great Horsetail		X
Eryngium maritimum	Sea-holly	x	
Euphorbia helioscopa	Sun-spurge	x	
Euphorbia paralisas	Sea-spurge	x	
Fallopia japonica	Japanese Knotweed	x	X
Festuca arundinacea	Tall Fescue		X
Festuca rubra agg.	Red Fescue	x	X

Filipendula ulmaria	Meadowsweet	x	X
Fumaria muralis subsp. boraei	Common Ramping-fumitory	x	X
Galium aparine	Cleavers		X
Galium palustre subsp. palustre	Common Marsh-bedstraw		X
Galium verum	Lady's Bedstraw	x	
Geranium dissectum	Cut-leaved Crane's-bill		X
Glaux maritime	Sea-milkwort	x	X
Heracleum sphondylium	Hogweed	x	X
Holcus lanatus	Yorkshire-fog	x	X
Honckenya peploides	Sea Sandwort	x	
Hypericum humifusum	Trailing St John's-wort		X
Hypericum perforatum	Perforate St John's-wort		X
Hypochaeris radicata	Cat's-ear	x	X
Inula crithmoides	Golden-samphire	x	
Iris pseudacorus	Yellow Iris		X
Isolepis setacea	Bristle Club-rush		X
Juncus articulates	Jointed Rush		X
Juncus conglomeratus	Compact Rush		X
Juncus effuses	Soft-rush		X
Juncus gerardii	Saltmarsh Rush	x	X
Juncus inflexus	Hard Rush		X
Juncus maritimus	Sea Rush	x	X
Lamium purpureum	Red Dead-nettle	x	
Lapsana communis subsp. Communis	Nipplewort		X
Lathyrus pratensis	Meadow Vetchling	x	X
Leontodon autumnalis	Autumn Hawkbit		X
Leontodon saxatilis	Lesser Hawkbit		X
Lepidium heterophyllum	Smith's Pepperwort		X
Leucanthemum vulgare	Oxeye Daisy		X
Limonium humile	Lax-flowered Sea-lavender	x	X
Lolium perennae	Perennial Rye-Grass	x	
Lotus corniculatus	Common Bird's-foot-trefoil	x	X
Lotus pedunculatus	Greater Bird's-foot-trefoil		X
Lythrum salicaria	Purple-loosestrife		X
Malva sylvestris	Common Mallow	x	X
Matricaria discoidea	Pineappleweed		X
Medicago lupulina	Black Medick		X
Mentha aquatic	Water Mint	x	
Odontites vernus	Red Bartsia		X
Ononis repens	Rest-harrow	x	
Perscicaria maculosa	Redshank	x	
Petasites fragrans	Winter Heliotrope		X
Petasites hybridus	Butterbur	x	
Phalaris arundinacea	Reed Canary-grass		X
Phragmites australis	Common Reed	x	
Picris echioides	Bristly Oxtongue		X
Plantago coronopus	Buck's-horn Plantain	x	X
Plantago lanceolata	Ribwort Plantain	x	X
Plantago major	Greater Plantain	x	X

Plantago maritime	Sea Plantain	x	X
Poa annua	Annual Meadow-grass		X
Poa trivialis	Rough Meadow-grass		X
Polygonum aviculare	Knotgrass	x	X
Potentilla anserine	Silverweed	x	X
Potentilla reptans	Creeping Cinquefoil	x	X
Puccinellia maritime	Common Saltmarsh-grass	x	X
Pulicaria dysenterica	Common Fleabane	x	X
Ranunculus acris	Meadow Buttercup		X
Ranunculus repens	Creeping Buttercup	x	X
Ranunculus sceleratus	Celery-leaved Buttercup		X
Reseda luteola	Weld	x	X
Rosa pimpinellifolia	Burnet Rose	x	
Rubus caesius	Dewberry		X
Rubus fruticosus agg.	Bramble	x	X
Rubus ulmifolius	Elm-leaved Bramble		X
Rumex acetosa	Common Sorrel	x	X
Rumex conglomeratus	Clustered Dock		X
Rumex crispus subsp. crispus	Curled Dock	x	X
Rumex obtusifolius	Broad-leaved Dock	x	X
Rumex sanguineus	Wood Dock		X
Rumex x pratensis	R. crispus x obtusifolius		X
Sagina apetala subsp. erecta	Upright Pearlwort		X
Sagina maritime	Sea Pearlwort		X
Sagina procumbens	Procumbent Pearlwort		X
Salicornia agg.	Glasswort	x	X
Salix cinerea subsp. oleifolia	Rusty Willow		X
Scrophularia auriculata	Water Figwort	x	X
Scrophularia nodosa	Common Figwort	x	
Senecio jacobaea	Common Ragwort	x	X
Senecio vulgaris	Groundsel	x	X
Sinapis arvensis	Charlock	x	X
Sonchus arvensis	Perennial Sow-thistle		X
Sonchus asper	Prickly Sow-thistle		X
Sonchus oleraceus	Smooth Sow-thistle	x	X
Spartina anglica	Common Cord-grass	x	X
Spergularia marina	Lesser Sea-spurrey		X
Spergularia media	Greater Sea-spurrey		X
Stachys palustris	Marsh Woundwort	x	X
Stachys sylvatica	Hedge Woundwort		X
Stellaria graminea	Lesser Stitchwort	x	
Stellaria media	Common Chickweed	x	X
Suaeda maritime	Annual Sea-blite		X
Taraxacum officinale	Dandeloin	x	
Trifolium dubium	Lesser Trefoil		X
Trifolium pretense	Red Clover	x	X
Trifolium repens	White Clover	x	X
Triglochin maritimum	Sea Arrowgrass	x	X
Tripleurospermum inodorum	Scentless Mayweed	x	X

Tripleurospermum maritimum	Sea Mayweed	x	X
Tussilago farfara	Colt's-foot		X
Ulex europaeus	Gorse	x	X
Urtica dioica	Common Nettle	x	X
Veronica persica	Common Field-speedwell	x	X
Veronica serpyllifolia subsp. Serpyllifolia	Thyme-leaved Speedwell		X
Vicia cracca	Tufted Vetch	x	X
Vicia sativa subsp. segetalis	Common Vetch		X
Viola arvensis	Field Pansy		X
Yucca	Yucca	x	
Total No. of Species		**102**	**138**

Spoil and Bare Ground (ED2)

This habitat occurs in a ring around the outer edge of the landfill sloping down to meet the mudflat or saltmarsh at the bottom. It includes the rock armour that has been placed at the bottom of the slope and the gravel path that runs around the perimeter of the site between the emission pipes. This habitat accounts for 4% of the entire site.

Figure 6. Gravel pathway around perimeter of Landfill Site

Recolonising Bare Ground (ED3)

Patches of recolonising bare ground occur throughout the site as a result of workings of machinery on the site. Most of these patches are in the process of re-vegetating and the 2013 site visit noted a decrease in bare ground since 2011. Use of scrambler bikes is deterring revegetation in some spots. This habitat accounts for <1% of the entire site.

Figure 7. Recolonising Bare Ground

Buildings and artificial surfaces (BL3)

This habitat category is used for areas covered with artificial materials such as concrete, gravel, tarmac, and all built areas. Within the landfill it includes sites such as the civic amenity yard and buildings that are devoid of vegetation cover. This category accounts for 22% of the overall landfill site area.

2.3.2 Habitats surrounding the landfill site

Constructed wetland (FL8 other artificial lakes and ponds)

In 2011 two wetland cells were constructed on the eastern edge of the landfill. These were installed with the aim of improving treatment of water quality in the environs of the landfill site to intercept existing overflow from Tramore CWW pumping station. Cells were planted with a range of rush, reed, sedge and emergent plant species.

In 2013 22ha of compensatory wetland is being completed at Kilmacleague on former polder land to compensate for saltmarsh lost within the SAC at the landfill site. The lands will be subject to tidal inundation and it is hoped that saltmarsh vegetation will regenerate within 5-7 years.

Figure 8. Site of compensatory wetland habitat to be completed at Kilmacleague in 2013

Buildings and artificial surfaces (BL3)

This category includes the road leading to the landfill, a carpark with an embankment around it, and the long and narrow un-surfaced car park area extending eastwards behind a shingle embankment separating it from the beach.

Upper Saltmarsh (CM2)

Saltmarshes are coastal and estuarine areas of land that are periodically immersed by the sea. They support vascular

plants that are adapted to the saline environment. Saltmarsh development is characterized by a series of vegetated zones determined by their height above sea level, and consequently the frequency of submergence and exposure.
At Tramore, upper saltmarsh exists as a narrow zone above larger areas of lower saltmarsh and is subject to less frequent and less prolonged inundation by the sea. This habitat also occurs on raised areas within the lower saltmarsh where sufficient sediment has built up- the area classified as a mosaic of upper and lower saltmarsh is an example of this. Red Fescue dominates these areas along with a mixture of terrestrial and saltmarsh plants such as Creeping Bent and Sea Plantain. Clumps of Sea Rush and Sea Aster are characteristic. Sea Purslane, usually considered a species of lower saltmarshes, is also found on the raised areas (it prefers creek banks that also tend to be drier). In the southeast corner of the site, dune species such as Marram Grass and Sand couch have colonized the drier raised areas. Other species of fixed dunes such as Bird's-foot Trefoil and Sea Mayweed also occur occasionally.
In areas where there is less tidal change in sea level, such as along the western boundary of the Inner Backstrand, plants of upper and lower saltmarsh occur together in a narrow strip. The dominant species here include Sea Rush, Sea Club-rush and Saltmarsh Rush, with Sea Arrow Grass, Sea- milkwort, Sea Aster, Sea Purslane, Lax-flowered Sea Lavender, Common Scurvy-grass, Sea Beet and Creeping Bent all occurring. A small stand of the invasive non-native Japanese Knotweed occurs on the landward side of this strip, just north of the landfill site boundary.
A more diverse habitat occurs south of the landfill that grades into recolonising bare ground where Fleabane and Water Figwort occur along with Red Fescue, Sea Aster and rushes as well as small amounts of Common Reed.
A mosaic of upper and lower saltmarsh occurs in the east (near the gap in the sea wall). Here a mixture of species occurs including Sea Rush, Saltmarsh Rush, Sea Arrowgrass and Creeping Bent.

Lower Saltmarsh (CM1)

Lower Saltmarsh is subject to longer periods of inundation by seawater and therefore supports species adapted to this environment. At Tramore, this takes the form of a low sward of Thrift, Sea Purslane, Sea Aster, Lax-flowered Sea Lavender, Glasswort and common Slatmarsh-grass. Sea Purslane often dominates along creek banks. Lower areas and creeks within this sward are colonized by Glasswort, Common Saltmarsh-grass and Common Cord-grass. Common Cord-grass extends as a dense mono dominant sward over the mudflats at the lower end of the saltmarsh and also grows higher up the shore.
The tidal creek flowing northwards along the western boundary of the landfill supports lower saltmarsh vegetation along its banks, including a small pool where an outfall enters the creek.
Several plants of the scarce Golden-samphire known from only seventeen 10km squares in Ireland were recorded from the lower saltmarsh southeast of the landfill in November 2008 and also noted in 2011 site visits.

Marram Dune (CD2)

Marram dunes are partially stabilized ridges of sand that occur along the seaward edge of a dune system. They lie seaward of fixed dunes. Marram dunes are dominated by Marram Grass which is a tussocky-forming species that consolidates the free-blowing sand that characterizes these dunes. They are not fully vegetated. Wind and tide erosion continually impact on Marram Dunes presenting blow outs and reducing the extent of this habitat.

Fixed Dune (CD3)

Fixed dunes are defined as stabilized ridges of sand with more or less complete vegetation cover. Where humus has accumulated in the soil a diverse mixture of dune and grassland species often occurs.
Fixed dunes occur in the south and east of the survey are between the saltmarsh habitats and Tramore Strand. The fixed dune vegetation also extends most of the way along the eastern sea wall. Grasses such as Red Fescue and Common Couch dominate with herbs typically of this habitat, including Lady's Bedstraw, Sea Mayweed and Rest-harrow. There is a progressively greater diversity of plant species further east along the dunes. Marram Grass occurs sporadically in this habitat, but does not dominate. Trampled paths through the dunes support plants typical of disturbed , nutrient-rich environments, including perennial Rye-Grass, White Clover and Scarlet Pimpernel. Sand Sedge, Sea Spurge and Sea Holly occur on areas of eroded dunes such as pathways. These have become wider and more extensive in recent years as a result of recreational use. Waterford County Council has carried out some dune conservation measures including fencing of blow outs, sand trapping using hessian mats and transplanting of Marram on bare dune surfaces. A section of the fixed dunes was subject to burning in May 2011 and has created a more diverse mix of species through succession.

Shingle and Gravel banks (CB1)

Shingle and gravel banks are generally formed by wave action in the sea. In the case of Tramore McGrath (2001)

notes the historical presence of a shingle bar above the beach prior to dune formation, and therefore the shingle bank possibly pre-dates the dune system.
This habitat is characteristically species poor, but several typical species occur especially Rock Samphire and Sea Sandwort, with Sea Mayweed, Sea Beet, Sand Couch and Sea Plantain. Orache species also occurs just above the tideline. This habitat is continuously subject to erosion where winter storms wash away material only to deposit again during calmer weather conditions.

2.3 Discussion

Grassland vegetation is now well established on the landfill cap and the flora survey indicates a good botanical mix of vascular plants with 138 species recorded in 2011 compared to 102 in 2008. However this is likely due the difference in recording times (November in 2008 vs June 2011). Due to the coastal nature of the site the vegetation may be influenced by maritime conditions and future monitoring will be interesting to see how the species mix develops with potential for colonization by maritime species. As the grassland sward develops, consideration will need to be given to the management regime as without some grazing or mowing, the habitat will tend to more dominant grass species and will lose the current wider botanical diversity. Some stands of gorse are encroaching on the northern end of the site and will likely spread further through the site. Gorse is a good plant for increasing biodiversity in terms of attracting insect life and passerine birds. Japanese Knotweed was also recorded form the site and this will need to sprayed in order to keep it under control.
The habitats surrounding the landfill comprise littoral sediments, saltmarshes and dunes of high ecological importance within the Tramore Dunes and Backstrand SAC and SPA designations. Six terrestrial habitats listed on Annex 1 of the Habitats Directive are present. These include the priority habitat of fixed coastal dunes with herbaceous vegetation as well as the Annex 1 habitats, Atlantic salt meadows, Mediterranean salt meadows, *Spartina* swards, *Salicornia* mudflats and perennial vegetation of stony banks. These habitats are generally in good condition. However the dunes are suffering some erosion from both storm related and recreational usage. A vascular plant, Wild Asparagus listed under the Flora Protection Order (1999) was recorded during the June 2011 survey. The scarce Golden- Samphire has also been recorded from the area including amidst dry grassland along the Riverstown relief road to the west of the landfill.

Mammals within the study area

Previous surveys of the site found evidence of Brown Rat and Otter. Otter are a protected species under the Wildlife Act 1976 (as amended in 2000), Annex 1 of the 1992 Habitats Directive and Appendix 11 of the Bern Convention. An INTERREG project called Mammals in a Sustainable Environment in which Waterford County Council are a partner with Waterford Institute of Technology is involved in surveying coastal habitats for Otter in County Waterford which will contribute useful data to the County Waterford Habitat Map and indicate otter usage of the coast and adjacent water corridors e.g. the Glen River and the Back Strand in Tramore.

SECTION 3 INTERTIDAL SURVEY OF TRAMORE BACKSTRAND
For Completion

4. AVIAN FAUNA OF TRAMORE BACKSTRAND AND BAY

4.1 Bird usage of Tramore Landfill

When Tramore landfill site was active, gulls and crows were the prevalent species present. Now that the site is closed and has been capped and re-seeded these species are no longer in abundance at the site. A walk–over of the site in February 2013 noted several Meadow Pipits in the grassland habitat.. Species noted in the immediate vicinity of the landfill on the Back Strand included Brent Goose, Oystercatcher, Mallard, Golden Plover Snipe, Little Egret and Grey Heron. The grassland habitat of the Landfill Site will be an attractive feeding site for passerine birds. As the site is subject to little disturbance it will also provide good cover for birdlife.

4.2 Bird data from Tramore Back Strand

Tramore Back Strand SPA is of high ornithological importance for wintering waterfowl with one species having a population of International Importance[4] and a further seven species having populations of National Importance[5]. In addition, three of the species are listed on Annex 1 of the EU Birds Directive. i.e. Golden Plover, Bar-tailed Godwit and Little Egret.

The site is not designated specifically for the protection of any Birds Directive Annex 1 species but rather for regularly occurring migratory species.

The Back Strand is an important site for wintering waterfowl, providing both feeding and roosting areas. Of particular importance is that the site supports an internationally important population of Light-bellied Brent Geese. The NPWS Site Synopsis for the SPA states that the site supports a further seven species in nationally important numbers : Golden Plover, Grey Plover, Lapwing, Dunlin, Sanderling, Bar-tailed Godwit and Black-tailed Godwit. However Irish Wetland Bird Survey (IWeBS) data from the period 199-8/99 to 2008/09 indicate a somewhat different situation with a somewhat different assemblage of seven species occurring regularly in numbers of national importance: Golden Plover, Grey Plover, Dunlin, Bar-tailed Godwit, Black-tailed Godwit, Curlew and Redshank; and a further five species occasionally doing so: Red-throated Diver, Little Egret, Lapwing, Knot and Greenshank.

[4]Species occurring in numbers that correspond to 1% or more of the individuals in a population of a species or subspecies.
[5] Species occurring in numbers that correspond to 1% or more of the individuals in the national population of a species

There is no evidence that Sanderling has occurred in nationally important numbers during the period. IWeBS data also indicates that Black-tailed Godwit occasionally occurs in numbers of international importance at the site. The IWeBS count area covers a somewhat larger area than the SPA which is likely to account for much of this discrepancy, and it is also likely that the status at the site of some species may have changed since the NPWS Site Synopsis was written in the 1990s.

Within the SPA boundary, the key habitats used by these species are the intertidal mudflats including the Eel-grass beds which provide an important food source for Light-bellied Brent Geese. There is overlap between the important ecological resources within the SPA and the cSAC.

Many bird species use grassland habitats outside the SPA boundary to the north of the Back Strand. Species include Light-bellied Brent Goose, Golden Plover, Lapwing and Curlew.

The population of Light-bellied Brent Goose at Tramore Back Strand is of international importance and has increased greatly in recent years. The mean peak from the period 1996 to 2000 of 344 birds ranked the site 19th in Ireland (Crowe, 2005) however more recent higher counts of up to 1,080 birds (RPS 2010)[6] would rank Tramore as now being one of the ten most important sites in Ireland for this species.

Table 2. IWeBS and RPS (2009/10) data on light- bellied Brent Goose Numbers at Tramore Backstrand

Period	5–year mean peak			2004/05 peak	2005/06 peak	2006/07 peak	2007/08 peak	2009/10 peak (RPS)
	1994-98	1995-99	1996-2000					
Number of birds	418	393	344	751	883	713	911	1,080

Table 3. IWeBS Data for Tramore Back Strand wader species

Species	Peak count for Tramore Back Strand 204-2008
Golden Plover	4,500
Lapwing	1,880
Curlew	677
Black-tailed Godwit	530
Bar-tailed Godwit	300
Greenshank	24
Redshank	411

A review of IWeBS data over the past 10 years gives a good indication of population trends in the range of waterfowl species present at the site. Two species show an apparent trend for increase- Light bellied Brent Goose and Shelduck. Numbers of Golden Plover are indicating a trend towards decrease. However numbers can be highly variable between seasons reflecting the need for review of long term data to deduce an accurate trend direction.

Table 4. Trends in mean peak counts of selected waterbirds at Tramore Bay 1998-20011
Blue indicates apparent increase. Red indicates apparent decrease

Species	2010/2011	2008/2009	2006/07	2005/06	2004/05	2002/03	2001/02	1999/00	1998/99
Light-bellied Brent Goose	814	850	713	883	751	562	414	375	313
Shelduck	40	70	51	48	44	22	19	37	24
Wigeon	249	77	46	108	109	53	87	51	82
Teal	67	40	20	30	71	16	67	75	115
Mallard	209	115	94	102	100	42	111	3	29
Oystercatcher	398	396	346	520	492	310	662	425	236
Golden Plover	350	1,750	2900	4000	4500	1	2500	2800	2420

[6] Bird Count carried out by RPS for Waterford County Council as part of the AA Screening for the Kilmacleague Compensatory Wetlands Project.

Lapwing	715	1,780	834	1880	1350	1342	633	3500	1605
Knot	95	184	26	210	70	62	12	37	28
Sanderling	25	10	56	48	35	58	10	30	48
Dunlin	600	1,000	688	697	790	1043	725	1790	1640
Black-tailed Godwit	322	176	238	343	530	391	151	377	303
Bar-tailed Godwit	195	205	210	247	300	318	271	405	227
Curlew	477	397	677	443	674	415	395	680	835
Redshank	99	165	165	411	304	334	314	201	215
Turnstone	17	30	35	49	27	51	9	25	20

4.3 Discussion

Tramore Back Strand continues to be a site of high ornithological importance and recent high counts of Light bellied-Brent Geese would now rank Tramore as being one of the most ten important sites in Ireland for this species. In terms of impacts from the landfill on bird usage of the area the site now attracts less scavenger species such as gulls, hooded crow and rooks and with the establishment of a grassland vegetation cover is providing habitat for birds such as Meadow Pippit and other passerine species. The closure and re-vegetation of the landfill site has now added another 11ha of grassland habitat to the wider site providing feeding and cover along with the dune areas. The now undisturbed nature of the site will also enhance use of the site by birdlife.

5. REFERENCES

Birdwatch Ireland IWeBS data for Tramore Backstrand 2008/09- 2011
Limosa Environmental Ecological and Environmental Consultancy *Ecological Survey of Tramore Landfill and Environs* Report for Waterford County Council (2008)
NPWS Site Synopsis for Tramore Dunes cSAC (1999)
NPWS Site Synopsis for Tramore Dunes SPA (2002)
RPS Consultants Tramore Wetland Restoration Project Appropriate Assessment Screening Report of Design Option 1A (2011)

Appendices

Flora Species List for Tramore Dunes June 2011

Taxon	**Vernacular**
Agrostis stolonifera	Creeping Bent
Aira caryophyllea	Silver Hair-grass
Ammophila arenaria	Marram
Anacamptis pyramidalis	Pyramidal Orchid
Anagallis arvensis	Scarlet Pimpernel
Anthoxanthum odoratum	Sweet Vernal-grass
Anthyllis vulneraria	Kidney Vetch
Arenaria serpyllifolia subsp. serpyllifolia	Thyme-leaved Sandwort
Armeria maritima subsp. maritima	Thrift
Arrhenatherum elatius var. bulbosum	False Oat-Grass
Asparagus officinalis subsp. prostratus	Wild Asparagus
Bellis perennis	Daisy
Beta vulgaris subsp. maritima	Sea Beet
Blackstonia perfoliata	Yellow-wort
Bromus hordeaceus	Soft-brome
Carex arenaria	Sand Sedge
Carlina vulgaris	Carline Thistle
Catapodium marinum	Sea Fern-grass
Centaurium erythraea	Common Centaury
Cerastium diffusum	Sea Mouse-ear
Cirsium arvense	Creeping Thistle
Cirsium vulgare	Spear Thistle
Cochlearia danica	Danish Scurvygrass

Convolvulus arvensis	Field Bindweed
Crataegus monogyna	Hawthorn
Crithmum maritimum	Rock Samphire
Dactylis glomerata	Cock's-foot
Daucus carota subsp. carota	Wild Carrot
Elytrigia juncea	Sand Couch
Erodium cicutarium	Common Stork's-bill
Erophila verna sens. lat.	Common Whitlowgrass
Eryngium maritimum	Sea-holly
Euonymus europaeus	Spindle
Euphorbia paralias	Sea Spurge
Euphorbia portlandica	Portland Spurge
Euphrasia officinalis agg.	Eyebright
Euphrasia tetraquetra	
Festuca rubra agg.	Red Fescue
Galium verum	Lady's Bedstraw
Glechoma hederacea	Ground-ivy
Helictotrichon pubescens	Downy Oat-grass
Heracleum sphondylium	Hogweed
Holcus lanatus	Yorkshire-fog
Honckenya peploides	Sea Sandwort
Hyacinthoides non-scripta	Bluebell
Hypochaeris radicata	Cat's-ear
Lathyrus pratensis	Meadow Vetchling
Leontodon hispidus	Rough Hawkbit
Leontodon saxatilis	Lesser Hawkbit
Ligustrum vulgare	Wild Privet
Linum catharticum	Fairy Flax
Lolium perenne	Perennial Rye-grass
Lotus corniculatus	Common Bird's-foot-trefoil
Luzula campestris	Field Wood-rush
Ononis repens	Common Restharrow
Phleum arenarium	Sand Cat's-tail
Pilosella officinarum	Mouse-ear-hawkweed
Plantago coronopus	Buck's-horn Plantain
Plantago lanceolata	Ribwort Plantain
Plantago major subsp. major	Greater Plantain
Poa pratensis	Smooth Meadow-grass
Poa trivialis	Rough Meadow-grass
Polygala vulgaris	Common Milkwort
Pteridium aquilinum	Bracken
Ranunculus acris	Meadow Buttercup
Ranunculus bulbosus	Bulbous Buttercup
Raphanus raphanistrum subsp. maritimus	Sea Radish
Rosa pimpinellifolia	Burnet Rose
Rubia peregrina	Wild Madder
Rubus caesius	Dewberry
Rubus fruticosus agg.	Bramble
Rumex acetosa subsp. acetosa	Common Sorrel
Sagina maritima	Sea Pearlwort

Sambucus nigra	Elder
Sedum acre	Biting Stonecrop
Senecio jacobaea	Common Ragwort
Senecio jacobaea var. flosculosus	
Solanum dulcamara	Bittersweet
Sonchus arvensis	Perennial Sow-thistle
Sonchus oleraceus	Smooth Sow-thistle
Stellaria holostea	Greater Stitchwort
Succisa pratensis	Devil's-bit Scabious
Taraxacum agg.	Dandelion
Thymus polytrichus	Wild Thyme
Trifolium dubium	Lesser Trefoil
Trifolium pratense	Red Clover
Trifolium repens	White Clover
Tripleurospermum maritimum	Sea Mayweed
Veronica arvensis	Wall Speedwell
Veronica chamaedrys	Germander Speedwell
Vicia sativa subsp. nigra	Narrow-leaved Vetch
Viola canina subsp. canina	Heath Dog-violet
Viola riviniana	Common Dog-violet
Viola tricolor subsp. curtisii	

SITE SYNOPSIS

SITE NAME : TRAMORE DUNES AND BACKSTRAND

SITE CODE : 000671

This composite coastal site lies at the head of Tramore Bay, east of Tramore, County Waterford. The Tramore dunes (Burrow) are the result of a classic inshore process - the growth of a spit of shingle and sand across a shallow bay. Behind the spit lies the Back Strand which dries out at low tide and is connected to the open sea by narrows at Rinneshark. The Burrow has a narrow neck and expands eastwards. Longshore drift is from the west so any loose material accumulates at the tip, which is hooked, and on the opposing spit at Bass Point.

The dunes here are well-developed and contain several habitats listed on Annex I of the EU Habitats Directive, including the priority habitat fixed dune. There are high ridges and valleys, old stabilised surfaces and new foredunes at shore level. Consequently all the major vegetation types are found from the strand flora, through mobile embryonic and marram dunes to stable fixed dunes, with saltmarsh on the northern fringe and slacks at Bass Point.

The flora of the fixed dunes is not as species-rich as at other systems, due mainly to the absence of grazing. This has led to the development of a tall, rank dune grassland and in places the development of dune scrub. Nevertheless, most of the characteristic dune species of the south-east are found, including Marram (*Ammophila arenaria)*, which is dominant over much of the system, Wild Thyme (*Thymus praecox),* Common Bird's-foot-trefoil (*Lotus corniculatus*), Lady's Bedstraw *(Galium verum),* Rest Harrow *(Ononis repens),* Fairy Flax *(Linum catharticum)* and Red Fescue *(Festuca rubra).* The moss *Tortula ruraliformis,* which is characteristic of fixed dune areas, is common in the dune turf. In some areas there is a shrubby community, with Wild Privet (*Ligustrum vulgare)* and Dewberry *(Rubus caesius*) being dominant. Bee Orchid (*Ophrys apifera*)*,* a Red Data Book species, has been recorded recently from the fixed dune grassland, while there are isolated patches of Wild Asparagus (*Asparagus officinalis* ssp. *prostratus),* a species protected under the Flora (Protection) Order 1999.

Salt marsh, another habitat on Annex I of the EU Habitats Directive, is well developed and fairly extensive in the sheltered inner part of the site. It is the lagoon type of salt marsh, which is the rarest type in Ireland. The communities found are characteristic of both Atlantic and Mediterranean salt marshes. The main species include Thrift (*Armeria maritima),* Common Saltmarsh-grass *(Puccinellia maritima),* Sea Lavender *(Limonium humile),* Sea Plantain *(Plantago maritima),* Sea Aster *(Aster trifolium),* Sea Puslane *(Halimione portulacoides*) and Sea Rush (*Juncus maritimus).* The scarce Hard-grass (*Parapholis strigosa*) occurs and a feature of this salt marsh is the presence of Golden Samphire (*Inula crithmoides)*, a species rarely found on salt marshes in Ireland. Glasswort (*Salicornia* spp.) and other annuals such as Sea Blite (*Suaeda maritima*) occur in channels and pans and also onto the mudflats. Cord-grass (*Spartina anglica*) is frequent on parts of the salt marshes and on the mudflats.

The intertidal mud flats and sand flats are another important habitat listed on Annex I of the EU Habitats Directive. The macrofauna is well developed, with Lugworm (A*renicola marina),* Furrow Shell (*Scrobicularia plana*), Ragworm *(Hediste diversicolor)* and Cockle *(Cerastoderma edule)* being common, and with large patches of Mussel (*Mytilus edulis)* and Periwinkles (*Littorina littorea)* also present. A feature of this habitat is the presence of Eelgrass (*Zostera noltii* and *Z. angustifolia*).

Several rare plants have been recorded from Tramore. It is the only site in the country where the Red Data Book plant Sea Knotgrass (*Polygonum maritimum*) has grown,

though it is sporadic in appearance. Other Red Data Book species which have been reported include Lesser Centaury (*Centaurium pulchellum*) and Cottonweed (*Otanthus maritimus*), both of which are listed on the Flora (Protection) Order, 1999, Sharp-leaved Fluellen (*Kickxia elatine*), Sea-kale (*Crambe maritima*) and Spring Vetch (*Vicia lathyroides*).

The Back Strand is a area of great importance for waterfowl on the south coast and is a designated SPA. The following figures are the average counts obtained during three seasons between 1994/95 and 1996/97. Brent Geese (482) occur in numbers which are of international significance. Six further species occur in nationally important numbers: Golden Plover (3,100), Grey Plover (261), Dunlin (1,970), Sanderling (53), Black-tailed Godwit (271) and Bar-tailed Godwit (405). Both Golden Plover and Bartailed Godwit are listed on Annex I of the EU Birds Directive.

The main threat to the stability of the dune habitats is from recreational pressures, with heavy usage of the site due to its proximity to Tramore. Already some large blow-outs and areas of bare sand are present. Driftline and shingle vegetation is also under pressure from heavy usage of the beach area. The intertidal and saltmarsh habitats are not under significant threat though possible seepage from the landfill site is a potential threat.

Tramore is of major ecological importance for the range of good quality coastal habitats which occur, including fixed dunes, which are listed as a priority habitat on Annex I of the European Habitats Directive. The site has a remarkably rich flora, featuring a number of rare and protected species, and the intertidal area is important for wintering waterfowl.

SITE SYNOPSIS

SITE NAME : TRAMORE BACK STRAND SPA

SITE CODE : 004027

This site lies a little east of Tramore town in County Waterford. It comprises a medium sized estuary sheltered from the open sea by a long, shingle spit, with high dunes. The area of the SPA, known as the Back Strand, empties almost completely at low tide. It is connected to the outer bay and sea by narrows at Rinneshark.

The intertidal mud flats and sand flats are an important habitat and are listed on Annex I of the E.U. Habitats Directive. The macrofauna is well developed, with Lugworm (*Arenicola marina*), Furrow Shell (*Scrobicularia plana*), Ragworm (*Hediste diversicolor*) and Common Cockle (*Cerastoderma edule*) being common, and with large patches of Common Mussel (*Mytilus edulis*) and Edible Periwinkles (*Littorina littoralis*) also present. A feature of this habitat is the presence of Eelgrass (*Zostera noltii* and *Z. angustifolia*), an important food item for herbivorous wildfowl.

Salt marsh, another habitat on Annex I of the E.U. Habitats Directive, is well developed and fairly extensive in the sheltered inner part of the site. It is the lagoon type of salt marsh, the rarest type in Ireland. The communities found are characteristic of both Atlantic and Mediterranean salt marshes. The main species include Thrift (*Armeria maritima*), Common Saltmarsh-grass (*Puccinellia maritima*), Lax-flowered Sea-lavender (*Limonium humile*), Sea Plantain (*Plantago maritima*), Sea Aster (*Aster tripolium*), Sea-purslane (*Halimione portulacoides*) and Sea Rush (*Juncus maritimus*). The scarce Hard-grass (*Parapholis strigosa*) occurs and a feature of this salt marsh is the presence of Golden-samphire (*Inula crithmoides*), a species rarely found on salt marshes in Ireland. Glasswort (*Salicornia* spp.) and other annuals such as Annual Sea Blite (*Suaeda maritima*) occur in channels and pans and also on the mudflats. Common Cord-grass (*Spartina anglica*) is frequent on parts of the salt marshes and on the mudflats.

The Back Strand is an important site for wintering waterfowl, providing both feeding and roosting areas. Counts are available for the 1970s and 1980s and for the 5 winters 1995/96 to 1999/00 (figures given are average peaks for the 90s). Of particular importance is that the site supports an Internationally Important population of Brent Geese (393). A further seven species occur in Nationally Important numbers: Golden Plover (2,924), Grey Plover (299), Lapwing (3,308), Dunlin (1,723), Sanderling (46), Black-tailed Godwit (289) and Bar-tailed Godwit (367). A range of other species also occur in significant numbers, including Wigeon (77), Teal (135), Red-breasted Merganser (18), Oystercatcher (347), Ringed Plover (55), Knot (75), Snipe (83), Curlew (620), Redshank (223), Greenshank (12) and Turnstone (24). In recent times Little Egret has become a regular visitor, with an average peak of six for the period. The regular occurrence of Little Egret, Golden Plover and Bar-tailed Godwit is of particular note as these are listed on Annex I of the E.U. Birds Directive.

A potential threat to the intertidal habitat is seepage of leachate from a landfill site adjacent to the estuary.

Tramore Back Strand SPA is of high ornithological importance for wintering waterfowl, with one species having a population of International Importance and a further seven species having populations of National Importance. In addition, three of the species are listed on Annex I of the E.U. Birds Directive i.e. Golden Plover, Bar-tailed Godwit and Little Egret.

Tramore Back Strand

Species	1% National	1% International	2005/06	2006/07	2007/08	2008/09	2010/11	Mean 2006/07 - 2010/11	Peak 2006/07 - 2010/11
Mute Swan	110		20	22	37	25	51	34	51
Light-bellied Brent Goose		260	883	713	911	850	814	822	911
Shelduck	150	3,000	46	51	52	70	40	53	70
Wigeon	820	15,000	108	46	39	77	249	103	249
Gadwall	20	600				2	62	16	62
Teal	450	5,000	30	20	23	40	67	38	67
Mallard	360	20,000	102	94	157	115	209	144	209
Shoveler	25	400					5	1	5
Tufted Duck	370	12,000					5	1	5
Long-tailed Duck	20	20,000			1	3	2	2	3
Red-breasted Merganser	35	1,700	12	6	10	14	7	9	14
Great Northern Diver		50				1		0	1
Little Grebe	25	4,000	2		22	2	5	7	22
Great Crested Grebe	55	3,600	2	2				1	2
Cormorant	140	1,200	7	26	15	15	35	23	35
Shag		2,000	12	8		5	13	7	13
Little Egret		1,500	28	17	11	12	2	11	17
Grey Heron	30	2,700	5	1	4	1		2	4
Moorhen	20	20,000					5	1	5
Coot	330	17,500					1	0	1
Oystercatcher	680	10,200	520	348	408	396	398	387	408
Ringed Plover	150	730	51	71		37	27	34	71
Golden Plover	1,700	9,300	4,000	2,900		1,750	350	1,250	2,900
Grey Plover	65	2,500	245	140	122	233	130	156	233
Lapwing	2,100	20,000	1,680	834	1,628	1,760	715	1,259	1,760
Knot	190	4,500	210	26	346	184	95	163	346
Sanderling	85	1,200	48	56	25	10	25	29	56
Dunlin	660	13,500	697	668	150	1,000	600	610	1,000
Jack Snipe			1				1	0	1
Snipe		20,000	105	8	9	8	1	7	9
Black-tailed Godwit	140	470	349	238	355	176	322	273	355
Bar-tailed Godwit	160	1,200	247	210	106	206	195	179	210
Curlew	550	8,500	443	677	396	397	477	487	677
Greenshank	20	2,500	13	11	13	16	1	10	16
Redshank	310	3,900	411	165	173	165	99	151	173
Turnstone	120	1,500	49	35	41	30	17	31	41
Mediterranean Gull		6,600		1	1			1	1
Black-headed Gull		20,000			175			44	175
Ring-billed Gull		20,000	1	1	1			1	1
Common Gull		16,000			27			7	27
Lesser Black-backed Gull		4,500			1			0	1
Herring Gull		13,000			40			10	40
Great Black-backed Gull		4,600			8			2	8

Appendix H

Management Structure

Management Structure of Waterford County Council

County Manager Mr Denis McCarthy

Director of Services

Environment & Planning Mr. Brian White

Senior Engineer Mr. Gabriel Hynes

Senior Executive Engineer **(Former SEE not replaced)**

Executive Scientific Officer	**Executive Engineer** (Deputy Manager)	**Environmental Consultants**
Mr. Paul Carroll	Ms. Aoife O Flaherty	MCOS

Landfill Manager

Mr. David Regan

Appendix I

Leachate Removal Records and Leachate Analysis

Leachate Removal Record - Tramore Landfill

Compliance with Conditions 8.2, 11.9 and 11.10 of Licence W0075-02

Date of Removal	Time of Removal	Amount Removed			Name and Address of Approved Carrier	Carrier Permit Number	Vehicle Reg	Final Destination of Leachate	Spillages during Removal/ Transportation
		Tonnes	Cubic Meters	Gallons					
16/07/2012	11:00:00	37.75	35.649	7922	Power Waste Disposal, Curraghduff, Carrick on Suir, Co. Waterford	WCP-KK-10-127-02	N/A	Tramore Waste Water Treatment Plant, Crobally Upper, Tramore, Co. Waterford	No
17/09/2012	14:00:00	36.25	34.223625	7605.25	Power Waste Disposal, Curraghduff, Carrick on Suir, Co. Waterford	WCP-KK-10-127-02	N/A	Tramore Waste Water Treatment Plant, Crobally Upper, Tramore, Co. Waterford	No
08/11/2012	11:00:00	36.15	34.48	7585	Power Waste Disposal, Curraghduff, Carrick on Suir, Co. Waterford	WCP-KK-10-127-02	N/A	Tramore Waste Water Treatment Plant, Crobally Upper, Tramore, Co. Waterford	No
24/12/2012	11:00:00	37	34.9317	7762.6	Power Waste Disposal, Curraghduff, Carrick on Suir, Co. Waterford	WCP-KK-10-127-02	N/A	Tramore Waste Water Treatment Plant, Crobally Upper, Tramore, Co. Waterford	No

Laboratory Reference	20120668
Date Of Sampling	28/06/2012
Sampled By	DR
Sample Description	Grab sample from leachate collection tank, Tramore Landfilll.
COD mg/L	58
BOD mg/L	7.8
Total Suspended Solids	81
Ammonia Nitrogen mg/L	6.26
Nitrite Nitrogen mg/L	1.61
Nitrate Nitrogen mg/L	<0.2
MRP mg/L	0.04
Chlorides	196.9
Iron mg/L	0.98
Manganese mg/L	2.38
Susan Cook	
Environmental Technician.	
09/07/2012	

Laboratory Reference	20120849
Date Of Sampling	10/09/2012
Sampled By	DR
Sample Description	Grab sample from leachate collection tank, Tramore Landfilll.
COD mg/L	54
Conductivity µS/cm	2220
Turbidity N.T.U.	25.1
Ammonia Nitrogen mg/L	52.4
Nitrite Nitrogen mg/L	0.17
Nitrate Nitrogen mg/L	3.9
MRP mg/L	0.014
Chlorides	200
Sulphate mg/L SO_4	73
Iron mg/L	2.85
Manganese mg/L	1.26
Susan Cook	
Environmental Technician.	
11/09/2012	

Laboratory Reference	20121063
Date Of Sampling	06/11/2012
Sampled By	DR
Sample Description	Grab sample from leachate collection tank, Tramore Landfilll.
COD mg/L	93
Total Suspended Solids	NT
Ammonia Nitrogen mg/L	98.15
Nitrite Nitrogen mg/L	0.09
Nitrate Nitrogen mg/L	0.681
MRP mg/L	0.055
Chlorides	215.3
Susan Cook	
Environmental Technician.	
14/11/2012	

Laboratory Reference	20121207
Date Of Sampling	10/12/2012
Sampled By	DR
Sample Description	Grab sample from leachate collection tank, Tramore Landfilll.
COD mg/L	79
Total Suspended Solids	NT
Ammonia Nitrogen mg/L	68.015
Nitrite Nitrogen mg/L	0.046
Nitrate Nitrogen mg/L	<0.2
MRP mg/L	0.043
Chlorides	189.7
Susan Cook	
Environmental Technician.	
13/12/2012	

Appendix J

Pollutant Release Transfer Register

Environmental Protection Agency

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.16

REFERENCE YEAR	2012

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

N	class_name
4.2	Recycling or reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes).
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.
4.10	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.
4.13	Storage of waste intended for submission to any activity referred to in a preceding paragraph of this Schedule, other than temporary storage, pending collection, on the premises where such waste is produced.
4.3	Recycling or reclamation of metals and metal compounds.
4.4	Recycling or reclamation of other inorganic materials.
Address 1	Tramore Intake & Tramore Burrows
Address 2	Tramore
Address 3	Co. Waterford
Address 4	
	Waterford
Country	Ireland
Coordinates of Location	-7.13286 52.1616
River Basin District	IESE
NACE Code	3821
Main Economic Activity	Treatment and disposal of non-hazardous waste
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 21112
AER Returns Contact Mobile Phone Number	086 8307065
AER Returns Contact Fax Number	058 45606
Production Volume	0.0
Production Volume Units	
Number of Installations	1
Number of Operating Hours in Year	2145
Number of Employees	1
User Feedback/Comments	
Web Address	www.waterfordcoco.ie

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
50.1	General
50.1	General

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

Is it applicable?	No
Have you been granted an exemption ?	Yes
If applicable which activity class applies (as per Schedule 2 of the regulations) ?	
Is the reduction scheme compliance route being used ?	

4. WASTE IMPORTED/ACCEPTED ONTO SITE

Guidance on waste imported/accepted onto site

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

This question is only applicable if you are an IPPC or Quarry site

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

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

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

SECTION B : REMAINING PRTR POLLUTANTS

RELEASES TO AIR					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			ADD EMISSION POINT	QUANTITY		
			Method Used					
No. Annex II	Name	M/C/E	Method Code	Designation or Description	Emission Point 1	T (Total) KG/Year	A (Accidental) KG/Year	F (Fugitive) KG/Year
01	Methane (CH4)	E	ESTIMATE	Estimated from Landgem model and flare data	585493.0	585493.0	0.0	0.0
03	Carbon dioxide (CO2)	E	ESTIMATE	Estimated from landgem model	2200000.0	2200000.0	0.0	0.0
07	**Non-methane volatile organic compounds (NMVOC)**	E	ESTIMATE	USA Landgem model	34500.0	34500.0	0.0	0.0

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

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

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

ADD NEW ROW | DELETE ROW * * 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	**T (Total) kg/Year**	**M/C/E**	**Method Used: Method Code**	**Method Used: Designation or Description**	**Facility Total Capacity m3 per hour**	
Total estimated methane generation (as per site model)	800000.0	E	ESTIMATE	Estimated from flare data	N/A	
Methane flared	214507.0	E	ESTIMATE	Estimated from flare data	250.0	(Total Flaring Capacity)
Methane utilised in engine/s	0.0				0.0	(Total Utilising Capacity)
Net methane emission (as reported in Section A above)	585493.0	E	ESTIMATE	Estimated from flare data	N/A	

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

Data on ambient monitoring of storm/surface water or groundwater, conducted as part of your licence requirements, should NOT be submitted under AER / PRTR

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

ADD NEW ROW | DELETE ROW *

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

SECTION B : REMAINING PRTR POLLUTANTS

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

ADD NEW ROW | DELETE ROW *

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

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

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

SECTION A : PRTR POLLUTANTS

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

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

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

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

SECTION A : PRTR POLLUTANTS

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

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

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

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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

Please enter all quantities on this sheet in Tonnes 0

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Method Used		Location of Treatment	Haz Waste : Name and Licence/Permit No of Next Destination Facility Non Haz Waste: Name and Licence/Permit No of Recover/Disposer	Haz Waste : Address of Next Destination Facility Non Haz Waste: Address of Recover/Disposer	Name and License / Permit No. and Address of Final Recoverer / Disposer (HAZARDOUS WASTE ONLY)	Actual Address of Final Destination i.e. Final Recovery / Disposal Site (HAZARDOUS WASTE ONLY)
						M/C/E	Method Used					
Within the Country	19 07 03	No	147.15	landfill leachate other than those mentioned in 19 07 02	D15	M	Volume Calculation	Offsite in Ireland	Sean Power,WCP-KK-10-127-02	Curraghduff,.,Carrick on Suir,Co. Waterford,Ireland		

Appendix L

Environmental Liability Risk Assessment

RPS

Waterford County Council
Comhairle Chontae Phortlairge

Environmental Liabilities Risk Assessment Report

Draft

January 2010

Tramore Landfill W0075-02

Environmental Liabilities Risk Assessment Report

DOCUMENT CONTROL SHEET

Client	Waterford County Council					
Project Title	Tramore Landfill					
Document Title	Environmental Liability Risk Assessment (ELRA)					
Document No.	MDR0349Rp0013					
This Document Comprises	DCS	TOC	Text	List of Tables	List of Figures	No. of Appendices
	1	2	24	1	-	3

Rev.	Status	Author(s)	Reviewed By	Approved By	Office of Origin	Issue Date
F01	Final Issue	J.Bennett	E.Boland	L.O'Toole	West Pier	Jan 2010

TABLE OF CONTENTS

LIST OF TABLES

1 INTRODUCTION

This report provides the results of a risk assessment and identification of environmental liabilities at Tramore Landfill, Co. Waterford. The study was undertaken in compliance with Condition 12.2.2 of the landfill's Waste Licence (W0075-02). Condition 12.2.2 is a sub-condition of Condition 12.2, which is entitled '*Environmental Liabilities*. Condition 12.2.2 is quoted below:

> '*The licensee shall arrange for the completion, by an independent and appropriately qualified consultant, of a comprehensive and fully costed Environmental Liabilities Risk Assessment (ELRA), which addresses the liabilities from past and present activities. The assessment shall include those liabilities and costs identified in Condition 10 for execution of the CRAMP. A report on this assessment shall be submitted to the Agency for agreement within twelve months of date of grant of this licence. The ELRA shall be reviewed as necessary to reflect any significant change on site, and in any case every three years following initial agreement: review results are to be notified as part of the AER*'

RPS Consulting Engineers have completed this study for Waterford County Council (WCC).

2 STUDY METHODOLOGY

The methodology adopted for this initial risk assessment was designed to allow the identification of the major risks in the closure, remediation and aftercare of the landfill. A risk has been defined as a measure of the likelihood and severity of an occurrence that is in some way harmful to a receptor.

Each risk was assessed in terms of its current controls and the availability of additional risk controls to reduce the level of risk. Risk management measures were allocated to each risk using the following approaches: risk acceptance, risk prevention / avoidance, risk reduction, risk transfer, or risk sharing.

The cost of the potential environmental liabilities was estimated based on the environmental liabilities identified during the risk assessment, plus the "known" liabilities at the site.

The following major tasks were undertaken during the study:

Task 1: Risk Management Workshop – Risk Data Collection:

A Risk Management Workshop was held by the project team to identify and quantify the risks inherent in the operation, closure, restoration and aftercare of the landfill facility, and to identify potential risk mitigation measures. The workshop was held in Dungarvan on the 12th December 2007 and was facilitated by Ms. Eleanor Boland of RPS. The workshop was also attended by the following persons:

- Mr. James Mansfield Waterford County Council Senior Executive Engineer
- Mr. Tom Longan Waterford County Council Facility Manager
- Mr. Micheál Spillane RPS Design Engineer

The following tasks were undertaken during the workshop:

- Identification of environmental receptors;
- Identification of processes carried out on site now and in the future;
- Identification of the environmental hazards that may arise as a direct result of the processes carried out on site using Failure Mode Effect Analysis (FMEA) forms;
- Assessment of the level of risk posed by each hazard based on it's potential severity and likelihood of occurrence, and the allocation of a Risk Score;
- Identification of risk mitigation measures;
- Identification of responsibilities for the management of each risk; and
- Re-evaluation of the level of risk following the implementation of mitigation measures.

Task 2: Interpretation and Analysis of Risk Data:

The risk data collected from the Risk Management Workshop in FMEA forms was interpreted and analysed through the following tasks:

- Completion of Failure Mode Effect Analysis forms;
- Creation of Risk Register and Risk Classification Table;
- Ranking of Current Risks;
- Identification of mitigation measure(s); and
- Ranking of risks following the implementation of mitigation measure(s)

Task 3: Assessment of Environmental Liabilities:

The environmental liabilities were identified and quantified through the following tasks:

- Identification and quantification of known environmental liabilities;
- Identification of potential liabilities associated with the environmental risks;
- Quantification of potential liabilities associated with the environmental risks; and
- Determination of the total environmental liabilities for the site.

3 SYSTEM DEFINITION AND OBJECTIVES

The Objectives and System Definition was agreed at the commencement of the study to define the limits of the risk assessment.

The Risk Assessment is being undertaken in accordance with the EPA's requirements as stated in Waste Licence W0075-02. The objectives of the study are to:

- Identify post closure risks at the landfill and risk mitigation measures where risk levels are unacceptable.

- Identify environmental liabilities at the site to allow for the making of a financial provision in accordance with the Waste Management Act 1996

The risk assessment covers current remediation works and management including the closure, restoration and aftercare phases. The risk assessment allowed for the participation of the main landfill stakeholders through the facilitated workshop during which risks were identified and quantified.

4 RISK IDENTIFICATION

4.1 METHODOLOGY

Risk identification was initially undertaken during the Risk Management Workshop with the main landfill stakeholders. The risk identification process involved:

- The identification of potential environmental receptors at the site.
- The identification of landfill processes that posed potential hazards to the environmental receptors.
- The identification and quantification of the risks using Failure Mode Effect Analysis (FMEA) forms.

4.2 IDENTIFICATION OF ENVIRONMENTAL RECEPTORS

The term 'environmental receptors' describes those parts of the surroundings likely to be affected by the processes that are ongoing at Tramore Landfill. The significant environmental receptors identified at the workshop are listed below. These receptors are used as a starting point to ensure that all significant risks are identified and all major aspects of the environment are taken into account.

Environmental Receptors:

- Groundwater
- Surface water
- Adjacent Special Area of Conservation (SAC)
- Human Beings
- Air Quality

4.3 IDENTIFICATION OF PROCESSES

A number of processes associated with the operation of a public civic amenity facility, and other processes associated with the restoration and aftercare period of the Landfill site were identified during the course of the workshop and afterwards and are listed below:

Processes:

- General Facility Operations – including nuisance control, traffic management, routine maintenance, monitoring and other site operations.
- Civic Amenity Facility Operations – including the temporary storage and transfer of waste.
- Landfill Gas – including landfill gas generation, migration, and control.
- Leachate – including leachate generation, collection, storage and transfer off site.

These current processes have been identified to cover all activities on site that may result in a risk to the environmental receptors. Each environmental receptor was assessed against the list of processes in order to identify potential hazards. The potential hazards identified were entered onto the FMEA forms.

4.4 IDENTIFICATION OF RISKS USING FAILURE MODE EFFECT ANALYSIS FORMS

Failure Mode Effect Analysis (FMEA) forms were used during the workshop to facilitate risk identification and quantification. The purpose of these forms is to assist in the identification and quantification the risks posed to the environmental receptors by the processes carried out at the landfill. The final FMEA form for the project is provided in **Appendix A** and a description of each aspect of the form is also provided there.

A brainstorming activity was undertaken during the Risk Management Workshop to identify the major risks at the site. The process aimed to identify the major risks through linking the processes and their potential hazards to each of the environmental receptors.

The major risks identified were transferred to the FMEA (refer **Appendix A**). A total of 24 major risks were identified in the FMEA and these risks are listed in the Project Risk Register provided in Table 4.1.

Table 4.1 – Project Risk Register

Risk	Potential Failure Mode / Risk
1	Improper handling of waste by staff and members of the public
2	Vehicles and/or person accidents in the Civic amenity area
3	Overfilling of storage containers in the Civic Amenity area
4	Risk of hazardous material passing inspection and being accepted at Civic Amenity
5	Member of public slipping/tripping in civic amenity area
6	Improper storage of permitted household hazardous waste
7	Escape of contaminated liquid from the Civic Amenity containment system
8	Off site migration of litter causing nuisance
9	Vermin carrying disease out of the landfill
10	Odours causing a nuisance
11	H&S Accident during environmental monitoring
12	Drowning in tidal estuarine area of staff or unauthorised member of public
13	Human exposure to leachate and /or landfill gas during general maintenance operations
14	Fire in the CA or landfill
15	Landfill gas migration off site and accumulation in structures.
16	Escape of gas to the atmosphere
17	Degradation of capping
18	Traffic accidents during off site disposal of leachate.
19	Leachate break out due to breach in liner
20	Failure of leachate collection infrastructure leading to groundwater contamination
21	Leachate being unsuitable for treatment at local WWTP
22	Escape of leachate from leachate storage tank to ground
23	Intrusion / Vandalism at flare compound
24	Dust causing a nuisance, blown off site.

5 ASSESSMENT OF RISKS

5.1 METHODOLOGY

A significant number of risks were identified during the workshop. These risks were assessed against the risk classification table (RCT) as provided in **Table 5.1**. The risk classification table was designed to reflect the critical levels of risk appropriate to the landfill.

Risk ratings were applied to each risk in the FMEA table for severity and occurrence as taken from the RCT. The severity rating adopted for each risk reflected the highest severity rating of the severity parameters (cost, safety, environment). This was generally found to be the rating for the financial cost, since the financial cost severity was deemed to include the costs associated with any corresponding environmental or safety impact. Where a parameter other than cost was the dominant severity parameter, this was noted on the FMEA.

A risk score was calculated for each risk using the selected severity and occurrence ratings. The risks were then ranked and compared based on the risk scores. The risks were placed in a risk matrix to illustrate the ranking and level of each risk, and allow the risks to be visually prioritised. The risk matrix is a particularly useful tool for tracking changes in risk levels over time. The level of management required for each risk is identified from the risk matrix.

Risk management measures were identified for each risk during the workshop and included in the FMEA. These measures are presented in Section 6.0.

5.2 RISK CLASSIFICATION TABLE

The Risk Classification Table (RCT) has been designed to reflect the critical levels of risk appropriate to the landfill. The table is provided in **Table 4.1** below.

Table 5.1 – Risk Classification Table

Rating	Description	Likelihood of Occurrence (%)	Severity		
			Financial Cost (€'000's)	Safety	Environment
1	**Nil**	0	0	No injury	No effect
2	**Very Low**	0 – 5	0 – 1	First aid injury	Slight effect, temporary
3	**Low**	5 - 10	1 – 10	Medically treated injury	Minor impact, temporary
4	**Medium**	10 - 20	10 – 50	Lost time injury to 1 week	Local impact, recoverable losses
5	**High**	20 - 50	50 – 100	Lost time injury > 1 week	Major impact, severe damage
6	**Very High**	> 50	>100	Permanent disability / fatality	Massive impact, severe long-term damage

The RCT provides appropriate levels of probability and severity for the ranking of risks. The levels for each parameter reflect suitable levels for assessing and ranking the risks identified at the landfill, and allocating appropriate management measures. The RCT was agreed with the main landfill stakeholders at the Risk Management Workshop.

5.3 RISK RANKING

Risk ratings were applied to each risk in the FMEA table for severity and occurrence as taken from the RCT. A risk score was then calculated for each risk using the ratings. The risk score is based on the product of the severity rating and the occurrence rating. This system allowed the risks to be ranked and compared.

The project risk register listing all the major risks identified at the landfill was provided in **Table 3.1**. This register has been expanded and rearranged in **Table 5.2** to include the risk scores and rank the risks in order of risk score.

Table 5.2 Project Risk Register – Ranked by Risk Score

Risk	Potential Failure Mode	Risk Score
2	Vehicles and/or person accidents in the Civic amenity area	20
12	Drowning in tidal estuarine area of staff or unauthorised member of public	18
21	Leachate being unsuitable for treatment at local WWTP	18
23	Intrusion / Vandalism at flare compound	18
19	Leachate break out due to breach in capping	16
18	Traffic accidents during off site disposal of leachate.	15
8	Off site migration of litter causing nuisance	15
3	Overfilling of storage containers in the Civic Amenity area	12
5	Member of public slipping/tripping in civic amenity area	12
11	H&S Accident during environmental monitoring	12
13	Human exposure to leachate and /or landfill gas during general maintenance operations	12
14	Fire in the CA or landfill	12
15	Landfill gas migration off site and accumulation in structures.	12
17	Degradation of capping	12
22	Escape of leachate from leachate storage tank to ground	12
4	Risk of hazardous material passing inspection and being accepted at Civic Amenity	9
6	Improper storage of permitted household hazardous waste	9
7	Escape of contaminated liquid from the Civic Amenity containment system	9
10	Odours causing a nuisance	9
1	Improper handling of waste by staff and members of the public	8
9	Vermin carrying disease out of the landfill	6
16	Escape of gas to the atmosphere	6
20	Failure of leachate collection infrastructure leading to groundwater contamination	6
24	Dust causing a nuisance, blown off site.	6

5.4 RISK MATRIX

The Risk Matrix has been developed to allow the risks to be easily displayed and prioritised. The severity and occurrence ratings are used in the matrix; with the level of severity forming the x-axis and the likelihood of occurrence forming the y-axis. This matrix will provide a visual tool for regular risk reviews since the success of mitigation can be easily identified. The risk matrix is displayed here in **Table 5.3**. The risks have been colour coded in the matrix to provide a broad indication of the critical nature of each risk. The colour code is as follows:

- Red (deep red and light red) – These are considered to be high-level risks requiring priority attention. These risks have the potential to be catastrophic and as such should be addressed quickly.
- Amber / Yellow – These are medium-level risks requiring action, but are not as critical as a red coded risk.
- Green (light and dark green) – These are lowest-level risks and indicate a need for continuing awareness and monitoring on a regular basis. Whilst they are currently low or minor risks, some have the potential to increase to medium or even high-level risks and must therefore be regularly monitored and if cost effective mitigation can be carried out to reduce the risk even further this should be pursued.

Table 4.3 – Risk Matrix – Current Risk Status

Occurrence								
	V. High	6						
	High	5			8	2		
	Medium	4				19		
	Low	3					18	12,21,23
	V. Low	2			9,16,20,24			
	Nil	1						
			1	2	3	4	5	6
			NIL	V. Low	Low	Medium	High	V. High

Severity

The risk matrix indicates that there are four risks in the red zone that requires priority attention. Two risks are in the yellow/amber zone indicating that these risks require action as soon as possible. All remaining risks are located in the green zone indicating a need for continuing awareness and monitoring on a regular basis. However, assessment of the green zone risks during the preparation of the FMEA's has indicated that some of these risks can be reduced through the implementation of mitigation measures. These measures should be adopted where considered cost-effective to further reduce the risks.

5.5 DISCUSSION OF RISK LEVELS

The following risk lies in the red zone and require priority attention:

- *Risk 2 - Vehicles and/or person accidents in the Civic amenity area*
- *Risk 12 - Drowning in tidal estuarine area of staff or unauthorised member of public*
- *Risk 21 - Leachate being unsuitable for treatment at local WWTP*
- *Risk 23 - Intrusion / Vandalism at flare compound*

The following risks lie in the amber / yellow zone and require attention as soon as possible:

- *Risk 8 – Off site migration of litter causing nuisance*
- *Risk 18 – Traffic accidents during off site disposal of leachate*
- *Risk 19 – Leachate break out due to breach in capping*

All remaining risks lie in the green zone. These risks require continuing awareness and monitoring on a regular basis. As these risks may have the potential to increase to yellow or red zone risks, additional risk management measures should be put in place to manage them at their current levels, or preferably to reduce them further, if required.

6 IDENTIFICATION AND ASSESSMENT OF MITIGATION ACTIONS

6.1 IDENTIFICATION OF MITIGATION ACTIONS

Risks requiring additional mitigation actions were identified in Section 5. These are comprised of four risks located in the red zone and three risks located in the amber / yellow zone. All remaining risks were found to be in the green zone.

Additional risk mitigation measures were identified during the risk management workshop for the four risks in the red zone, reducing the risk for one to green, two to yellow, and one remains unchanged at red, but a possible future mitigation was identified for the fourth (the risk level remains unchanged until monitoring indicates the mitigation is warranted). The three risks that are still in the red zone are inherently risky, and thus procedures and monitoring is necessary on an ongoing basis. A review should be carried out regularly identifying any further opportunities to reduce these risks, and to ensure that the risk level does not increase.

Two of the three risks in the yellow zone have a certain level of risk by their nature, and the risk cannot be readily reduced as mitigation measures are already in place. These measures will reduce these risks to more acceptable levels. The third yellow zone risk was reduced to a green risk by mitigation measures. Again, a review should be carried out regularly identifying any further opportunities to reduce these risks, and to ensure that the risk level does not increase.

Additional cost-effective risk mitigation measures were also identified for 5 of the 17 green zone risks during the workshop. Since green zone risks may have the potential to increase to yellow or red zone risks, these risk mitigation measures should be implemented since they are considered cost-effective.

Additional cost-effective risk mitigation measures could not be identified for the remaining 12 of the 17 green zone risks. For these risks, the current risk management measures were considered acceptable.

The recommended risk mitigation measures identified during the workshop and included in the FMEA are provided in **Table 6.1**. This table provides the risks in descending order of risk score with the proposed mitigation measure. The current controls are also provided.

6.2 EFFECTIVENESS OF MITIGATION MEASURES IN RISK REDUCTION

The risk scores have been re-calculated on the basis that the additional mitigation measures are fully implemented. **Table 6.1** provides the revised risk scores after the implementation of the risk mitigation measures, and compares them to the current risk score. **Table 6.2** provides a revised risk matrix following the implementation of the risk mitigation measures.

Table 6.1 indicates that the risk scores for 5 of the risks are reduced by the implementation of the measures, whilst there would be no significant change to 19 of the risks. However, recommended mitigation measures have been proposed and assessed for 6 of the 19 risks which do not exhibit improved risk scores, and these measures should increase the robustness of the risk controls already in place.

In addition, the risk matrix indicates that two of red code risks have been reduced to a yellow yellow/amber code risk, and one to green. One yellow/amber code risk has been reduced to a green zone risk, and one of the green code risks have moved to the lower green zone.

The recommended mitigation measures therefore show a real reduction in risk at the landfill and since they are considered cost-effective, should be implemented. Section 7.0 provides a management plan for the implementation of the recommended mitigation measures.

Table 6.1 – Proposed Risk Mitigation Measures

Risk	Potential Failure Mode / Risk	Current Controls	Recommended Mitigation Measures	Current Risk Score	Revised Risk Score
2	Vehicles and/or person accidents in the Civic amenity area	Traffic Management Plan	Review procedures, and amend where appropriate	20	16
12	Drowning in tidal estuarine area of staff or unauthorised member of public	Partial fence, maintain fence	Vigilance to maintain fence, erect signage	18	12
23	Intrusion / Vandalism at flare compound	Caretaking, telemetry, security fence	Monitor situation - possible security camera to be considered	18	18
21	Leachate being unsuitable for treatment at local WWTP	Leachate monitoring	Monitor leachate and review if necessary to plan alternative in advance	18	15
19	Leachate break out due to breach in liner	SW / GW monitoring, visual monitoring	Current measures are considered adequate	16	16
18	Traffic accidents during off site disposal of leachate.	Only use licenced drivers, and traffic management procedures	Current measures are considered adequate	15	15
8	Off site migration of litter causing nuisance	Litter fencing and litter pickers	Review current arrangements, increased litter collection/control	15	12
14	Fire in the CA or landfill	Emergency response procedure, waste inspection procedure	Review CA procedures	12	12
13	Human exposure to leachate and /or landfill gas during general maintenance operations	Use experienced personnel, training, documented procedures, inoculations	Current measures are considered adequate	12	12
5	Member of public slipping/tripping in civic amenity area	Current C.A. procedures	Extra awareness, extra signs, information, supervision	12	12
22	Escape of leachate from leachate storage tank to ground	Groundwater monitoring, caretaking	Monitor situation - possible additional security fence to be considered	12	12
3	Overfilling of storage containers in the Civic Amenity area	Current C.A. procedures	Increased policing	12	12
11	H&S Accident during environmental monitoring	Use experienced personnel	Current measures are considered adequate	12	12
15	Landfill gas migration off site and	Gas extraction and flaring system installed	Current measures are considered adequate	12	12

Risk	Potential Failure Mode / Risk	Current Controls	Recommended Mitigation Measures	Current Risk Score	Revised Risk Score
	accumulation in structures.				
17	Degradation of capping	Monitoring	Current measures are considered adequate	12	12
6	Improper storage of permitted household hazardous waste	Current C.A. procedures	Current measures are considered adequate	9	9
4	Risk of hazardous material passing inspection and being accepted at Civic Amenity	Waste inspection procedure. Waste inspected at waste disposal area. If unsuitable, removed to waste quarantine area.	Current measures are considered adequate	9	9
10	Odours causing a nuisance	Landfill capped, gas extraction and flaring system installed	Current measures are considered adequate	9	9
7	Escape of contaminated liquid from the Civic Amenity containment system	Design of containment system	Recording of emptying of containment system	9	9
1	Improper handling of waste by staff and members of the public	Staff wear PPE, supervision of public on site	Extra awareness, extra signs, information, supervision	8	6
16	Escape of gas to the atmosphere	Gas extraction and flare system	Current measures are considered adequate	6	6
9	Vermin carrying disease out of the landfill	Nuisance control procedures	Current measures are considered adequate	6	6
24	Dust causing a nuisance, blown off site.	cap prepared for natural colonisation	Current measures are considered adequate	6	6
20	Failure of leachate collection infrastructure leading to groundwater contamination	System monitoring and a back-up system	Current measures are considered adequate	6	6

Table 6.2 – Revised Risk Matrix – Post Recommended Mitigation Measures

Occurrence								
	V. High	6						
	High	5						
	Medium	4			3,8	2,19		
	Low	3		1	4,6,7,10	5	18,21	23
	V. Low	2			9,16,20,24			11,12,13,14,15,17,22
	Nil	1						
			1	2	3	4	5	6
			NIL	V. Low	Low	Medium	High	V. High

Severity

7 RISK MANAGEMENT PROGRAM

7.1 GENERAL

Every risk requires a certain amount of management in order to reduce the risk or manage the risk at an acceptable level. Risk owners have therefore been allocated to each risk to undertake this role. For the majority of the risks identified, the management of the risk will involve the implementation of the recommended mitigation measures and the maintenance of current controls.

Where additional risk mitigation measures have not been identified, the risk owner is required to ensure that the current levels of controls are maintained and that the level of risk does not increase.

A time scale has been applied to all proposed risk mitigation measures in order to ensure that the mitigation measures are implemented in a timely fashion.

7.2 RISK MANAGEMENT PROGRAMME

The risk owner must be competent enough to understand the risk and the recommended mitigation measures, and have the authority to implement the mitigation measure. The risk owner must also be able to be held responsible for the risk. The risk owners considered suitable for the risk management programme were:

- Licencee (Waterford County Council)
- Landfill Manager

The proposed timescales for the implementation of the mitigation measures must be realistic and appropriate to the level of risk. The timescales have been prepared in consultation with the risk owners where available.

Table 7.1 allocates risk owners to each individual risk, and provides timeframes for the completion of each risk mitigation measure. However, it should be noted that ultimately the licencee is responsible for all risks, and the allocation of risk owners is undertaken to assist the Licencee manage the risks.

Table 7.1 – Proposed Risk Owners with Mitigation Measures and Timescales

Owner	Mitigation measure	Relevant Risk ID	Mitigation Measure Completion Date
Landfill Manager	Current measures are considered adequate	4,6,9,10,11,13,15, 16,18,19,20,24	-
	Extra awareness, extra signs, information, supervision	1,5	Mar-10
	Increased policing	3	Feb10
	Monitor leachate and review if necessary to plan alternative in advance	21	Jan-10
	Monitor situation - possible security camera to be considered	23	Jan-10
	Monitor situation - possible additional security fence to be considered	22	Jan-10
	Recording of emptying of containment system	7	Feb10
	Review CA procedures	14	Mar-10
	Review current arrangements, increased litter collection/control	8	Feb10
	Review procedures, and amend where appropriate	2	Mar-10
	Vigilance to maintain fence, erect signage	12	Mar-10
Licensee	Current measures are considered adequate	17	-

7.3 RISK MANAGEMENT REVIEW

Risk management at the landfill is a dynamic process. This assessment and report provides a baseline assessment of the major risks at the landfill, and provides recommendations for risk mitigation and management measures. However, landfill processes and conditions will change and this assessment should be reviewed periodically to ensure that all risks are being identified and managed.

This document should be considered to be a live document. It is recommended that the Licensee reviews the risk management at the site on a six-monthly basis and updates the risk register and risk management programme as appropriate. It is also recommended that a formal risk assessment be undertaken every three years at the landfill to assist in this process and to comply with Condition 12.2.2.

8 ASSESSMENT OF POTENTIAL ENVIRONMENTAL LIABILITIES

8.1 TYPES OF ENVIRONMENTAL LIABILITIES

The assessment of potential environmental liabilities may be broken down into two separate sections, the "known" environmental liabilities and the potential or "unknown" environmental liabilities.

The "known" environmental liabilities are understood, definable and current. These liabilities relate to costs that are currently known to be required for the protection of environmental receptors based on past and present operations at the landfill and civic amenity. These include ongoing maintenance of the capping, leachate and gas management systems and ongoing maintenance of the civic amenity area.

The "unknown" environmental liabilities are those liabilities that may or may not arise due to the occurrence of the environmental risks identified in the risk assessment.

8.2 'KNOWN' ENVIRONMENTAL LIABILITIES

The 'known' environmental liabilities can be broken into those arising during the operational phase of the civic amenity in order to close it, and those arising during the aftercare phase of the landfill. The 'known' environmental liabilities associated with the operational phase of the civic amenity include for closure costs. The final closure costs of the Civic Amenity site include for removal of all structures, plant and cabins. The aftercare phase of the landfill includes costs associated with the management of the leachate infrastructure, landfill gas infrastructure and environmental monitoring.

The aftercare phase liabilities are those costs that will arise during a 30 year period following the closure of the entire site. The assessment of the environmental liabilities has been limited to a 30 year period in accordance with Article 10 of the *Council Directive 1999/31/EC of 26 April 1999 on the Landfill of Waste*. However, it is expected that the environmental liabilities will extend beyond the 30 years period. The aftercare phase environmental liabilities include costs for ongoing monitoring and maintenance.

Table 8.1 provides the "known" liabilities and an estimate of their approximate cost. The cost estimates have been based on 2009 rates and prices.

Table 8.1 – "Known" Environmental Liabilities and Associated Costs

Environmental Liability	Description	Cost Estimate
Final closure Phase		
Capping, gas and leachate management systems	Construction finished, cost €3.7m (ex. VAT), payments of €33k due in 2010	*€ 33,000*
Civic Amenity Site[2]	Demobilisation and restoration cost of €100k to close.[2]	*€ 100,000*[2]
Contingency for increase scope (10%)		*€ 13,300*
Sub-total for final closure Phase		*€ 146,300*
Aftercare Phase (30yrs)		
- General maintenance and management, including monitoring programme.	€ 50,000 per annum– monitoring contract with Laboratory, small maintenance works, licence.	€ 1,500,000
- Management and maintenance of gas and leachate management system.	€ 20,000 per annum- maintain LTP and SCADA system and replace pumps, lines etc. where required; power supply; testing	€ 600,000
- Leachate treatment.	€ 100,000 per annum – assumes offsite treatment of 260m^3 per annum x €400/m^3	€ 3,000,000
Contingency for increase scope (at 10%)		*€ 510,000*
Sub-total for Aftercare Phase		*€ 5,610,000*
	Total for 30 year period	**€ 5,756,300**

Notes:

1. All cost estimates based on current 2009 prices and rates
2. The Civic Amenity Site was closed in 2009 indefinitely – but this report and costs assume that it is open for 30 years. In the case where the CA is closed in the period, the demobilisation cost for the CA would reduce to €50,000.

8.3 'UNKNOWN' ENVIRONMENTAL LIABILITIES – CURRENT STATUS

The 'unknown' environmental liabilities are associated with the environmental risks identified in Sections 4 and 5, and may or may not occur. The best case scenario is that none of the environmental risks occur, and hence at the end of the assessment period, the additional costs incurred by the landfill owner due to the environmental risks are zero. Alternatively, should a significant number of the risks materialise, significant additional costs could be incurred.

In order to identify an indicative level of environmental liability associated with the environmental risks for the purposes of Condition 12.2.2 of the Waste Licence, a cost model has been used to generate the expected cumulative cost of the risks. The modelling has been undertaken using specialist risk management and decision making software utilising the Monte Carlo sampling method to estimate the probability distribution for the expected costs.

The process assumes triangular distributions for the probability and cost ranges for each risk. Samples of expected costs are estimated based on random values of probability and cost for each risk. The sample expected costs are calculated using 1000 iterations of cost and probability values generated from the triangular distributions. A probability distribution for the expected cost is then generated.

The probability distribution can be converted to a cumulative probability distribution. This cumulative distribution provides the expected costs at each percentile. Therefore, the 50% percentile expected

cost represents the cost at which 50% (or 500) of the samples/iterations exceeded this cost and 50% did not exceed this cost. Similarly, the 90% percentile expected cost represents the expected cost at which 10% (or 100) of the samples / iterations exceeded this cost and 90% did not exceed this cost.

The most likely expected cost is usually taken as the 50% percentile expected cost. This amount is €220,736. However, in order to allow a contingency on the expected costs due to the environmental risks, the 90% percentile has been adopted, which is €271,708.

This figure represents an indicative cost of liabilities due to environmental risks based on the estimated cost and probability ranges for each risk. The method cannot give an accurate prediction of the final cost due to the subjective and uncertain nature of the risk data. However, it should be accurate enough to assist making judgements on the appropriate level of financial provision required for environmental liabilities at the landfill.

Table 8.2 summarises the highest cost scenario, the lowest cost scenario, the most likely (50% percentile cost scenario), and the most likely scenario with contingency (90% percentile). It is recommended that the later value be adopted as an indicative cost for the "unknown" environmental liabilities.

Table 8.2 – Summary of Potential "Unknown" Environmental Liabilities

Description	Estimate of "Unknown" Environmental Liabilities	Assumptions
Highest Cost Scenario	€ 505,000	Assumes risks occur at their maximum cost at their maximum probability of occurrence
Lowest Cost Scenario	€12,900	Assumes risks occur at their minimum cost at their minimum probability of occurrence
Expected Cost - Most Likely Scenario – 50% Percentile	€ 220,736	Based on the 50% percentile of the statistical analysis of the risk costs.
Expected Cost - Most Likely Scenario with Contingency – 90% Percentile	€ 271,708	Based on the 90% percentile of the statistical analysis of the risk costs.

8.4 'UNKNOWN' ENVIRONMENTAL LIBILITIES – POST RISK MITIGATION

The 'unknown' environmental liabilities can be re-evaluated after the proposed mitigations for the risks have been implemented and a reduced liability should be evident. This should be undertaken during the future risk assessments, and following the implementation of the mitigation measures.

8.5 TOTAL CURRENT ENVIRONMENTAL LIABILITIES

The total current environmental liabilities at Tramore, assuming that the landfill shall remain closed and the civic amenity shall continue to operate in accordance with the current plans in the short term, is estimated to be the sum of the 'known' environmental liabilities and the 'unknown' environmental liabilities.

The 'known' environmental liabilities currently outstanding are:

€ 5,756,300

The 'unknown' environmental liabilities which may arise due to unexpected risk events is:
€ 271,708 (most likely scenario with contingency)

The total current environmental liability is therefore estimated to be:
€ 6,028,008 (most likely scenario with contingency)

It is proposed that the financial provision to cover environmental liabilities be based on this figure.

9 CONCLUSIONS AND RECOMMENDATIONS

This study has been undertaken at the request of Waterford County Council in order to comply with Condition 12.2.2 of Waste Licence 0075-02. This condition requires the completion of an Environmental Liabilities Risk Assessment at Tramore Landfill.

The landfill operations risk assessment identified 24 major risks at the landfill. These risks were quantified and potential risk mitigation measures identified. A risk management programme was prepared to manage the risks, and in particular the implementation of the risk mitigation measures. Risk owners were allocated to manage each risk and timeframes agreed for the implementation of the mitigation measures.

Through the implementation of the risk management programme, the major risks identified at the landfill will be reduced. This has been illustrated in the comparison of pre-risk levels and post-risk levels presented in Section 5.

It is noted that the risk assessment process is a dynamic and continuous process. The associated FMEA's, risk registers, and the risk mitigation programme should be regarded as live documents and subjected to regular reviews. It is therefore recommended that the landfill operators review the risk management at the site on a monthly basis and update the risk register and risk management programme as appropriate. It is also recommended that a formal risk assessment be undertaken annually at the landfill to assist in this process.

Potential environmental liabilities at the landfill have also been quantified. These were comprised of "known" environmental liabilities and "unknown" environmental liabilities. The "known" liabilities are known, well defined, and current liabilities. The "unknown" environmental liabilities are potential liabilities that may arise due to the environmental risks associated with the operation, closure and aftercare of the landfill. The "unknown" liabilities have been quantified using an expected cost model, based on the expected financial cost of each potential risk, and the expected probability of occurrence of each risk.

The current estimate of environmental liabilities at the landfill is **€ 6,028,008.** It is proposed that the financial provision to cover environmental liabilities be based on this figure.

APPENDIX A

Failure Mode and Effect Analysis Form

Failure Modes and Effects Analysis Form
(FMEA)

APPENDIX B

Expected Cost Model for 'Unknown' Environmental Liabilities

Crystal Ball Report - Full
Simulation started on 2/10/2010 at 12:31:40
Simulation stopped on 2/10/2010 at 12:31:41

Run preferences:	
Number of trials run	1,000
Monte Carlo	
Random seed	
Precision control on	
Confidence level	95.00%
Run statistics:	
Total running time (sec)	1.48
Trials/second (average)	675
Random numbers per sec	33,067
Crystal Ball data:	
Assumptions	49
Correlations	0
Correlated groups	0
Decision variables	0
Forecasts	1

Forecasts

Worksheet: [MDE0156Rp0011F01_AppCD02.xls]Stats

Forecast: Expected Cost **Cell: J29**

Summary:
Entire range is from € 114,122 to € 353,257
Base case is € 160,263
After 1,000 trials, the std. error of the mean is € 1,224

Statistics:	Forecast values
Trials	1,000
Mean	€ 221,378
Median	€ 220,772
Mode	---
Standard Deviation	€ 38,710
Variance	€ 1,498,486,991
Skewness	0.1817
Kurtosis	2.77
Coeff. of Variability	0.1749
Minimum	€ 114,122
Maximum	€ 353,257
Range Width	€ 239,136
Mean Std. Error	€ 1,224

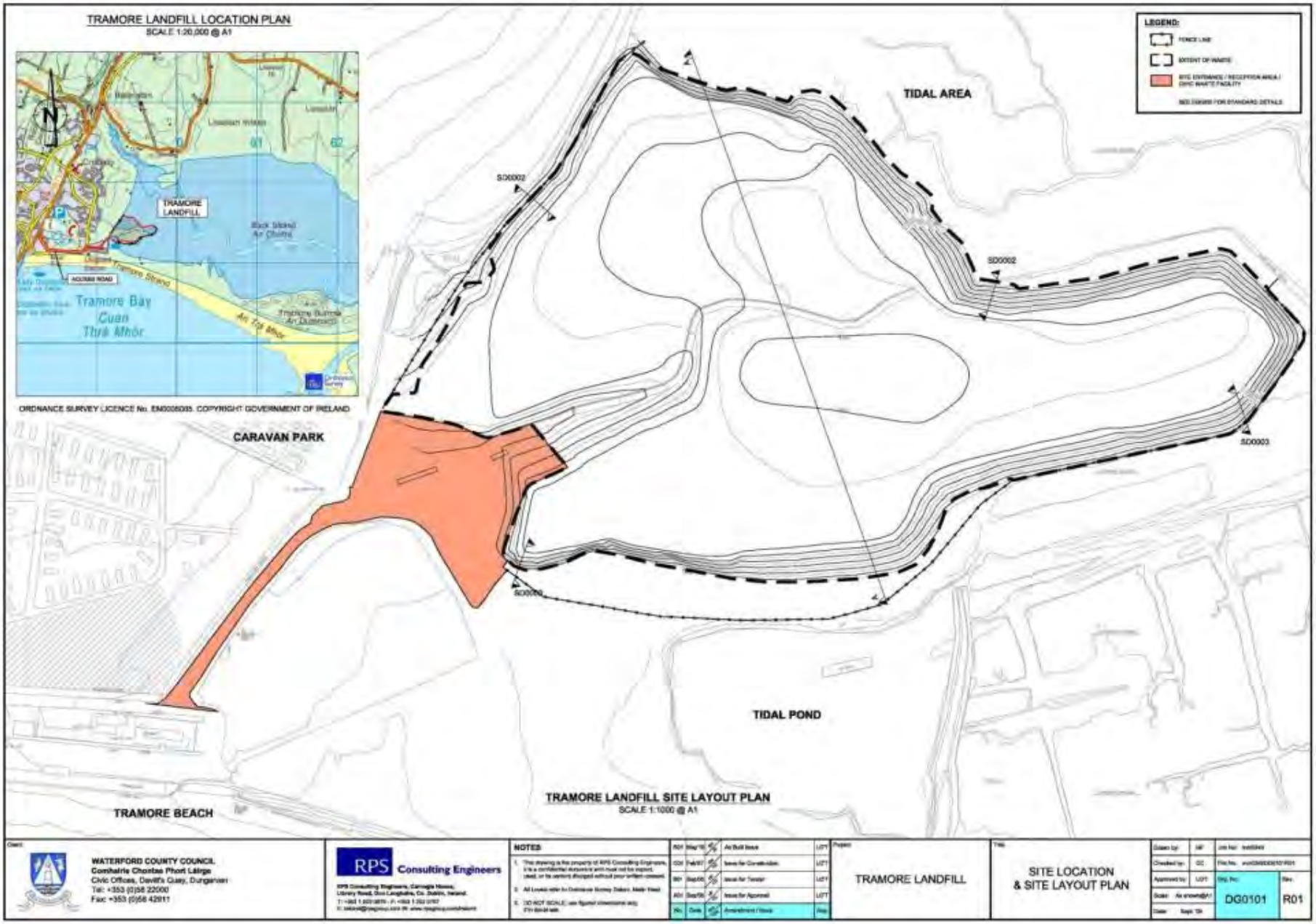
Forecast: Expected Cost (cont'd) **Cell: J29**

Percentiles:	Forecast values
0%	€ 114,122
10%	€ 170,868
20%	€ 187,265
30%	€ 199,255
40%	€ 209,296
50%	€ 220,736
60%	€ 230,971
70%	€ 240,986
80%	€ 253,572
90%	€ 271,708
100%	€ 353,257

End of Forecasts

Forecast of Environmental Liability due to Environmental Risk

Risk ID	Severity Rating	Occurrence Rating	Expected Cost Range			Expected Probability Range			Expected Cost (= most likely cost x most likely probability)	Worst Case Cost (= maximum cost x maximum probability)	Best Case Cost (= minimum cost x minimum probability)
			Minimum Cost	Most Likely Cost	Maximum Cost	Minimum Probability	Most Likely Probability	Maximum Probability			
1	2	3	€ 0	€ 500	€ 1,000	5.0%	7.5%	10.0%	€ 38	€ 100	€ 0
2	4	4	€ 10,000	€ 30,000	€ 50,000	10.0%	15.0%	20.0%	€ 4,500	€ 10,000	€ 1,000
3	3	4	€ 1,000	€ 5,500	€ 10,000	10.0%	15.0%	20.0%	€ 825	€ 2,000	€ 100
4	3	3	€ 1,000	€ 5,500	€ 10,000	5.0%	7.5%	10.0%	€ 413	€ 1,000	€ 50
5	4	3	€ 10,000	€ 25,000	€ 50,000	5.0%	7.5%	10.0%	€ 1,875	€ 5,000	€ 500
6	3	3	€ 1,000	€ 5,500	€ 10,000	5.0%	7.5%	10.0%	€ 413	€ 1,000	€ 50
7	3	3	€ 1,000	€ 5,500	€ 10,000	5.0%	7.5%	10.0%	€ 413	€ 1,000	€ 50
8	3	4	€ 1,000	€ 5,500	€ 10,000	10.0%	15.0%	20.0%	€ 825	€ 2,000	€ 100
9	3	2	€ 1,000	€ 5,500	€ 10,000	0.0%	2.5%	5.0%	€ 138	€ 500	€ 0
10	3	3	€ 1,000	€ 5,500	€ 10,000	5.0%	7.5%	10.0%	€ 413	€ 1,000	€ 50
11	6	2	€ 100,000	€ 550,000	€ 1,000,000	0.0%	2.5%	5.0%	€ 13,750	€ 50,000	€ 0
12	6	2	€ 100,000	€ 550,000	€ 1,000,000	0.0%	2.5%	5.0%	€ 13,750	€ 50,000	€ 0
13	6	2	€ 100,000	€ 550,000	€ 1,000,000	0.0%	2.5%	5.0%	€ 13,750	€ 50,000	€ 0
14	6	2	€ 100,000	€ 550,000	€ 1,000,000	0.0%	2.5%	5.0%	€ 13,750	€ 50,000	€ 0
15	6	2	€ 100,000	€ 500,000	€ 1,000,000	0.0%	2.5%	5.0%	€ 12,500	€ 50,000	€ 0
16	3	2	€ 1,000	€ 5,500	€ 10,000	0.0%	2.5%	5.0%	€ 138	€ 500	€ 0
17	6	2	€ 100,000	€ 500,000	€ 1,000,000	0.0%	2.5%	5.0%	€ 12,500	€ 50,000	€ 0
18	5	3	€ 50,000	€ 75,000	€ 100,000	5.0%	7.5%	10.0%	€ 5,625	€ 10,000	€ 2,500
19	4	4	€ 10,000	€ 25,000	€ 50,000	10.0%	15.0%	20.0%	€ 3,750	€ 10,000	€ 1,000
20	3	2	€ 1,000	€ 5,500	€ 10,000	0.0%	2.5%	5.0%	€ 138	€ 500	€ 0
21	5	3	€ 50,000	€ 75,000	€ 100,000	5.0%	7.5%	10.0%	€ 5,625	€ 10,000	€ 2,500
22	6	2	€ 100,000	€ 550,000	€ 1,000,000	0.0%	2.5%	5.0%	€ 13,750	€ 50,000	€ 0
23	6	3	€ 100,000	€ 550,000	€ 1,000,000	5.0%	7.5%	10.0%	€ 41,250	€ 100,000	€ 5,000
24	3	2	€ 1,000	€ 5,500	€ 10,000	0.0%	2.5%	5.0%	€ 138	€ 500	€ 0
								Total Estimated Costs	€ 160,263	€ 505,100	€ 12,900


TRAMORE LANDFILL LOCATION PLAN
SCALE 1:20,000 @ A1
TRAMORE LANDFILL
Tramore Bay
Cuan Thrá Mhór
ORDNANCE SURVEY LICENCE No. EN0026095. COPYRIGHT GOVERNMENT OF IRELAND
LEGEND:
TIDAL AREA
SD0002
SD0003
CARAVAN PARK
TIDAL POND
TRAMORE BEACH
TRAMORE LANDFILL SITE LAYOUT PLAN
SCALE 1:1000 @ A1
WATERFORD COUNTY COUNCIL
Comhairle Chontae Phort Láirge
Civic Offices, David's Quay, Dungarvan
Tel: +353 (0)58 22000
Fax: +353 (0)58 42911
RPS Consulting Engineers
NOTES
TRAMORE LANDFILL
SITE LOCATION & SITE LAYOUT PLAN
DG0101
R01

Appendix L

Flare Servicing Reports and Landfill Gas Survey

Unit W10C, Tougher Business Park, Naas, Co. Kildare. IRELAND.
Tel: +353 (0) 45 409 314 Web: www.irishbiotechsystems.ie
Fax: +353 (0)1 6865 012 Email: Info@irishbiotechsystems.ie

Site: Tramore Landfill **Gas Field Balance Results**

Date	*Conditions*	*Amb °C*	*H2S ppm*	*CO ppm*	*Atm Press*		*Comment*
12/07/2012	Wet	17	189	3	1010		
							On arrival the leachate tank was full and there was no suction to manifolds 1,2 & 4. By activating the float switch in the tank (which we would recommend be replaced due to corrosion) we allowed the pumps to turn on for 5 mins approx. This was enough time for KOP3 to be emptied without overflowing the tank and gave us suction to manifold 4. KOP 2 was still full after 5 mins so we had no suction to manifolds 1 & 2. The current air line configuration does not allow for the the KOP's in the field to be ran independantly of the leachate extraction pumps in the wells. Gas extraction would be maintained if they had thier own air supply and as the volume of condensate vs the volume of leachate in the wells is much smaller, only a relatively small amount of tank capacity would be required to keep the main lines clear.

Sample Point	*CH_4*	*CO2*	*O_2*	*(-) Press*	*Temp*	*Flow m^3*	*Comment*
	%	*%*	*%*	*mBar*	*°C*	*m^3/hr*	
Flare pre bal	43.4	29	1.1	-5	1023	50	Suction swinging indicating condensate in pipework
Flare post bal	44.1	28.2	1.8	-15	1020	110	Suction swinging indicating condensate in pipework

Manifold 1	*CH_4*	*CO2*	*O_2*	*Press(pre)*	*Press(post)*	*Flow m^3*	*Comment*
1.1	40.4	26.7	1.5	0	0		
1.2	39.1	26	1.6	0	0		
1.3	45.3	29	0	0	0		
1.4	11.3	6.5	14.9	0	0		
1.5	39.2	23.5	2	0	0		
1.6	35.9	22.9	3.2	0	0		
1.7	55.1	32.9	0	0	0		
1.8	36.8	23.4	2.9	0	0		
1.9	37.2	23.5	3.1	0	0		

Unit W10C, Tougher Business Park, Naas, Co. Kildare. IRELAND.
Tel: +353 (0) 45 409 314 Web: www.irishbiotechsystems.ie
Fax: +353 (0)1 6865 012 Email: Info@irishbiotechsystems.ie

Manifold 2	*CH_4*	*CO2*	*O_2*	*Press(pre)*	*Press(post)*	*Flow m^3*	*Comment*
2.1	50.3	28.4	0	0	0		
2.2	41.9	28	0	0	0		
2.3	11.7	6.6	14.4	0	0		
2.4	7.1	3.3	16.2	0	0		
2.5	0.8	0.2	19.6	0	0		
2.6	15.8	13.3	4.2	0	0		
2.7	0.7	0.1	19.6	0	0		
2.8	70.1	11.7	0	0	0		

Manifold 3	*CH_4*	*CO2*	*O_2*	*Press(pre)*	*Press(post)*	*Flow m^3*	*Comment*
3.1	61.3	32.6	0.8	-16	-5		
3.2	68	28.9	0	(+)0.5	-2		
3.3	42.3	27.6	2.9	-10	-5		
3.4	61.8	32.9	0.5	-10	-5		
3.5	50.1	26.7	5.1	-12	-3		
3.6	41.2	26	5.4	-16	-5		
3.7	39.5	27.7	0.6	-10	-8		
3.8	45.3	27.9	0	-13	-6		Suction swinging indicating condensate in conecting pipe
3.9	30.5	28.3	0.2	-13	-5		
3.10	36.6	24.9	3.7	-13	-6		

Manifold 4	*CH_4*	*CO2*	*O_2*	*Press(pre)*	*Press(post)*	*Flow m^3*	*Comment*
4.1				0	0		No suction at well head, pipe blocked between manifold and well.
4.2				0	0		No suction at well head, pipe blocked between manifold and well.
4.3	65.8	33.8	1	0	-5		
4.4	60.7	33.4	2.1	0	-5		
4.5	28.3	18.2	6.5	0	-1		Suction swinging indicating condensate in conecting pipe
4.6				0	0		No suction at well head, pipe blocked between manifold and well.
4.7	2.8	0.4	19.2	0	0		
4.8	9.5	4.5	17.3	0	0		
4.9	0.8	0.4	19.6	0	0		Air being drawn in at well head, new gasket required.
4.10	38.7	14.6	9	0	-1		

nvironmental Protection Agency

A survey of landfill sites to determine the quantity of methane flared and or recovered in utilisation plants for 2012

Please choose from the drop down menu the license number for your site	W0075
Please choose from the drop down menu the name of the landfill site	Tramore
Please enter the number of flares operational at your site in 2012	1
Please enter the number of engines operational at your site in 2012	0
Total methane flared	214,507 kg/year
Total methane utilised in engines	0 kg/year

Please note that the closing date for reciept of completed surveys is 31/03/2013

Introduction

The Office of Climate Licensing and Resource Use (OCLR) of the Environmental Protection Agency acts as the inventory agency in Ireland with responsibility for compiling and reporting national greenhouse gas inventories to the European Commission and the United Nations Framework Convention on Climate Change. In addition to meeting international commitments Ireland's national greenhouse gas inventory informs national agencies and Government departments as they face the challenge to curb emissions and meet Ireland's targets under the Kyoto Protocol. The national inventory also informs data suppliers, making them aware of the importance of their contributions to the inventory process and a means of identifying areas where input data may be improved.

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

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

Once completed please send the completed file as an attachment clearly stating the name and or license number of the landfill site (e.g. W000 Xanadu landfill_2012) to:
LFGProject@epa.ie

	to be filled in by licensee		calculated by spreadsheet	

Flare No. 1

Flare type ? Other — **If "other" enter flare description here**

Is the flare an open or enclosed flare ? Enclosed — **Rated flare capacity ?** 250 **m3/hr**

Month /year comissioned ? April 2009

Month decomissioned if decomissioned in 2012 ? Select

What is the function of the flare ? Extraction from capped area — **If "other" enter flare function here**

Monthly	Method M/C/E	Runtime days/month	Runtime hrs/day	Downtime hrs	Total runtime hrs/month	Average Inlet Pressure (mbg)	Average Flow Rate (m^3/hr)	Average CH_4 %v/v	Average CO_2 %v/v	Average O_2 %v/v	Combustion efficiency (%)	Total CH_4 m^3	Total CH_4 kgs
January	MCE	30	24.0	0.0	720	-22	102	37.50	12.50	1.10	98.0	26,989	18,230
February	MCE	27	24.0	0.0	648	-22	102	37.50	12.50	1.10	98.0	24,290	16,407
March	MCE	30	24.0	0.0	720	-22	102	37.50	12.50	1.10	98.0	26,989	18,230
April	MCE	29	24.0	0.0	696	-22	102	37.50	12.50	1.10	98.0	26,090	17,622
May	MCE	30	24.0	0.0	720	-22	102	37.50	12.50	1.10	98.0	26,989	18,230
June	MCE	29	24.0	0.0	696	-22	102	37.50	12.50	1.10	98.0	26,090	17,622
July	MCE	30	24.0	0.0	720	-22	102	37.50	12.50	1.10	98.0	26,989	18,230
August	MCE	30	24.0	0.0	720	-22	102	37.50	12.50	1.10	98.0	26,989	18,230
September	MCE	29	24.0	0.0	696	-22	102	37.50	12.50	1.10	98.0	26,090	17,622
October	MCE	30	24.0	0.0	720	-22	102	37.50	12.50	1.10	98.0	26,989	18,230
November	MCE	29	24.0	0.0	696	-22	102	37.50	12.50	1.10	98.0	26,090	17,622
December	MCE	30	24.0	0.0	720	-22	102	37.50	12.50	1.10	98.0	26,989	18,230
Total					8,472							317,573	214,507

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

Yearly	Method M/C/E	Runtime days/year	Runtime hrs/day	Downtime hrs	Total runtime hrs/year	Average Inlet Pressure (mbg)	Average Flow Rate m^3/hr	Average CH_4 %v/v	Average CO_2 %v/v	Average O_2 %v/v	Combustion efficiency (%)	Total CH_4 m^3	Total CH_4 kgs
2012					0						98.0	0	0

Appendix M

Site Slope Stability Assessment

Slope Stability Assessment

Background
The inspection in relation to the slope stability assessment was carried out on 4th January, 2010.

Slope Section 1 (North-Western boundary of the site)

This slope shows no signs of movement of cracking. The surface water drain at the foot of the slope has been cleaned out and the slope here has been flattened at the base. Fencing in this area had been in a state of disrepair and has now been removed. This slope is deemed to be in a stable condition.

Slope Section 1 looking South

Slope Section 2 (Northern Boundary of the site, western section)

Due to the gradient of the slope, a protective grid was used in portion of the slope to prevent slippage when this slope was being constructed and this has proved to be successful as there are no signs of any movement or cracking . Vegetation on the slope has thrived since the last survey was carried out in December 2007.

Slope Section 2 facing west

Slope Section 3 (Northern boundary of the site, central section)

Gabion baskets had previously installed in this area in order to facilitate a reduction of the angle of repose on this slope. The baskets were covered as part of the remediation program. The surface water drain and outfall in this area have now been completed. The outfall pipes have been surrounded by rock armour in order to protect them from the tide. Vegetation on the slope is thriving and the slope is in a stable condition, there is no evidence of any cracking or slope slippage.

Slope Section 3 showing the Surface Water drainage outfall.

Slope Section 4 (Northern boundary of the site, Eastern section)

Due to the gradient of the slope, a protective grid was used during construction and this has proved to be successful as there has been no cracking or slippage. The protective grid has been augmented by rock armour and the slope is in a stable condition. The litter fencing that was previously in place at the bottom of the slope has been removed. Vegetation in this area is thriving.

Slope Section 4

Slope Section 5 (Eastern boundary of the site)

Vegetation is now thriving on this slope and the slope remains in a stable condition following the installation of rock armour to augment the protective grid that was installed during construction.

Slope Section 5 with Rock Armour.

Slope Section 6 (Southern boundary of the site, Eastern section)

The rock armour that was installed on this slope has proved to be a success as there are no signs of movement or cracking thereon. Surface water drainage has been completed and a gravel pathway to the surface water outfall on the western end of this slope will be constructed over the rock armour. Vegetation in this area is also thriving.

Slope Section 6 showing Rock Armour

Slope Section 7 (Southern boundary of the site, Western section)

Vegetation on this slope is now thriving. Surface water drainage at the base of this slope has been completed. There are no signs of any movement or cracking. This slope is deemed to be in a stable condition.

Slope Section 7