Waterford City WWTP (Sludge Treatment)
Springfield House, Gorteens, Co. Kilkenny

Waste Licence Number W0244

ANNUAL ENVIRONMENTAL REPORT FOR 2011

Prepared By: Maura Phelan ..... Date: 21/08/12

Maura Phelan, Assistant Engineer

Checked By: Paul Tooher ..... Date: 21/8/2012

Paul Tooher, Senior Executive Engineer

Approved By: Colette Byrne ..... Date: 21/8/12

Colette Byrne, Director of Services

Waterford City Council

1. Introduction and Background to 2011 AER

1.1 Summary Report on 2011

Name and location of the site

The primary discharge is from a wastewater treatment plant located at Gorteens, Co. Kilkenny approximately 3km east of Waterford City, adjacent to Belview Port.

Description of the plant

The facility is a wastewater treatment plant (WWTP) for Waterford City and its Environs to cater for domestic and industrial wastewater. It is located approximately 3km east of Waterford City in the townland of Gorteens, County Kilkenny. The facility is operated by Celtic Anglian Water on behalf of Anglian Water International , who are contracted by Waterford City Council to operate the plant 24 hours/day and 365 days/year.

The wastewater treatment process consists of inlet screening, grit and grease removal, primary settlement, activated sludge process and final settlement. The facility includes infrastructure for the treatment of excess sludge generated by the wastewater treatment process. The maximum tonnage of sewage sludge to be treated is 95,100 tonnes per annum. No sludges or other wastes are permitted to be imported for treatment.

The sludge arising from wastewater treatment is thickened, pasteurised, treated in one of two anaerobic digesters and dewatered. Biogas from the digestion process is used for the on-site boilers, with any excess gas being flared. The wastewater preliminary treatment works and sludge dewatering works are located indoors, in the inlet works building and sludge building respectively. These areas are operated under negative air pressure with odours extracted to two odour control units for treatment.

The plant was commissioned in July 2010.

2. Monitoring Reports Summary

2.1 Emissions from the facility

2.1.1 Emissions to Air

There is continuous monitoring of Hydrogen Sulphide (H2S) on both odour control unit emission stacks. No 30 minute mean value exceeded the emission limit value of 5 ppm during 2011.

The monitoring of emissions on the two odour control units was carried out quarterly. Sampling was undertaken for amines, mercaptans and ammonia. The amine sampling was carried out using SKC sorbent tubes, the mercaptan sampling was carried out using a treated filter and the ammonia sampling was carried out using dilute sulphuric acid impingers. The two outlets were also monitored for volume flow using L type pitot and K type thermocouple. During the monitoring all processes were running normally.

Table 2.1: Emissions to Air OCU-1 (Odour Control Unit)

Date	Parameter	Ammonia	Mercaptans	Amines[1]	Volume Flow
	Time (mins)	(ppm)	(ppm)	(ppm)	m^3/hr
Q1 2011	0-30	<0.2	<0.9	<1.8	13,372
Q2 2011	0-30	<0.13	<0.3	<3.5	10,524
Q3 2011	0-30	<0.25	<0.25	<2.8	9,166
Q4 2011	0-30	ND[2]	ND	<2.8	---------
ELV		**50**	**5**	**5**	**54,000**

Table 2.2: Emissions to Air OCU-2 (Odour Control Unit)

Date	Parameter	Ammonia	Mercaptans	Amines	Volume Flow
	Time (mins)	(ppm)	(ppm)	(ppm)	Nm^3/hr
Q1 2011	0-30	<0.2	<0.9	<1.8	8,071
Q2 2011	0-30	<0.02	<0.7	<2.0	5,677
Q3 2011	0-30	<0.25	<0.25	<2.8	2,884
Q4 2011	0-30	ND	ND	<2.8	2,135
ELV		**50**	**5**	**5**	**50,760**

[1] *Results are referenced to standard temperature 273K and pressure 101.325 kPa no correction for oxygen or moisture.*
Results for amines are referenced to trimethylamine for purposes of conversion from w/v to v/v.

[2] "ND" means Not Detected

The monitoring of Boiler Emissions was carried out in May 2011. The boilers were running on plant gas, and all processes were running normally during the monitoring period.

Table 2.3: Emissions to Air A-01(a) Boiler 1

Time (mins)	NO_x as NO_2	CO	Total VOC's as C
	mg/m^3	mg/m^3	mg/m^3
0-30	207	25.7	7.7
30-60	213.9	12.4	7.5
ELV	**100**	**60**	**-**

Table 2.4: Emissions to Air A-01(b) Boiler 2

Time (mins)	NO_x as NO_2	CO	Total VOC's as C
	mg/m^3	mg/m^3	mg/m^3
0-30	33.1	201.5	8.4
30-60	23.3	260.9	11.1
ELV	**100**	**60**	**-**

Noise Emissions

There were no noise incidents or complaints in 2011.

Storm Water Emissions

No storm water sampling was conducted in 2011. A storm water sampling chamber was installed onsite early in 2012 to facilitate sampling of storm water emissions from the site.

2.2 Waste Management Record

Transfer Destination	European Waste Code	Hazardous	Quantity (Tonnes per Year)	Description of Waste	Waste Treatment Operation	Location of Treatment	Name and Licence/Permit No of Recover/Disposer	Non Haz Waste: Address of Recover/Disposer
Within the Country	19 08 05	No	3961	sludges from treatment of urban waste water	R10	Offsite in Ireland	Greenstar,WCP-DC-08-1120-01	David Reck,Courtnacuddy,Clonroche,Co. Wexford,Ireland
Within the Country	19 08 01	No	88	screenings	D5	Offsite in Ireland	Greenstar,W0177-03	Ballynagran, ,Co. Wicklow,.,Ireland
Within the Country	19 08 99	No	9	wastes not otherwise specified	D5	Offsite in Ireland	Greenstar,W0177-03	Ballynagran, ,Co. Wicklow,.,Ireland

2.3 Energy and Water Consumption

The energy supplied to the WWTP is from three sources:

- Electricity (from National Grid)
- Biogas from the Anaerobic Digester
- Diesel Fuel

The records for electricity consumption are contained in Table 2.5. No information was available on biogas production. Diesel usage was minimal

Table 2.5: Energy Consumption

Month	Monthly Power Consumption kWh	Average Daily Power Consumption kWh
January	199,764	6,444
February	203,168	7,256
March	226,362	7,302
April	203,460	6,782
May	210,242	6,782
June	214,530	7,151
July	234,701	7,571
August	226,703	7,313
September	221,340	7,378
October	231,477	7,467
November	211,680	7,056
December	216,163	6,973
TOTAL	**2,599,590**	**7,123**

Table 2.6: Water Consumption

Month	Potable Water Consumption (m^3)	Average Daily Potable Water Consumption (m^3)
January	20	0.65
February	86	3.07
March	474	15.29
April	265	8.83
May	474	15.29
June	243	8.10
July	370	11.94
August	*	*
September	30	1.00
October	13	0.42
November	125	4.17
December	*	*

**No information available*

2.4 Environmental Incidents and Complaints

There were no environmental incidents or complaints in 2011.

2.5 Pollutant Release and Transfer Register (PRTR) - report for previous year

| PRTR# : D0022 | Facility Name : Waterford City Waste Water Treatment Plant | Filename : WWDL D0022 AER 2011 Returns.xls | Return Year : 2011 |

Guidance to completing the PRTR workbook

AER Returns Workbook

Version 1.1.13

REFERENCE YEAR	2011

1. FACILITY IDENTIFICATION

Parent Company Name	Waterford City Council
Facility Name	Waterford City Waste Water Treatment Plant
PRTR Identification Number	D0022
Licence Number	D0022-01

Waste or IPPC Classes of Activity

No.	class_name
30.4	General

Address 1	Maritana Gate
Address 2	Canada Street
Address 3	Waterford City
Address 4	Co. Waterford
	Waterford
Country	Ireland
Coordinates of Location	-7.09856 52.2547
River Basin District	IESE
NACE Code	3700
Main Economic Activity	Sewerage
AER Returns Contact Name	Paul Tooher
AER Returns Contact Email Address	ptooher@waterfordcity.ie
AER Returns Contact Position	Senior Executive Engineer
AER Returns Contact Telephone Number	051-849636
AER Returns Contact Mobile Phone Number	
AER Returns Contact Fax Number	
Production Volume	0.0
Production Volume Units	
Number of Installations	0
Number of Operating Hours in Year	0
Number of Employees	0
User Feedback/Comments	
Web Address	

2. PRTR CLASS ACTIVITIES

Activity Number	Activity Name
5(f)	Urban waste-water treatment plants

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

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

4.1 RELEASES TO AIR

Link to previous years emissions data

| PRTR# : D0022 | Facility Name : Waterford City Waste Water Treatment Plar

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

RELEASES TO AIR				
POLLUTANT		METHOD		
			Method Used	
No. Annex II	Name	M/C/E	Method Code	Designation or Description
01	Methane (CH4)	E	ESTIMATE	EPA UWWTP Tool v4.0
02	Carbon monoxide (CO)	E	ESTIMATE	EPA UWWTP Tool v4.0
03	**Carbon dioxide (CO2)**	E	ESTIMATE	EPA UWWTP Tool v4.0
05	Nitrous oxide (N2O)	E	ESTIMATE	EPA UWWTP Tool v4.0
07	Non-methane volatile organic compounds (NMVOC)	E	ESTIMATE	EPA UWWTP Tool v4.0
08	Nitrogen oxides (NOx/NO2)	E	ESTIMATE	EPA UWWTP Tool v4.0
11	Sulphur oxides (SOx/SO2)	E	ESTIMATE	EPA UWWTP Tool v4.0

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

SECTION B : REMAINING PRTR POLLUTANTS

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

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

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

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

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

4.2 RELEASES TO WATERS Link to previous years emissions data | PRTR# : D0022 | Facility Name : Waterford City Waste Water Treatment Plant | Filename : WWDL D0022 AER 2011 Returns.xls | Return Year : 2011 | 23/02/2012 14:39

SECTION A : SECTOR SPECIFIC PRTR POLLUTANTS

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

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT					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
44	1,2,3,4,5,6-hexachlorocyclohexane(HCH)	E	ESTIMATE	EPA WWTP Tool V4.0	0.032	0.032	0.0	0.0
34	1,2-dichloroethane (EDC)	E	ESTIMATE	EPA WWTP Tool V4.0	0.536	0.539	0.0	0.003
25	Alachlor	E	ESTIMATE	EPA WWTP Tool V4.0	0.112	0.113	0.0	0.001
61	Anthracene	E	ESTIMATE	EPA WWTP Tool V4.0	0.114	0.115	0.0	0.001
17	Arsenic and compounds (as As)	E	ESTIMATE	EPA WWTP Tool V4.0	10.717	10.768	0.0	0.051
27	Atrazine	E	ESTIMATE	EPA WWTP Tool V4.0	0.692	0.695	0.0	0.003
91	Benzo(g,h,i)perylene	E	ESTIMATE	EPA WWTP Tool V4.0	0.043	0.043	0.0	0.0
18	Cadmium and compounds (as Cd)	E	ESTIMATE	EPA WWTP Tool V4.0	0.577	0.58	0.0	0.003
28	Chlordane	E	ESTIMATE	EPA WWTP Tool V4.0	0.021	0.021	0.0	0.0
30	Chlorfenvinphos	E	ESTIMATE	EPA WWTP Tool V4.0	0.011	0.011	0.0	0.0
79	Chlorides (as Cl)	E	ESTIMATE	EPA WWTP Tool V4.0	2668905.893	2681500.402	0.0	12594.509
31	Chloro-alkanes, C10-C13	E	ESTIMATE	EPA WWTP Tool V4.0	2.253	2.264	0.0	0.011
19	Chromium and compounds (as Cr)	E	ESTIMATE	EPA WWTP Tool V4.0	3.954	3.973	0.0	0.019
20	Copper and compounds (as Cu)	E	ESTIMATE	EPA WWTP Tool V4.0	19.013	19.103	0.0	0.09
82	Cyanides (as total CN)	E	ESTIMATE	EPA WWTP Tool V4.0	18.742	18.83	0.0	0.088
33	DDT	E	ESTIMATE	EPA WWTP Tool V4.0	0.115	0.116	0.0	0.001
70	Di-(2-ethyl hexyl) phthalate (DEHP)	E	ESTIMATE	EPA WWTP Tool V4.0	13.44	13.503	0.0	0.063
36	Dieldrin	E	ESTIMATE	EPA WWTP Tool V4.0	2.227	2.238	0.0	0.011
37	Diuron	E	ESTIMATE	EPA WWTP Tool V4.0	1.012	1.017	0.0	0.005
38	Endosulphan	E	ESTIMATE	EPA WWTP Tool V4.0	0.067	0.067	0.0	0.0
65	Ethyl benzene	E	ESTIMATE	EPA WWTP Tool V4.0	0.857	0.861	0.0	0.004
88	Fluoranthene	E	ESTIMATE	EPA WWTP Tool V4.0	0.148	0.149	0.0	0.001
83	Fluorides (as total F)	E	ESTIMATE	EPA WWTP Tool V4.0	3751.47	3769.17	0.0	17.7
40	Halogenated organic compounds (as AOX)	E	ESTIMATE	EPA WWTP Tool V4.0	25.601	25.722	0.0	0.121
42	Hexachlorobenzene (HCB)	E	ESTIMATE	EPA WWTP Tool V4.0	0.011	0.011	0.0	0.0
43	Hexachlorobutadiene (HCBD)	E	ESTIMATE	EPA WWTP Tool V4.0	0.011	0.011	0.0	0.0
89	Isodrin	E	ESTIMATE	EPA WWTP Tool V4.0	0.63	0.633	0.0	0.003
23	Lead and compounds (as Pb)	E	ESTIMATE	EPA WWTP Tool V4.0	10.67	10.72	0.0	0.05
45	Lindane	E	ESTIMATE	EPA WWTP Tool V4.0	0.027	0.027	0.0	0.0
21	Mercury and compounds (as Hg)	E	ESTIMATE	EPA WWTP Tool V4.0	0.704	0.707	0.0	0.003
68	Naphthalene	E	ESTIMATE	EPA WWTP Tool V4.0	4.912	4.935	0.0	0.023
22	Nickel and compounds (as Ni)	E	ESTIMATE	EPA WWTP Tool V4.0	83.159	83.551	0.0	0.392
64	Nonylphenol and Nonylphenol ethoxylates (NP/NPEs)	E	ESTIMATE	EPA WWTP Tool V4.0	0.71	0.713	0.0	0.003
69	Organotin compounds (as total Sn)	E	ESTIMATE	EPA WWTP Tool V4.0	0.107	0.108	0.0	0.001
48	Pentachlorobenzene	E	ESTIMATE	EPA WWTP Tool V4.0	0.011	0.011	0.0	0.0
71	Phenols (as total C)	E	ESTIMATE	EPA WWTP Tool V4.0	132.512	133.137	0.0	0.625
50	Polychlorinated biphenyls (PCBs)	E	ESTIMATE	EPA WWTP Tool V4.0	0.088	0.088	0.0	0.0
72	Polycyclic aromatic hydrocarbons (PAHs)	E	ESTIMATE	EPA WWTP Tool V4.0	8.654	8.695	0.0	0.041
52	Tetrachloroethylene (PER)	E	ESTIMATE	EPA WWTP Tool V4.0	4.802	4.825	0.0	0.023
73	Toluene	E	ESTIMATE	EPA WWTP Tool V4.0	1.255	1.261	0.0	0.006
12	Total nitrogen	E	ESTIMATE	EPA WWTP Tool V4.0	65628.82	66298.79	0.0	669.97
76	Total organic carbon (TOC) (as total C or COD/3)	E	ESTIMATE	EPA WWTP Tool V4.0	369361.3	371104.3	0.0	1743.0
13	Total phosphorus	E	ESTIMATE	EPA WWTP Tool V4.0	25285.45	25466.06	0.0	180.61
57	Trichloroethylene	E	ESTIMATE	EPA WWTP Tool V4.0	0.814	0.818	0.0	0.004
77	Trifluralin	E	ESTIMATE	EPA WWTP Tool V4.0	0.019	0.019	0.0	0.0
75	Triphenyltin and compounds	E	ESTIMATE	EPA WWTP Tool V4.0	0.021	0.021	0.0	0.0
60	Vinyl chloride	E	ESTIMATE	EPA WWTP Tool V4.0	0.536	0.539	0.0	0.003
78	Xylenes	E	ESTIMATE	EPA WWTP Tool V4.0	3.001	3.015	0.0	0.014
24	Zinc and compounds (as Zn)	E	ESTIMATE	EPA WWTP Tool V4.0	381.709	383.51	0.0	1.801

SECTION B : REMAINING PRTR POLLUTANTS

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

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

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

RELEASES TO WATERS					Please enter all quantities in this section in KGs			
POLLUTANT					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
303	**BOD**	M	OTH	Lab Tests - Projections	1437717.0	1437777.0	0.0	60.0
306	COD	M	OTH	Lab Tests - Projections	3331887.0	3331887.0	0.0	0.0
240	Suspended Solids	M	OTH	Lab Tests - Projections	1574939.0	1574939.0	0.0	0.0
379	Total Oxidised Nitrogen (TON)	M	OTH	Lab Tests - Projections	0.0	0.0	0.0	0.0
238	Ammonia (as N)	M	OTH	Lab Tests - Projections	0.0	0.0	0.0	0.0

4.3 RELEASES TO WASTEWATER OR SEWER

Link to previous years emissions data

SECTION A : PRTR POLLUTANTS

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

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

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

OFFSITE TRANSFER OF POLLUTANTS DESTINED FOR WASTE-WATER TREATMENT OR SEWER					Please enter all quantities in this section in KGs			
POLLUTANT		METHOD			QUANTITY			
			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

4.4 RELEASES TO LAND

Link to previous years emissions data

| PRTR# : D0022 | Facility Name : Waterford City Waste Water Treatment Plant | Filename : WWDL D0022 AER 2011 Returns.xls | Return Year : 20 23/02/2012 14:45

SECTION A : PRTR POLLUTANTS

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

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

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

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

5. ONSITE TREATMENT & OFFSITE TRANSFERS OF WASTE

| PRTR# : D0022 | Facility Name : Waterford City Waste Water Treatment Plant | Filename : WWDL D0022 AER PRTR 2011 Returns.xls | Return Year : 2011 | 27/02/2012 10:19

Please enter all quantities on this sheet in Tonnes

6

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 08 05	No	3961.22	sludges from treatment of urban waste water	R10	M	Weighed	Offsite in Ireland	Greenstar,WCP-DC-08-1120-01	David Reck,Courtnacuddy,Clonroche,Co. Wexford,Ireland		
Within the Country	**19 08 01**	**No**	87.63	screenings	D5	M	Weighed	Offsite in Ireland	Greenstar,W0177-03	Ballynagran, ,Co. Wicklow,.,Ireland		
Within the Country	19 08 99	No	9.4	wastes not otherwise specified	D5	E	Volume Calculation	Offsite in Ireland	Greenstar,W0177-03	Ballynagran, ,Co. Wicklow,.,Ireland		

3. Environmental Management

3.1 Report on Environmental Management Programme (2011)

The environmental monitoring objectives as set out in the AER for 2010 were achieved.

3.2 Schedule of Environmental Objectives and Targets/ Environmental Management Programme Report (2012)

Complete all environmental monitoring required

Task	Details	Due Date	By Whom	Status
1	Conduct monitoring	Dec 2012	WWTP Manager	Ongoing

Energy and resource efficiency

Task	Details	Due Date	By Whom	Status
2	Monitor electricity diesel and biogas usage	Dec 2012	WWTP Manager	Ongoing
3	Efficiency test on boilers	Dec 2012	WWTP Manager	Ongoing
4	Monitor water usage	Dec 2012	WWTP Manager	Ongoing

Waste handling and reduction

Task	Details	Due Date	By Whom	Status
5	Retain records of all waste production and collection onsite	Dec 2012	WWTP Manager	Ongoing
6	Review process to identify waste reductions	Dec 2012	WWTP Manager	Ongoing

The following development/ infrastructural works are also proposed at the facility

- Biogas meter
- CO monitors and SCADA connection
- Biogas Monitor for Flare Stack

4. Licence Specific Reports

4.1 Noise Management Report Summary

There were no noise incidents or complaints in 2011. A full noise survey was undertaken during the commissioning of the plant in 2010.

4.2 Odour Management Programme Summary

There were no odour incidents or complaints in 2011.

The odours generated by the sludge treatment works and the inlet works (and primary settlement tanks) are monitored to ensure that the maximum allowable odour emission rates are not exceeded.

There are 2 no. Odour Control Units (OCUs) within the facility, one for the sludge treatment works and one for the inlet works (and primary settlement tanks).

The odour control units are designed to extract odour from the specified areas. The odour extraction from these areas will create a negative pressure in these areas so that no odour can escape. In addition, U-traps are provided on all drain points for the OCUs to further ensure that odours will not escape.

Duty / standby fans will extract air continuously from the following sources:
- Preliminary treatment
- Preliminary treatment building
- Primary settlement tanks
- Picket Fence thickener
- Secondary Sludge thickener
- Sludge dewaterer
- Sludge dewatering building
- Return liquors pumping station
- Sludge holding tanks
- Pasteuriser tanks

In addition the aeration system at the plant is a diffused aeration system which minimises the potential of odour from the activated sludge process.

Operation and Maintenance of OCUs

The odour control units are checked weekly by site personnel and the results are recorded. Any maintenance to the odour control units is recorded and reported in Monthly Status Reports.

If an issue was noted in relation to odour assessment it would be recorded in the site logbook.

4.3 Sludge Register

Sludge Cake Testing (NMP 2011)

CAW Waterford sludge analyses summary, August 2011			Value	Unit
Dry Basis	DM Content	15.6 %		
	Total N	49000 mg/kg	49	kg/t
	Total P	23110 mg/kg	23.11	kg/t
Wet Basis	Total N	7644 mg/kg	7.6	kg/t
	Total P	3605.2 mg/kg	3.6	kg/t

CAW Waterford sludge analyses summary, January 2012			Value	Unit
Dry Basis	DM Content	17.7 %		
	Total N	53000 mg/kg	53	kg/t
	Total P	14910 mg/kg	14.91	kg/t
Wet Basis	Total N	9381 mg/kg	9.4	kg/t
	Total P	2639.1 mg/kg	2.6	kg/t

Average Anaylsis on a wet basis										
	P (mg/kg)	N (mg/kg)	DM %	Zinc (mg/kg)	Cadmium (mg/kg)	Nickel (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Mercury (mg/kg)	Chromium (mg/kg)
Aug-11	3605.2	7644	15.6	94.1	0.047	1.6458	16.3644	63.0708	0.000	1.852
Jan-12	2639.1	9381	17.7	481.6	0.2	4.2	33.8	168.1	0.007	7.298
Average (mg/kg)	**3122.1**	**8512.5**	**16.7**	**287.9**	**0.1**	**2.9**	**25.1**	**115.6**	**0.0**	**4.6**
Average (kg/t)	**3.12**	**8.51**	**0.02**	**0.29**	**0.00014**	**0.003**	**0.03**	**0.12**	**0.000004**	**0.005**

A summary of sludge disposal records is contained in Appendix A.

4.4 Ambient Monitoring Summary

Clearpower carried out soil sampling for the T&A Byrne Farm in September 2010 as part of the Nutrient Management Plan. Soil analysis for the land plots (field locations and associated soil references included in Table below) was carried out by FBA Laboratories Ltd. of Cappoquin Co. Waterford. Soil samples were tested for phosphorous and potassium nutrient levels, pH, and the seven heavy metals (cadmium, chromium, copper, mercury, nickel, lead and zinc) and taken in accordance to the Teagasc Code of Practice for Soil Sampling.

A summary of the monitoring data is presented in the Table below.

Area	Field ID	Sample	pH	Total P (mg/l)	Total K (mg/l)	Copper (Cu) (mg/kg)	Zinc (Zn) (mg/kg)	Cadmium (Ca) (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Chromium (mg/kg)	Mercury (mg/kg)	Organic Matter %	Clay Content %
Clonroche	Y13003027	SS1	5.3	2.7	157.7	25.22	77.03	0.12	20.75	28.95	37.55	0.04	8.4	82
		SS2	5.2	1.9	129.0	20.65	76.15	0.15	22.29	29.17	42.76	0.05	11.6	14
Ballygalvert	Y12901206	SS3	6.7	4.2	144.3	20.88	75.95	0.16	23.88	24.91	31.25	0.07	8.1	80
	Y12901148	SS4	6.7	3.8	136.9	34.90	142.80	0.30	37.63	39.20	38.89	0.10		
		SS5	6.8	5.3	100.3	19.23	72.84	0.24	24.94	25.59	39.58	0.10	8.5	53
	Y12901182	SS6	6.7	3.9	139.8	19.67	77.50	0.23	27.48	26.60	38.65	0.10	10.4	14
	Y12901113	SS7	6.2	1.9	122.4	24.86	85.58	0.25	36.73	30.16	45.94	0.11	8.5	53
		SS8	5.4	2.1	105.5	27.99	103.20	0.21	30.22	33.32	40.88	0.09		
	Y12901183	SS9	6.6	12.9	143.9	23.74	90.76	0.19	26.29	28.68	43.24	0.07		
		SS10	6.3	15.6	158.2	24.59	93.74	0.21	27.19	30.19	45.01	0.08	8.9	60
		SS11	6.9	13.3	109.9	23.08	91.17	0.21	23.21	29.96	42.53	0.07	9.4	82
Chapel	Y13002052	SS12	6.2	4.8	152.4	21.30	94.59	0.28	27.88	30.28	46.42	0.07	8.9	76
		SS13	6.3	6.8	177.0	22.71	100.20	0.29	26.28	28.49	44.03	0.07	9.4	82
		SS14	6.3	2.2	63.2	20.57	116.50	0.20	23.03	30.83	43.39	0.07		
Tominearly	Y13013086	SS15	5.9	1.8	50.1	18.59	93.50	0.20	27.70	32.83	63.34	0.07	9.0	63
	Y13013087	SS16	6.4	3.3	46.5	23.36	97.74	0.21	27.86	27.20	44.48	0.09	9.0	63
	Y13013098	SS17	5.8	3.5	33.2	17.49	75.66	0.18	22.59	30.90	69.18	0.04		
		SS18	6.0	2.5	98.9	24.04	96.07	0.18	27.93	30.08	53.98	0.07	8.9	76
Growtown Upper	Y15012056	SS19	5.6	2.7	39.1	8.65	35.73	0.10	15.21	12.71	24.30	0.04	8.9	60
	Y15012057	SS20A	6.4	9.1	65.4	9.88	38.85	0.13	16.62	11.85	32.05	0.05	9.4	35
		SS20B	6.4	3.3	42.1	12.16	33.96	0.11	16.58	12.37	30.52	0.04	12.2	44
	Y15012014	SS21	6.0	4.3	79.1	17.11	55.37	0.17	23.11	14.94	34.01	0.06		
	Y15012007	SS22	6.4	2.5	127.8	8.93	35.01	0.15	16.10	8.97	28.64	0.05	6.4	82
	Y15012053	SS23	6.2	5.2	65.1	13.12	58.42	0.15	22.94	12.95	34.25	0.06	8.8	46
	Y15012054	SS24	5.8	3.6	69.6	11.50	47.59	0.15	17.53	11.29	28.37	0.06	10.5	85
Clonroche 2	Y13003106	SS25	6.4	2.2	64.3	22.50	81.88	0.24	26.37	26.87	45.16	0.08		
		SS26	6.6	2.8	97.2	21.92	83.92	0.18	29.82	29.92	54.87	0.10	7.1	78
		SS27	6.6	2.8	69.7	22.22	80.28	0.19	30.84	25.10	46.44	0.08		
		SS28	6.5	3.0	66.2	23.35	78.84	0.22	31.82	24.43	52.55	0.10		

Area	Field ID	Sample	pH	Total P (mg/l)	Total K (mg/l)	Copper (Cu) (mg/kg)	Zinc (Zn) (mg/kg)	Cadmium (Ca) (mg/kg)	Lead (mg/kg)	Nickel (mg/kg)	Chromium (mg/kg)	Mercury (mg/kg)	Organic Matter %	Clay Content %
Ardenagh Great	Y11601057	SS29	6.8	12.0	139.1	25.11	90.57	0.31	34.46	24.81	52.00	0.08		
	Y11601041	SS30	5.8	11.6	106.1	20.89	77.82	0.28	26.71	21.83	41.89	0.07		
	Y11601026	SS31	6.7	11.6	99.5	25.39	81.84	0.26	34.32	19.22	41.58	0.07		
	Y11601048	SS32	6.8	6.4	105.9	6.72	36.10	0.27	13.38	7.61	12.71	0.06	9.2	72
	Y11601044	SS33	6.9	6.2	106.3	21.62	72.97	0.24	32.90	16.41	34.02	0.06	9.0	72
	Y11601039/ Y11601052	SS34	5.6	10.9	118.9	22.43	100.10	1.95	22.21	48.44	36.29	0.10		
	Y11601052	SS35	7.4	30.0	77.0	26.11	102.90	0.79	33.13	13.47	12.82	0.07		
	Y11601018	SS36	5.4	1.6	78.7	24.91	71.65	0.39	25.95	22.06	31.82	0.06	8.2	60
	Y11614014	SS37	5.9	3.4	246.8	23.66	81.22	0.27	32.36	21.64	44.83	0.07	9.2	63
	Y11601020	SS38	6.5	6.3	117.0	10.10	45.40	0.18	22.90	15.15	42.05	0.03	9.0	71
	Y11601012	SS39	5.7	5.6	191.3	27.79	87.85	0.29	30.31	21.56	50.79	0.06	8.2	71
	Y11601012	SS40	6.5	3.9	105.7	22.35	76.80	0.26	31.66	19.39	49.22	0.06	8.4	79
	Y11601028	SS41	6.3	8.6	113.9	27.39	97.30	0.32	35.95	22.04	51.56	0.07	10.0	66
	n/a	SS42	6.7	10.9	108.1	*	*	*	*	*	*	*		
	Y11601027	SS43	6.8	6.7	97.6	48.52	87.00	0.27	31.92	20.76	48.93	0.07		
	Y11601021	SS44	6.8	4.8	89.6	20.33	76.58	0.32	29.81	17.67	50.20	0.07	9.7	100
	Y11601017	SS45	6.3	8.3	158.4	34.04	99.27	0.32	40.89	22.43	50.29	0.07	10.2	100
	Y11601050	SS46	7.4	30.0	90.4	24.29	140.60	0.51	39.84	17.57	16.57	0.08		

4.5 Tank and Pipeline Testing and Inspection Report

Tank and pipelines were integrity pressure tested during the commissioning of the plant which was completed in 2010. There has been no visible, or, process analysis indications of wastewater leakage from the plant. Mass Balance calculations based on monitoring of the numerous flow meters throughout the site have confirmed the system integrity.

4.6 Energy Efficiency Audit Report Summary

An energy audit for 2011 was prepared. The scope of the audit focussed on the following items:

- Existing energy usage
- Review of Plant Loading versus Electricity Loading
- Identification of energy systems
- Discussion
- Recommendations

7 recommendations were made and are outlined in the Energy Audit Report in Appendix B

4.7 Report on the Assessment of the efficiency of use of Raw Materials in Processes and the Reduction in Waste Generated

The raw materials used are the fuel for the facility; biogas, electricity and diesel and polyelectrolytes for sludge thickening and dewatering.

The electricity usage for the plant is shown in Table 2.5. Total consumption for the year was 2,599,590 Kwh

Biogas generated within the anaerobic digesters is stored and used as required to power the boilers (which provide hot water for the pasteurization process). There is currently no measurement of biogas production onsite.

Diesel fuel is stored on site for the generator and the boilers for situations where there is a shortfall in the primary fuel source, i.e. electricity and biogas. The capacity of boiler fuel tank is 10,000 litres diesel and the generator fuel tank also holds 10,000 litres diesel. Records for diesel usage onsite were not available. Diesel fuel usage during 2011 was minimal.

Polyelectrolytes are used in the thickening and dewatering process of the sewage treatment. These are the only chemicals that are used on site. Two types are used for the WWTP: PLF 1700Q (for sludge thickening) and PLF 2800Q (for sludge dewatering). The polyelectrolyte is in powder form and approximately 2.4 tonnes is to be held on site, i.e. one week supply.

The quantities of raw materials utilised in the process will continue to be monitored to ensure efficiency of use.

4.8 Report on Progress Made and Proposals being developed to minimise water demand and the volume of trade effluent discharges

The water consumption onsite is monitored; the monthly water consumption is shown in Table 5.6. The consumption of water onsite will continue to be monitored.

Water Consumption is minimised by the reuse of the treated effluent as a washwater supply for sludge thickening, sludge dewatering and general washdown activities.

4.9 Development/Infrastructural works summary

The following development/ infrastructural works were completed in early 2012

- Biogas meter
- CO monitors and SCADA connection
- Biogas Monitor for Flare Stack
- Storm water sampling chamber

4.10 Decommissioning Management Plan

The Residual Management Plan for the Waterford City WWTP is contained in Appendix D. The estimate of "known" decommissioning costs identified in the Residual Management Plan Report for this site is €335,500.00.

4.11 Environmental Liability and Financial Provisions

4.11.1 Statement of Measures

Waterford City Council is aware of the environmental risks associated with the discharges from the agglomeration to the Lower River Suir Special Area of Conservation (cSAC).

The Waterford City WWTP is operated to the highest standards and all environmental monitoring required under this license is undertaken. Process monitoring is also undertaken and alarm and call-out systems are in place to address any incidents should they arise.

Waterford City Council monitors the operation of the drainage network and addresses any incident which occurs.

4.11.2 Environmental Liabilities Risk Assessment

A total of 19 risks were identified with appropriate measures taken or adopted in relation to the prevention of environmental damage. See Appendix C

Appendix A

Summary of Sludge Storage and Deliveries from Mar 2011 – Oct 2011 Period

Sludge Storage and Deliveries from Mar 2011 – Oct 2011 Period:

Storage Facility	David Reck, Courtnacuddy, Co. Wexford
Tonnes delivered to Storage Facility in Period	2745.7
Tonnes already in storage	540.15
Tonnes removed	3185.85
Total tonnes in storage at end of Period	100

Ted & Aidan Byrne NMP (No. 1)

Table 1: Summary of sludge delivery and re-use at Ted and Aidan Byrne's *(NMP No.1)* (Clonroche, Co. Wexford)

Ted & Aidan Totals: Period: Mar 2011 – Oct 2011	
	Tonnes
Waterford WWTP sludge delivered during period	1173.38
Waterford WWTP sludge recycled during period	1173.38

***Note:** 1059.93 tonnes were spread in the Spring period as per this NMP, as described in the last Recycling Report

Table 2: Ted & Aidan Byrne progress against NMP *(No 1)* 2011 and application of sludge by field according to the NMP

Field ID	Soil analysis ref	Total area (ha)	Usable area (ha)	Crop	P index	P Max (kg/ha)	P Max (kg)	Sludge fertiliser required in terms of P (t)	N index	N max (kg/ha)	N max (kg)	Sludge fertiliser required in terms of N (t)	Sludge fertiliser required (t)	Max loading based on NMP and max hyd load (t/ha)	Sludge Spread	Capacity Remaining
Clonroche																
Y13003027	SS1	4.4	4.4	Winter Oats	1	45	197.91	132.83	1	145	637.71	164.87	118.75	27.00	118.75	0.00
	SS2	4.4	4.4	Winter Oats	1	45	198.00	132.89	1	145	638.00	164.94	118.80	27.00	118.8	0.00
Ballygalvert																
Y12901206	SS3	2.0	1.0	Spring Barley	2	35	35.46	23.80	1	135	136.76	35.36	23.80	27.00	23.8	0.00
Y12901148	SS4	2.6	2.6	Spring Barley	2	35	0.00	0.00	1	135	353.16	91.30	0.00	0.00		0.00
	SS5	6.5	6.5	Spring Barley	2	35	226.73	152.17	1	135	874.53	226.09	152.17	27.00	152.17	0.00
Y12901182	SS6	5.9	5.9	Spring Barley	2	35	206.85	138.83	1	135	797.85	206.27	138.83	27.00	138.83	0.00
Y12901113	SS7	4.6	4.6	Spring Barley	1	45	0.00	0.00	1	135	622.49	160.93	0.00	0.00		0.00
	SS8	7.3	7.3	Spring Barley	1	45	0.00	0.00	1	135	986.31	254.99	0.00	0.00		0.00
Y12901183	SS9	6.4	6.4	Spring Barley	4	0	0.00	0.00	1	135	867.24	224.21	0.00	0.00		0.00
	SS10	1.9	1.9	Spring Barley	4	0	0.00	0.00	1	135	259.88	67.18	0.00	0.00		0.00
	SS11	4.2	4.2	Spring Barley	4	0	0.00	0.00	1	135	565.38	146.17	0.00	0.00		0.00
Chapel																
Y13002052	SS12	3.0	3.0	Spring Barley	2	35	0.00	0.00	1	135	405.00	104.71	0.00	0.00		0.00
	SS13	3.0	3.0	Spring Barley	3	25	75.00	50.34	1	135	405.00	104.71	50.34	27.00	50.34	0.00
	SS14	3.0	3.0	Spring Barley	1	45	0.00	0.00	1	135	405.00	104.71	0.00	0.00		0.00
Tominearly																
Y13013086	SS15	3.9	3.8	Winter Oats	1	45	0.00	0.00	1	145	549.55	142.08	0.00	0.00		0.00
Y13013087	SS16	4.1	4.1	Spring Barley	2	35	142.80	95.84	1	145	591.60	152.95	95.84	27.00	95.84	0.00
Y13013098	SS17	6.0	4.7	Winter Oats	2	35	0.00	0.00	1	145	675.70	174.69	0.00	0.00		0.00
	SS18	6.0	4.6	Winter Oats	1	45	0.00	0.00	1	145	672.80	173.94	0.00	27.00		0.00
Growtown Upper																
Y15012056	SS19	4.2	4.2	Winter Oats	1	45	188.51	126.51	1	145	607.41	157.03	113.10	27.00	113.1	0.00
Y15012057	SS20A	3.6	3.5	Winter Oats	3	25	87.50	58.72	1	145	507.50	131.20	58.72	27.00	58.72	0.00
	SS20B	3.6	3.5	Winter Oats	2	35	122.50	82.21	1	145	507.50	131.20	82.21	27.00	82.21	0.00
Y15012014	SS21	6.7	6.6	Spring Barley	2	35	231.00	155.03	1	135	891.00	230.35	118.80	27.00	118.8	0.00
Y15012007	SS22	3.3	3.3	Spring Barley	1	45	149.54	100.36	1	135	448.61	115.98	89.72	27.00	89.72	0.00
Y15012053	SS23	3.7	3.7	Spring Barley	2	35	130.13	87.34	1	135	501.93	129.76	87.34	27.00	87.34	0.00
Y15012054	SS24	4.9	2.8	Spring Barley	2	35	97.34	65.33	1	135	375.44	97.06	65.33	27.00	65.33	0.00

								Clonroche 2								
Y13003106	SS25	5.7	3.9	Spring Barley	1	45	173.27	116.29	1	135	519.82	134.39	0.00	0.00		0.00
	SS26	5.7	3.9	Spring Barley	1	45	173.27	116.29	1	135	519.82	134.39	103.96	27.00	103.96	0.00
	SS27	3.2	4.0	Spring Barley	1	45	180.00	120.81	1	135	540.00	139.61	0.00	0.00		0.00
	SS28	3.7	5.0	Spring Barley	1	45	225.00	151.01	1	135	675.00	174.51	0.00	0.00		0.00
								Ardenagh Great								
Y11601057	SS29	3.0	3.0	Winter Wheat	4	0	0.00	0.00	1	190	578.93	149.67	0.00	0.00		0.00
Y11601041	SS30	1.7	1.7	Winter Wheat	4	0	0.00	0.00	1	190	324.90	84.00	0.00	0.00		0.00
Y11601026	SS31	4.0	4.0	Winter Wheat	4	0	0.00	0.00	1	190	763.80	197.47	0.00	0.00		0.00
Y11601048	SS32	5.2	5.2	Spring Barley	3	25	130.50	87.58	1	190	991.80	256.41	87.58	27.00	87.58	0.00
Y11601044	SS33	2.7	2.7	Spring Barley	3	25	68.28	45.82	1	190	518.89	134.15	45.82	27.00	45.82	0.00
Y11601039	SS34	4.1	4.1	Winter Wheat	4	0	0.00	0.00	1	190	784.70	202.87	0.00	0.00		0.00
Y11601052	SS34	1.0	1.0	Winter Wheat	4	0	0.00	0.00	1	190	184.30	47.65	0.00	0.00		0.00
Y11601018	SS35	2.5	2.5	Winter Wheat	4	0	0.00	0.00	1	190	469.30	121.33	0.00	0.00		0.00
Y11614014	SS36	5.1	5.1	Winter Wheat	1	45	227.84	152.91	1	190	961.97	248.70	136.70	27.00	136.7	0.00
Y11601020	SS37	2.7	2.3	Winter Wheat	2	35	80.15	53.79	1	190	435.10	112.49	53.79	27.00	53.79	0.00
Y11601038	SS38	3.0	3.0	Winter Wheat	3	25	75.45	50.64	1	190	573.42	148.25	50.64	27.00	50.64	0.00
Y11601012	SS39	3.5	3.5	Winter Wheat	2	35	121.80	81.74	1	190	661.20	170.94	81.74	27.00	81.74	0.00
Y11601030	SS40	5.4	5.4	Winter Wheat	2	35	188.30	126.38	1	190	1022.20	264.27	126.38	27.00	126.38	0.00
Y11601028	SS41	4.2	4.2	Winter Wheat	3	25	103.75	69.63	1	190	788.50	203.85	69.63	27.00	69.63	0.00
Y11601027	SS43	4.0	3.0	Winter Wheat	3	25	75.00	50.34	1	190	570.00	147.36	50.34	27.00	50.34	0.00
Y11601021	SS44	3.5	3.5	Winter Wheat	2	35	120.75	81.04	1	190	655.50	169.47	81.04	27.00	81.04	0.00
Y11601017	SS45	2.5	1.9	Winter Wheat	3	25	47.00	31.54	1	190	357.20	92.35	31.54	27.00	31.53	0.01
Y11601050	SS46	3.0	3.0	Winter Wheat	4	0	0.00	0.00	1	190	578.55	149.57	0.00	0.00		0.00
	Total	*188.77*	*178.81*				**4079.61**	**2,737.99**			**27758.22**	**7176.37**	**2232.90**		2232.90	**0.00**
	N in Waterford City WWTP sludge					9.67	kg/t	*Max application (tonnes):*			***2,232.90***					
	40% availability (as per SI 378, 2006 Note: 15(4))					3.87	kg/t	*Phosphorus is the limiting nutrient*								
	P in Waterford City WWTP sludge					2.98	kg/t									
	50% availability (as per guidelines from DoEHLG, 2008)					1.49	kg/t									

Ted & Aidan Byrne NMP (No. 2 Grassland)

Table 3: Summary of sludge delivery and re-use at Ted and Aidan Byrne's *(NMP No. 2)* (Clonroche, Co. Wexford)

Ted & Aidan Totals: Period: Mar 2011 – Oct 2011	
	Tonnes
Waterford WWTP sludge delivered during period	462.8
Waterford WWTP sludge recycled during period	462.8

Table 4: Ted & Aidan Byrne progress against NMP *(No 2)* 2011 and application of sludge by field according to the NMP

Nutrient Management Plan - Grassland																							
Field ID	Field Parcel number	Total Area (ha)	Usable Area (ha)	Crop	P Index	P Max (kg/Ha)	P livestock manure fertiliser (kg/Ha)	P Max - sludge fertiliser (kg/ha)	P Max (kg)	P Sludge Fertiliser Max (kg)	Sludge fertiliser required in terms of P (t)	N Index	N Max (kg/Ha)	N livestock manure fertiliser (kg/Ha)	N Max - sludge fertiliser (kg/ha)	N Max (kg)	N Sludge Fertiliser Max (kg)	Sludge fertiliser required in terms of N (t)	Max sludge fertilizer allowed in terms of heavy metal loading (t/ha)	Max sludge fertilizer allowed in terms of heavy metal loading (t)	Max sludge fertiliser allowed (t)	Max sludge fertiliser required (t/ha)	Sludge Spread	Remaining Capacity
1	Y13002118	3.10	1.79	Grassland	4	0		0.0	0.0	0.0	0.0	1	226		0.00	0.0	0.0	0.0	0.00	0.0	0.0	0.00		0.0
2	Y13002092	5.32	5.00	Grassland	2	25	4.26	20.7	132.9	103.7	67.1	1	226	11.33	214.67	1201.2	1073.4	397.5	27.00	135.0	67.1	13.42	67.1	0.0
3	Y13002092	5.32	5.32	Grassland	1	35	4.26	30.7	186.0	163.5	105.8	1	226	11.33	214.67	1201.2	1142.0	369.1	27.00	143.6	105.8	19.90	105.8	0.0
4	Y13002126	2.50	2.35	Grassland	4	0		0.0	0.0	0.0	0.0	1	226			0.0	0.0	0.0	0.00	0.0	0.0	0.00		0.0
5	Y13002109	4.86	4.05	Grassland	4	0		0.0	0.0	0.0	0.0	1	226			0.0	0.0	0.0	0.00	0.0	0.0	0.00		0.0
6	Y13002053	4.74	4.74	Grassland	2	25	4.26	20.7	118.5	98.3	63.6	1	226	11.33	214.67	1071.2	1017.5	320.0	27.00	128.0	63.6	13.42	63.6	0.0
7	Y13002053	4.74	4.25	Grassland	2	25	4.26	20.7	118.5	88.1	57.1	1	226	11.33	214.67	1071.2	912.3	286.9	27.00	114.8	57.1	13.42	57.1	0.0
8	Y15406073	6.80	6.45	Grassland	2	25	4.26	20.7	170.0	133.5	0.0	1	226	11.33	214.67	1536.8	1384.6	0.0	0.00	0.0	0.0	0.00		0.0
9	Y15406034	2.84	2.40	Grassland	1	35	4.26	30.7	99.4	73.8	0.0	1	226	11.33	214.67	641.8	515.2	162.0	0.00	0.0	0.0	0.00		0.0
10	Y15406094	4.57	4.57	Grassland	1	35	4.26	30.7	160.0	140.5	0.0	1	226	11.33	214.67	1032.8	981.0	308.5	0.00	0.0	0.0	0.00		0.0
11	Y13007146	4.14	3.80	Grassland	2	25	4.26	20.7	103.4	78.6	51.0	1	226	11.33	214.67	934.9	815.7	256.5	27.00	102.6	51.0	13.42	51	0.0
12	Y13007146	4.14	4.14	Grassland	2	25	4.26	20.7	103.4	85.9	27.8	1	226	11.33	214.67	934.9	888.7	279.5	27.00	111.8	27.8	6.71	27.8	0.0
13	Y13007146	4.14	4.14	Grassland	1	35	4.26	30.7	144.8	127.3	0.0	1	226	11.33	214.67	934.9	888.7	0.0	0.00	0.0	0.0	0.00		0.0
14	Y13007008	1.32	0.35	Grassland	4	0		0.0	0.0	0.0	0.0	1	226			0.0	0.0	0.0	0.00	0.0	0.0	0.00		0.0
15	Y13007039	4.89	4.02	Grassland	2	25	4.26	20.7	122.3	83.4	54.0	1	226	11.33	214.67	1105.1	863.0	271.4	27.00	108.5	54.0	13.42	54	0.0
16	Y13007014	1.94	1.94	Grassland	2	35	4.26	30.7	67.9	59.6	0.0	1	226	11.33	214.67	438.4	416.5	0.0	27.00	0.0	0.0	0.00		0.0
17	Y13007030	3.52	3.52	Grassland	2	35	4.26	30.7	123.2	108.2	0.0	1	226	11.33	214.67	795.5	755.6	0.0	27.00	0.0	0.0	0.00		0.0
18	Y13007018	2.16	1.82	Grassland	1	35	4.26	30.7	75.6	55.9	36.2	1	226	11.33	214.67	488.2	390.7	122.9	27.00	49.1	36.2	19.90	36.2	0.0
Total		**71.02**	**64.65**						**1725.8**	**1400.8**	**462.6**					**13386.2**	**12045.1**	**2704.3**		**893.4**	**462.6**			**0.0**
N in WWTP sludge				7.95	kg/t																			
40% N availability (as per SI 101, 2009 Note 15(4))				3.18	kg/t																			
P in WWTP sludge				3.09	kg/t																			
50% availability(as per guidelines from DoEHLG 2008				1.55	kg/t																			

Ted & Aidan Byrne NMP (No. 3)

Table 4: Summary of sludge delivery and re-use at Ted and Aidan Byrne's *(NMP No. 3)* (Clonroche, Co. Wexford)

Ted & Aidan Totals: Period: Mar 2011 – Oct 2011	
	Tonnes
Waterford WWTP sludge delivered during period	242.8
Waterford WWTP sludge recycled during period	242.8

Table 5: Ted & Aidan Byrne progress against NMP *(No 3)* 2011 and application of sludge by field according to the NMP

Nutrient Management Plan - 3rd NMP																						
LIPS Num of Field	Field ID	Total Area (ha)	Usable Area (ha)	Crop	Soil analyses ref	P Index	P Max (kg/Ha)	P livestock manure fertiliser (kg/Ha)	P Max - sludge fertiliser (kg/ha)	P Max (kg)	P Sludge Fertiliser Max (kg)	Sludge fertiliser required in terms of P (t)	N Index	N Max (kg/Ha)	N livestock manure fertiliser (kg/Ha)	N Max - sludge fertiliser (kg/ha)	N Max (kg)	N Sludge Fertiliser Max (kg)	Sludge fertiliser reqd in terms of N (t)	Max sludge fertiliser reqd (t)	Max loading based on NMP / and max hydraulic loading (t / ha)	Sludge Spread	Remaining Capacity
	SS1	1.6	0.7	Winter Wheat	SS1	1	45	0	45	31.5	31.5	17.5	1	210	0	210	147.0	147.0	48.4	17.5	25.0	17.5	0.0
	SS2	3.7	2.1	Winter Wheat	SS2	1	45	0	45	94.5	94.5	52.5	1	210	0	210	441.0	441.0	145.1	52.5	25.0	52.5	0.0
	SS3	2.1	0.0	Winter Wheat	SS3	2	35	0	0	0.0	0.0	0.0	1	210	0	0	0.0	0.0	0.0	0.0	0.0		0.0
	SS4	3.7	1.0	Winter Wheat	SS4	1	45	0	45	45.0	45.0	25.0	1	210	0	210	210.0	210.0	69.1	25.0	25.0	25	0.0
	SS5	1.8	0.0	Winter Wheat	SS5	1	45	0	0	0.0	0.0	0.0	1	210	0	0	0.0	0.0	0.0	0.0	0.0		0.0
Y13013203	SS6	5.8	1.4	Spring Wheat	SS6	2	35	0	35	49.0	49.0	27.2	1	140	0	140	196.0	196.0	64.5	27.2	19.4	27.2	0.0
Y13013203	SS7	5.8	0.0	Spring Wheat	SS7	3	35	0	0	0.0	0.0	0.0	1	140	0	0	0.0	0.0	0.0	0.0	0.0		0.0
Y13007165	SS8	4.1	0.0	Spring Wheat	SS8	4	0	0	0	0.0	0.0	0.0	1	140	0	0	0.0	0.0	0.0	0.0	0.0		0.0
Y13007168	SS9	5.0	0.0	Spring Wheat	SS9	3	25	0	0	0.0	0.0	0.0	1	140	0	0	0.0	0.0	0.0	0.0	0.0		0.0
Y13007161	SS10	5.6	1.2	Spring Wheat	SS10	1	45	0	45	54.0	54.0	30.0	1	140	0	140	168.0	168.0	55.3	30.0	25.0	30	0.0
Y13007167	SS11	8.3	4.3	Grassland	SS11	2	35	0	35	150.5	150.5	83.6	1	226	0	226	971.8	971.8	319.7	83.6	19.4	83.6	0.0
Y13013168	SS12	3.6	0.5	Spring Wheat	SS12	3	25	0	25	12.5	12.5	6.9	1	140	0	140	70.0	70.0	23.0	6.9	13.9	6.9	0.0
	Total	**51.11**	**11.20**								**437.0**	**242.8**							**724.9**	**242.8**			0.1
	N in WWTP sludge				7.60	kg/t																	
	40% N availability (as per SI 610 of 2010 Note 15(4))				3.04	kg/t																	
	P in WWTP sludge				3.60	kg/t																	
	50% available				1.80	kg/t																	

David Reck NMP

Table 6: Summary of sludge delivery and re-use at David Reck's (Courtnacuddy, Enniscorthy, Co. Wexford)

David Reck Totals: Period: Mar 2011 – Oct 2011	
	Tonnes
Sligo sludge delivered to field during period	246.94
Sligo sludge recycled during period	246.94

Table 7: David Reck progress against NMP 2011 and application of sludge by field according to the NMP

Nutrient Management Plan																							
Field ID	Soil analysis ref and Field Parcel number	Total Area (ha)	Usable Area (ha)	Crop	P Index	P Max (kg/Ha)	P livestock manure fertiliser (kg/Ha)	P Max - sludge fertiliser (kg/ha)	P Max (kg)	P Sludge Fertiliser Max (kg)	Sludge fertiliser required in terms of P (t)	N Index	N Max (kg/Ha)	N livestock manure fertiliser (kg/Ha)	N Max - sludge fertiliser (kg/ha)	N Max (kg)	N Sludge Fertiliser Max (kg)	Sludge fertiliser required in terms of N(t)	Max sludge fertilizer allowed in terms of heavy metal loading (t/ha)	Max sludge fertilizer allowed in terms of heavy metal loading (t)	Max sludge fertiliser allowed (t)	Max sludge fertiliser required (t/ha)	Sludge Spread	Remaining Capacity
1	Y16612025	5.07	4.12	Spring Barley	4	0	0.00	0.0	0.0	0.0	0.0	1	135	0.00	0.00	684.5	0.0	0.0	0.00	0.0	0.0	0.00		0.0
2	Y16607200	3.72	2.70	Spring Barley	3	25	1.40	23.6	93.0	63.7	42.8	1	135	4.09	130.91	502.2	353.5	91.4	27.00	72.9	42.8	15.84		72.9
3	Y16607370	1.67	0.94	Spring Barley	3	25	1.40	0.0	41.8	0.0	0.0	1	135	4.09	0.00	225.5	0.0	0.0	0.00	0.0	0.0	0.00		0.0
4	Y16607138	3.77	1.68	Spring Barley	2	35	1.40	33.6	132.0	56.5	37.9	1	135	4.09	130.91	509.0	219.9	56.9	27.00	45.4	37.9	22.55		45.4
5	Y16607186	4.28	4.28	Spring Barley	4	0	0.00	0.0	0.0	0.0	0.0	1	135	0.00	0.00	577.8	0.0	0.0	0.00	0.0	0.0	0.00		0.0
6	Y16607178	5.1	5.10	Spring Barley	4	0	0.00	0.0	0.0	0.0	0.0	1	135	0.00	0.00	688.5	0.0	0.0	0.00	0.0	0.0	0.00		0.0
7	Y16607102	5.36	5.36	Spring Barley	3	25	1.40	0.0	134.0	0.0	0.0	1	135	4.09	0.00	723.6	0.0	0.0	0.00	0.0	0.0	0.00		0.0
8	Y16605034 A	4.1	3.50	Spring Barley	1	45	1.40	43.6	184.5	152.6	102.4	1	135	4.09	130.91	553.5	458.2	118.5	27.00	94.5	94.5	27.00		94.5
9	Y16605095	1.45	1.45	Spring Barley	2	35	1.40	0.0	50.8	0.0	0.0	1	135	4.09	0.00	195.8	0.0	0.0	0.00	0.0	0.0	0.00		0.0
10	Y16605034 B	2.1	2.10	Spring Barley	3	25	1.40	23.6	52.5	49.6	33.3	1	135	4.09	130.91	283.5	274.9	71.1	27.00	56.7	33.3	15.84		56.7
12	Y16605021	1.96	1.96	Spring Barley	4	0	0.00	0.0	0.0	0.0	0.0	1	135	0.00	0.00	264.6	0.0	0.0	0.00	0.0	0.0	0.00		0.0
13	Y16605022	3.21	2.98	Spring Barley	3	25	1.40	0.0	80.3	0.0	0.0	1	135	4.09	0.00	433.4	0.0	0.0	0.00	0.0	0.0	0.00		0.0
14	Y16605008	2.34	2.34	Spring Barley	2	35	1.40	33.6	81.9	78.6	52.8	1	135	4.09	130.91	315.9	306.3	79.2	27.00	63.2	52.8	22.55	63.2	0.0
15	Y16605030	6.16	6.16	Spring Barley	2	35	1.40	33.6	215.6	207.0	138.9	1	135	4.09	130.91	831.6	806.4	208.5	27.00	166.3	138.9	22.55		166.3
16	Y16605004	3.47	3.47	Spring Barley	3	25	1.40	23.6	86.8	81.9	55.0	1	135	4.09	130.91	468.5	454.9	117.4	27.00	93.7	55.0	15.84	93.7	0.0
17	Y16605009	2.99	2.99	Spring Barley	2	35	1.40	33.6	104.7	100.5	67.4	1	135	4.09	130.91	403.7	391.4	101.2	27.00	80.7	67.4	22.55		80.7
18	Y17403095	2.39	2.39	Spring Barley	2	35	1.40	33.6	83.7	80.3	53.9	1	135	4.09	130.91	322.7	312.9	80.9	27.00	64.5	53.9	22.55		64.5
19	Y17403088	2.29	2.29	Spring Barley	2	35	1.40	33.6	80.2	77.0	51.6	1	135	4.09	130.91	309.2	299.8	77.5	27.00	61.8	51.6	22.55		61.8
20	Y17403087	5.19	4.80	Spring Barley	2	35	1.40	33.6	181.7	161.3	108.3	1	135	4.09	130.91	700.7	628.4	162.5	27.00	129.6	108.3	22.55	90.04	39.6
Total		66.62	60.61						1603.1	1108.9	744.2					8993.7	4506.9	1164.9		929.3	736.3			682.4
N in WWTP sludge				9.67	kg/t																			
40% N availability (as per SI 101, 2009 Note 15A))				3.87	kg/t																			
P in WWTP sludge				2.98	kg/t																			
50% availability(as per guidelines from DoEHLG 2009				1.49	kg/t																			

Details of Spreading

T&A Byrne NMP No. 1
As per previous report 1059.93 tonnes were spread previously in February.
The remaining 1173.38 tonnes allocated to this NMP were spread at different times as follows:

- 16th, 17th, 18th and 19th of September
- 05th and 6th of October
- 15th of October

T&A Byrne NMP No. 2
Spreading commenced on the 08/09/2011 for 1 and a half days to this landbank as per the NMP.
The full allocated volume of 462.8 tonnes was spread.

T&A Byrne NMP No. 3
Spreading commenced on the 15/09/2011 for 1 day to this landbank as per the NMP.
The full allocated volume of 242.8 tonnes was spread.

David Reck NMP
Spreading commenced on the 05/10/2011 and went on for 2 days sporadically
A total of 246.94 tonnes were spread from an allocated volume of 736.3

Appendix B

Energy Audit

Energy Audit

Anglian Water International

Wastewater Treatment Plant
Located at Belview

W0244-01

Final Report
27th January 2012

Table of Contents

1.0 Introduction

The Environmental Protection Agency (EPA) has issued a Waste Licence (W0244-01) to Waterford City Council for a wastewater treatment plant located at Gorteens, Co. Kilkenny. Waterford City Council is the Licensee while the plant is operated by Anglian Water International (AWI) on behalf of the City Council. AWI is contracted to operate the treatment plant over a 20 year period.

Condition 7 of the waste licence refers to resource use and energy efficiency.

Condition 7.1

"The licensee shall carry out an audit of the energy efficiency of the site within one year of the date of grant of this licence. The audit shall be carried out in accordance with the guidance published by the Agency, "Guidance Note on Energy Efficiency Auditing". The energy efficiency audit shall be repeated at intervals as required by the Agency."

Condition 7.2

"The audit shall identify all practicable opportunities for energy use reduction and efficiency and the recommendations of the audit shall be incorporated into the Schedule of Environmental Objectives and Targets under Condition 2."

Condition 7.3

"The licensee shall identify opportunities for reduction in the quantity of water used on-site including recycling and reuse initiatives, wherever possible. Reductions in water usage shall be incorporated into the Schedule of Environmental Objectives and Targets."

Anglian Water International (AWI) has requested PP Environmental Consultants to complete the initial Energy Audit for the site.

The plant operation was officially handed over to AWI in July 2010. This energy audit covers the period October 2010 to end of September 2011 – i.e. one full year of operation.

PP Environmental Consultants have referred to the EPA's Guidance Note during the completion of this Energy Audit for the site.

2.0 Energy Audit Team

Peter Pearson of PP Environmental Consultants acted as Lead Auditor. Conor Rush (Plant Manager) acted as Project Co-ordinator, while Liam Harrison (Site Electrician) assisted with compiling the necessary input information as well as identifying various recommendations for improvement on behalf of AWI.

3.0 Summary Description of Site Activities

The facility is a wastewater treatment plant for Waterford City and its Environs to cater for both domestic and industrial wastewater. It is located approximately 3km east of Waterford City in the townland of Gorteens, Co. Kilkenny. As previously discussed, the facility is operated by AWI on behalf of Waterford City Council and operates 24 hours/day and 365 days/year.

The wastewater treatment process consists of inlet screening, grit and grease removal, primary settlement, activated sludge process and final settlement. The facility includes infrastructure for the treatment of excess sludge generated as part of the process.

The sludge arising from the wastewater treatment is thickened, pasteurised, treated in anaerobic digesters and then dewatered. Biogas from the digestion process is used for the on-site boilers, with any excess gas being flared. The wastewater preliminary treatment works and sludge dewatering works are located indoors. These indoor areas are operated under negative air pressure with odours extracted to two odour control units for treatment.

4.0 Scope of Audit

As this is the first energy audit for the site, the scope of the audit focussed on the following items:

- Existing energy usage
- Review of Plant Loading versus Electricity Loading
- Identification of energy systems
- Discussion
- Recommendations

5.0 Existing Energy Usage

The site utilises the following resources on-site:

a) Electricity from the main grid
b) Biogas from the on-site sludge digestion process
c) Gas oil – as back-up to Biogas
d) Groundwater

There is no natural gas main connected to the site or mains water supply from the Local Authority. A summary as per Table 1 of the EPA guidance note is included in Appendix 2.

5.1 Electricity Usage

A complete review of electricity supply invoices has been completed for the period October 2010 through to September 2011.

Table 5.1.1 below details the annual electricity usage for the relevant period. Figures 5.1 and 5.2 provide an overview of the electricity demand.

Table 5.1.1 – Summary of Oct 2010 – Sep 2011 Electricity Demand

	Oct 2010 – Sep 2011
Consumption (kWhr)	2,683,400
Annual Cost (€)	247,597
Cost (cent/kWhr)	9.23

Figure 5.1 - Monthly Electricity Demand

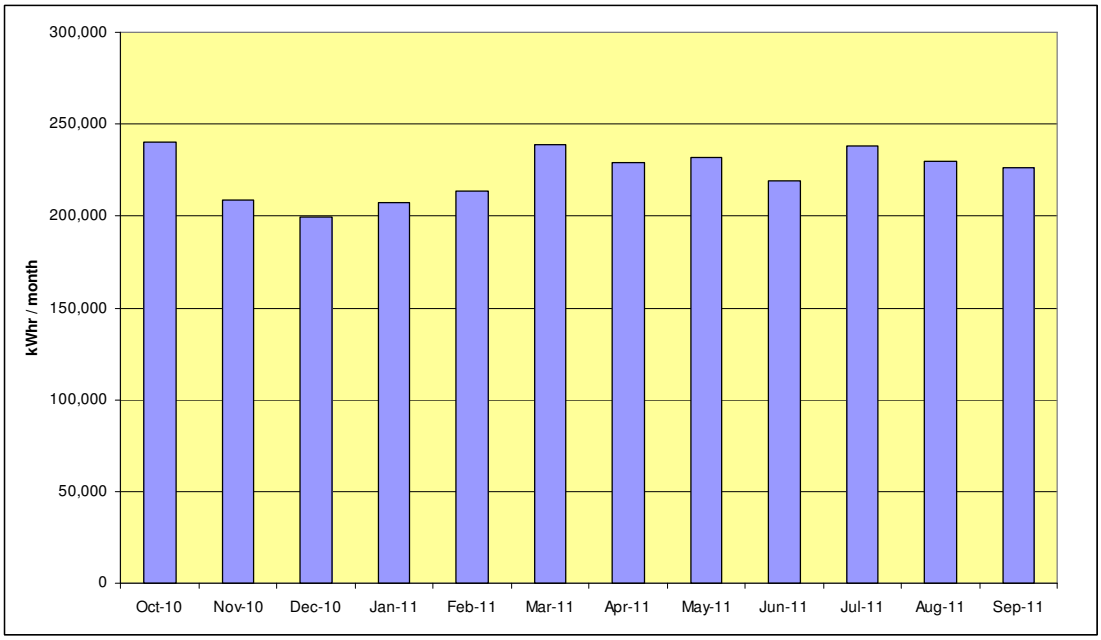
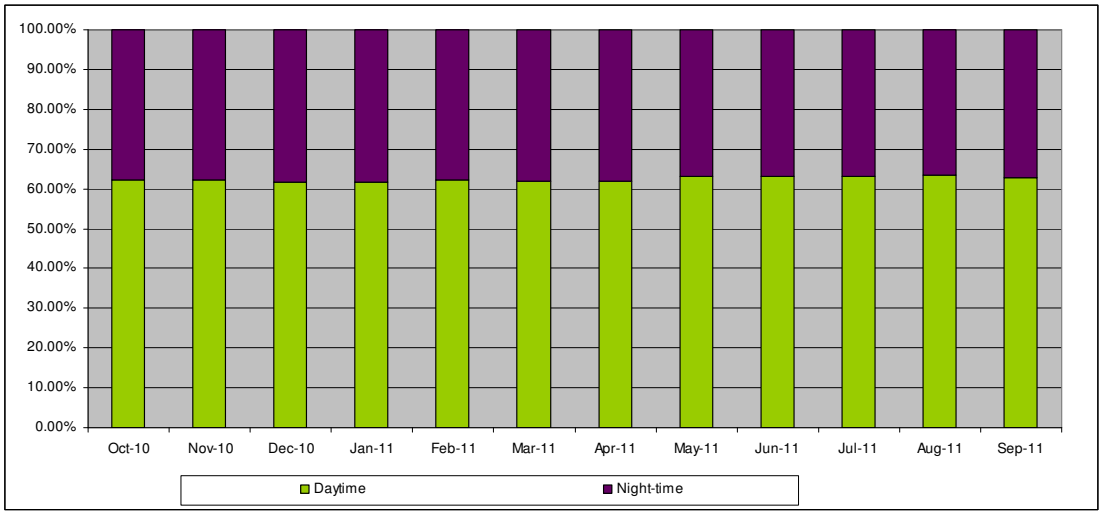


Figure 5.2 - Monthly Electricity Breakdown



While there is a variation in the monthly demand for electricity, there is very little variation in demand for electricity between daytime and night-time hours. The daytime demand varies slightly between 61% and 63% of the total electricity demand.

Figure 5.3 – Average Hourly Daytime Usage

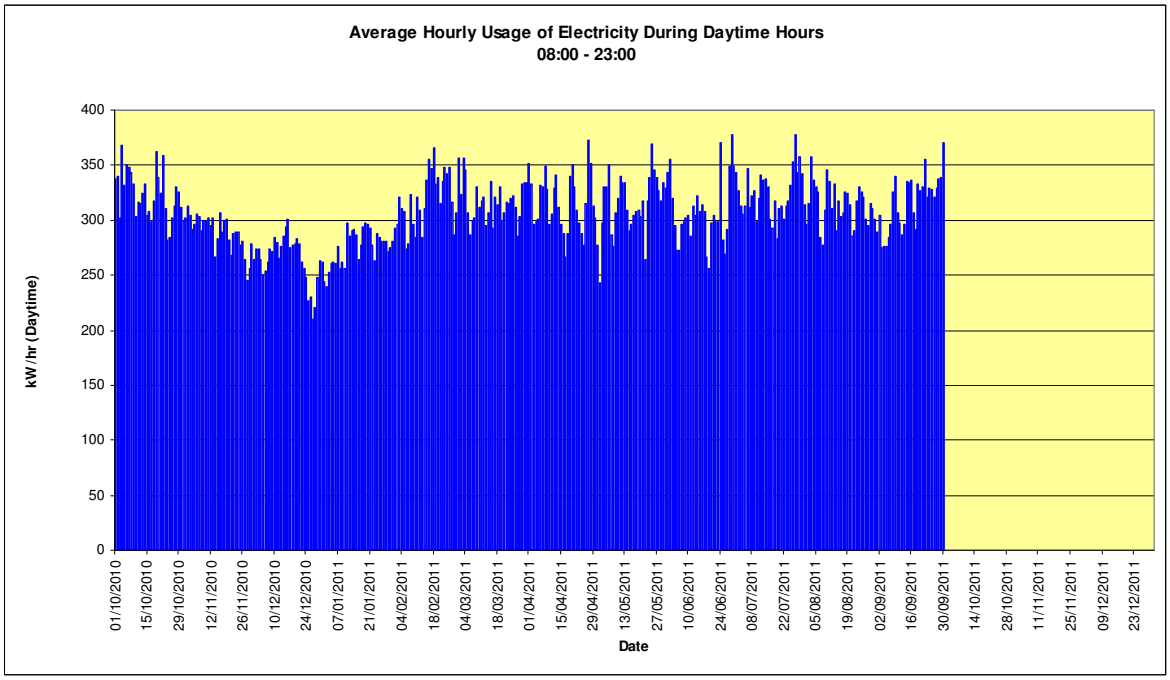
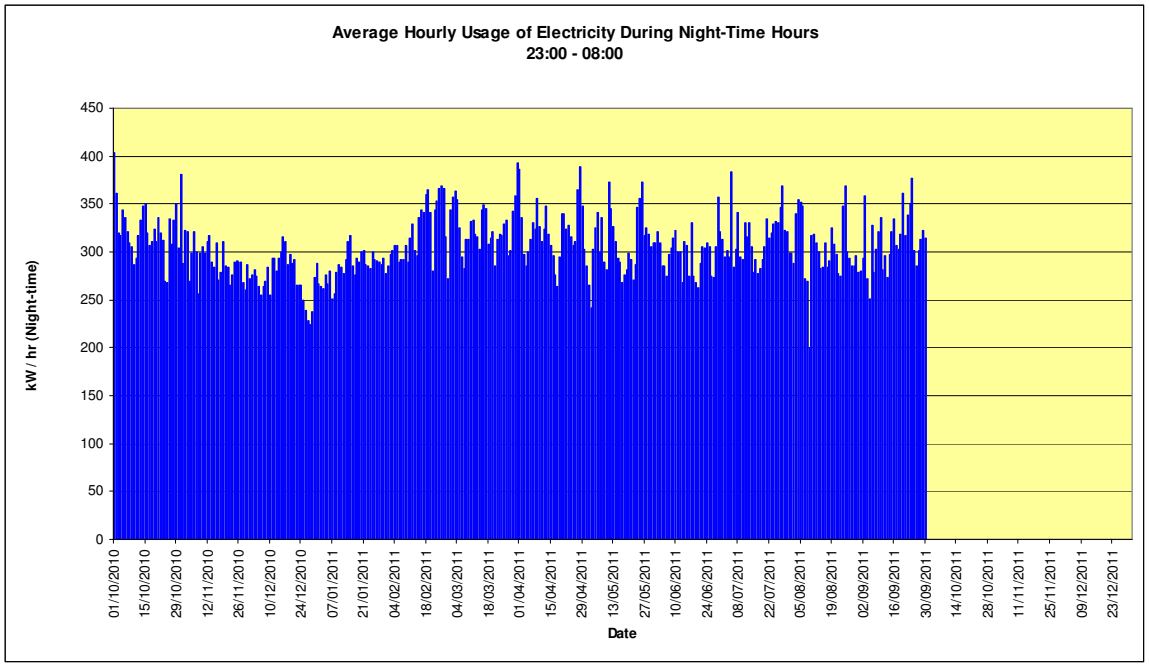


Figure 5.4 – Average Hourly Night-time Usage



Figures 5.3 and 5.4 indicate that there is very little difference between the daytime and night-time electrical loading of the plant. This is expected as the plant operates on a 24 hour basis.

There is no usage of sub-metering on-site at present, however a portable electricity monitoring device is available to the operation team. This is used by the site's electrician to provide a better understanding of usage in certain areas.

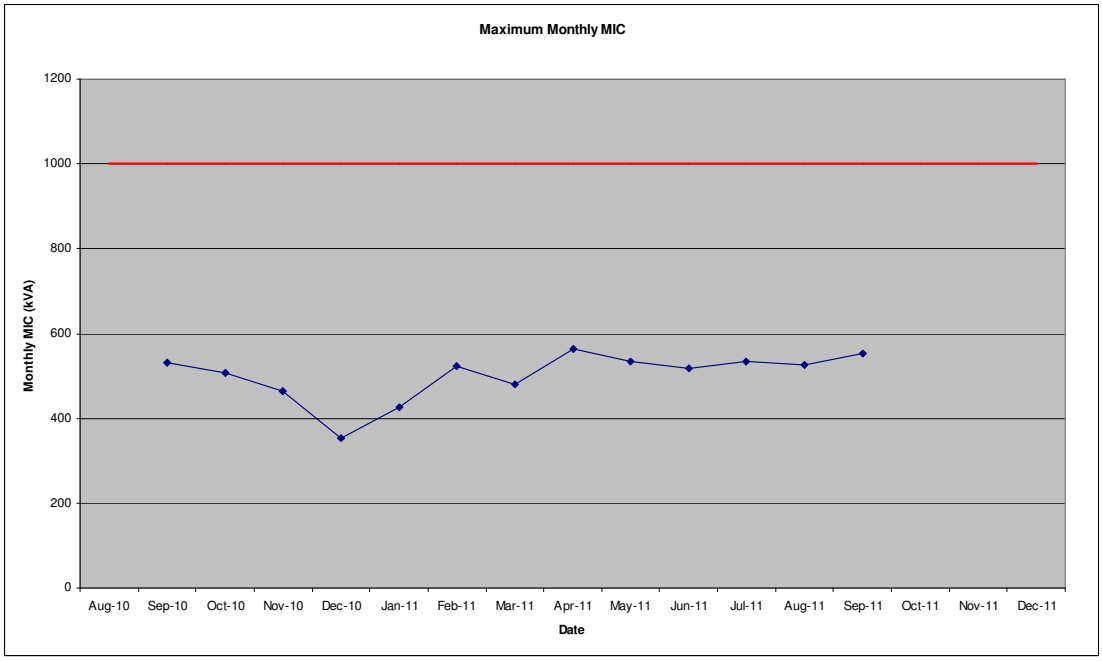
MIC Capacity

The site has a maximum import capacity (MIC) of 1,000 kVA. The maximum monthly 15-minute kVA Maximum Demand figures are shown in Figure 5.5 below.

The site is currently operating well below the MIC and as such there is the potential to reduce the MIC capacity for the site in order to provide cost savings on the monthly invoices.

An application has recently been made by AWI to ESB Networks to reduce the MIC capacity to 700 kVA.

Figure 5.5 – Monthly Maximum Demand Figures



5.2 Biogas Usage

Biogas is generated on-site through the sludge digestion process. This gas is diverted into a gas balloon where it is stored prior to being used on-site. Currently the biogas is used for the two boilers on-site that provide the hot water for the sludge pasteurisation process. These boilers are rated at 500 kW each.

Any excess biogas generation is currently sent to a flare and burnt off.

There is currently no metering system on-site for the biogas. A metering system is being investigated and this is discussed later on in this report.

5.3 Gas Oil Usage

In the event of there being a problem with the on-site biogas system, there is a quantity of gas oil stored on-site for use as a back-up fuel to the two boilers. During 2011, to date, there has been no requirement for gas oil.

5.4 Groundwater Usage

Groundwater is used to provide all water necessary for the toilets, washbasins, etc on-site. It is also used in the polyelectrolyte make-up system. It is not used for drinking water purposes.

Since 23rd July 2010, AWI has used 3,049 m^3 of groundwater or an average of 6.4 m^3/day.

5.5 Treated Final Effluent Usage

Treated final effluent, from the final settlement tanks, is used on-site in a number of processes including washing screenings, sludge thickening, sludge dewatering and in the odour control units. Since 23rd July 2010, AWI has used 272,499 m^3 of treated final effluent on-site or an average of 576 m^3/day.

The usage of treated final effluent on-site reduces considerably the need for groundwater (a valuable natural resource).

5.6 Carbon Emissions

With the introduction of a carbon tax, it is important for companies to understand the quantity of carbon emissions generated on-site either directly (e.g. gas or oil usage) or indirectly (electricity usage).

AWI is in the unusual position of generating its own biogas requirement. AWI regularly checks the methane content (% methane) of the biogas however it is currently not possible to quantify the CO_2 emissions associated with its usage.

In relation to electricity usage, the suppliers of the electricity can usually provide an indication of the quantity of CO_2 emissions per kWhr of electricity used. In relation to the treatment plant site this factor has been given as 0.532 kg CO_2 / kWhr by the current electricity supplier.

Electricity Usage (Oct ’10 – Sep ’11)	2,683,400 kWhr
CO_2 Emissions:	1,428 tonnes

6.0 Review of Plant Loading Versus Electrical Loads

In order to identify Energy Performance Indicators (EnPI's) appropriate for the site it is necessary to investigate what parameters have an influence on the site's electrical demand.

As part of this energy audit, two parameters were investigated as follows:

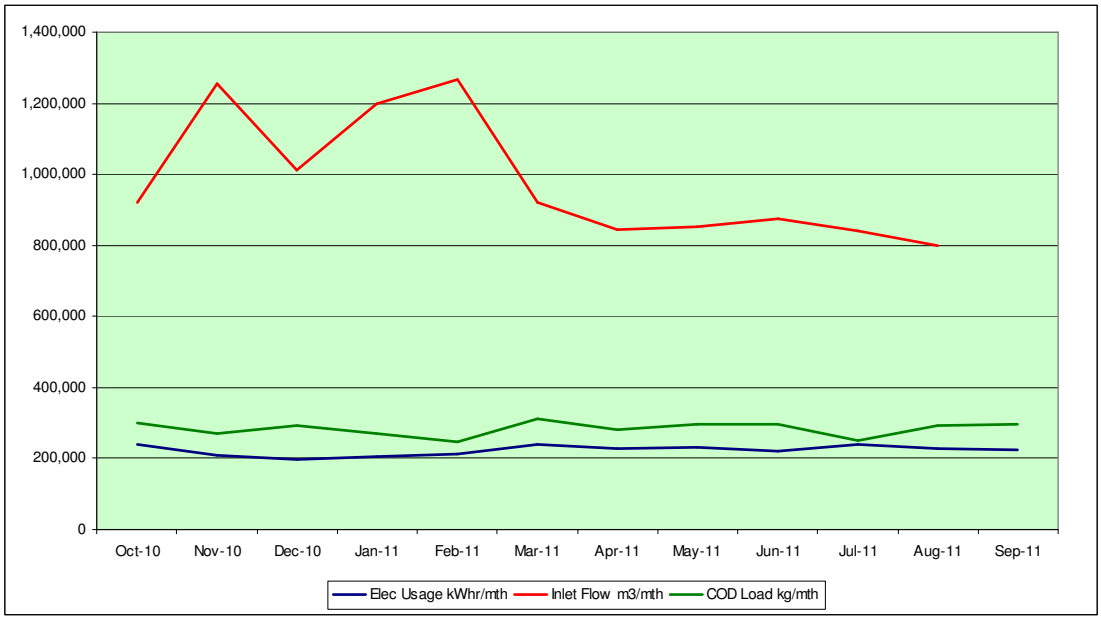
- Effluent input volumes
- COD Loading to the plant

Figure 6.1 below compares the monthly volumetric flow through the plant with both the monthly COD load and the site's electricity usage.

This graph indicates that there would appear to be some correlation between the COD loading and the site's electrical load. It would be recommended to continue monitoring this correlation.

There would appear to be no correlation between effluent volumes and site electrical load. This should continue to be monitored.

Figure 6.1 – Comparison of Monthly Flows / COD Load / Electricity Load



As well as flow and COD volumes, it is recommended that the Licensee commence reviewing other measured parameters against electricity usage, initially on an entire site basis but eventually monitoring key parameters in individual energy systems as electrical sub-meters are installed.

7.0 Energy Systems

In order to understand the energy usage at the treatment plant site and identify areas where improvements can be made it was decided to split the site into different Energy Systems, as follows:

Energy Systems

System 1: Inlet works including odour control unit (OCU 1) & Belview pumping station.

System 2: Primary Settlement / Stormwater Holding

System 3: Aeration

System 4: Final Settlement

System 5: Sludge Holding

System 6: Sludge Pasteurisation & Digestion

System 7: Sludge Dewatering / Thickening

System 8: Boiler House

System 9: Gas Balloon

System 10: Odour Control Unit No. 2

System 11: Return Liquor Pumping Station

System 12: Final Effluent Washwater

In each area, the following information was gathered:

- List of motors
- Description of motors and their location
- Installed power capacity of each motor
- Actual power usage of each motor
- Usage
- Duty or standby
- Variables affecting the energy usage in the Energy System, where known

The information compiled for each area is provided in Attachment 1. This information should be maintained and updated as and when new equipment is installed on-site and should be reviewed annually.

7.1 System 1 (Inlet Works)

Effluent from Waterford City sewerage network is delivered to site and passed through the inlet works. The inlet works contains equipment to remove solids, grit, fats, oils and grease and other non-biodegradable objects from the effluent.

The screens remove the larger foreign objects. The effluent from the screens is then passed along an aerated grit channel which is used to remove the grit from the effluent. After a pre-determined time sequence, set by the operators, the settled grit is blown onto a conveyor where it is passed through a compactor before being discharged into a skip, ready for offsite disposal.

Grease that floats to the top of the effluent passing through the aerated grit channel is removed through the use of surface scrapers.

The main energy users in System 1 are the:

- 2 No. Grit and grease blowers (rated at 15kW each but operating at approximately 9kW).
- Odour control exhaust fan
- Belview pumping station pump

There are two pieces of each equipment operating on a duty/standby basis.

The grit and grease blowers, as previously mentioned, operate on a pre-determined time sequence set by the operators. Too little grit being collected indicates that the dwell time is too long and will lead to grit build-up in the equipment.

The odour control fan is operational 24/7 as it removes air from both the inlet works building and the two primary settlement tanks.

The Belview pump operates as and when required and is dependent on effluent volumes from Belview Port and infiltration during rainfall events.

As part of initial investigations completed as part of this energy audit, the following variable may have some influence on the electrical load in this energy system.

- Effluent volumes – higher volumes are normally typical of rainfall ingress into the foul effluent drainage collection system thereby leading to higher grit quantities and the potential for shorter dwell times on the blowers.

Shorter dwell times will increase the energy usage required by the blowers.

7.2 System 2 (Primary Settlement / Stormwater Holding)

The main energy users in System 2 are the stormwater tank mixers and return pumps. The usage of this equipment is mainly dependent on rainfall conditions in the Waterford City area as there is still a quantity of stormwater entering the foul sewer drainage system in the city.

AWI has no control over the level of infiltration to the foul sewer system. Any reduction in the infiltration of these waters will reduce the energy requirement at the treatment plant.

Currently, when effluent volumes from the inlet works exceeds 968 litres/second the excess effluent is diverted to the two stormwater holding tanks which are interconnected. When there is effluent being stored in the stormwater tanks, the jet mixers are timed to operate for 5 minutes and dwell for 25 minutes as set by the operations staff.

Once the flow from the inlet works goes below 750 litres/second one stormwater tank pump is enabled and this pumps the effluent back to the splitter chamber of the primary settlement tanks. Once the flow from the inlet works goes below 650 litres/second the second stormwater pump is enabled.

On a daily basis, the plant operators check the sludge quality being pumped from the primary settlement tanks. Depending on the dry solids content (% DS) of the sludge then the primary sludge pumps time sequence is changed. Typically these pumps operate on a run time of 1 minute and a dwell time of 4 minutes.

The main variables affecting the energy usage in this system are currently considered to be:

- Solid content of effluent
- Influent volumes

It has been identified that there is a small leak in the storm weir penstock leading to an unnecessary flow to the stormwater holding tanks. This influent has to be pumped back to the inlet works thereby utilising energy. AWI propose to address this leak in the penstock as soon as possible in order to eliminate this energy requirement.

7.3 System 3 (Aeration Tanks)

The largest energy user in the aeration system is the aeration blowers. While each blower has a power rating of 110 kW they are actually operating at 78 kW. The three blowers constantly in use in this system currently make up approximately 43% of the overall site load of 300 kW.

The blowers cut in and out based on the concentration of dissolved oxygen (DO) (range of 1.3 mg/l to 3.0 mg/l). The blowers cut in when the DO reaches 1.3 mg/l and cut out when the DO level reaches 3.0 mg/l.

If the DO content is too low, the environment in the aeration tanks is not stable for the bugs and they will die due to anaerobic conditions. However, if the DO content is too high then energy can be wasted.

AWI would appear to have set an acceptable range for DO levels.

Investigative Work already completed by AWI:

As part of the secondary treatment process, there are five blowers installed to supply air to the four aeration tanks. The initial design was for four blowers to operate (one in each aeration basin) and a separate blower to act as a standby. Due to the lower than expected design flows, AWI is operating only 3 of the 4 aeration basins and hence only 3 of the blowers. This project highlights the idea of matching load to throughput.

A project has recently been completed whereby a variable speed drive was fitted to one of the blowers and this was used to maintain a constant DO level of 2.0 mg/l in the aeration basin. The energy usage of the variable speed drive system compared with the normal blower was found to be higher over a period of time. The details of the trial are maintained in the environmental management programmes.

The higher energy usage may be explained by the blower operating outside its efficient operating range over periods of the aeration cycle. It is not intended to undertake any further investigative work on variable speed drives at this point.

Other Issues:

Historical DO trends indicate that during periods of rapid increases in influent conductivity (measured in microsiemens), the DO concentration is suppressed leading to the aeration blowers having to operate for longer time periods in order to maintain the desired DO setpoints.

Seasonal variations could have an impact on blower usage however, there is currently insufficient energy consumption data available from the blowers to analyse this in detail.

7.4 System 4 (Final Settlement)

The return activated sludge (RAS) pumps are the main energy users at the final settlement tanks. These pumps are used to return activated sludge (RAS) from the bottom of the settlement tanks back to the aeration tanks in order to allow the microbiological process to continue.

AWI is utilising 3 of the 4 settlement tanks in order to match current effluent volumes.

The usage of the RAS pumps is matched to the effluent volumes passing through the inlet works with a fixed percentage of RAS sent back to the aeration tanks.

7.5 System 5 (Sludge Holding)

Sludge from the primary settlement tanks is pumped to the picket fence thickener where it is thickened before being pumped to the sludge blending tank.

Surplus activated sludge from the secondary settlement tanks is pumped to the gravity belt thickeners in the sludge building where the sludge is thickened before being transferred to the sludge blending tank.

Both types of sludge are then blended in the sludge blending tank before being pumped to the sludge pasteurisation process.

The quantity of sludge processed through these tanks is based on volumetric throughput and operator input in relation to run/dwell times on the sludge pumps.

The primary and secondary sludge holding tanks are only used in the event of operational issues at either the sludge blending tank or the sludge dewatering process. These tanks are rarely used. As such, the energy input for the sludge holding and blending process is low.

7.6 System 6 (Sludge Pasteurisation)

The sludge pasteurisation process is based on maintaining a certain temperature range over a 4-hour period. The sludge is heated by hot water from the on-site boilers which is passed through heat exchangers.

Pumps are used to transport the sludge from the sludge blending tank through the pasteurisation process and into the digestor. The power rating of the four pasteurisation pumps (2 feed and 2 outlet pumps) has been identified as being 11 kW each. However, based on the actual consumption and run hours for each pump the power consumption varies between 2.0 and 2.4 kW.

The mixers in the pasteurisation tanks come on when the tank is greater than 20% full and go off when the tank goes below 6% during the sludge emptying process. During the 4-hour pasteurisation stage, the mixers run for 4 minutes and dwell for 10 minutes. This is a pre-determined time sequence input by the operators.

The mixer in the digester operates continuously at 50% load, while the digested sludge holding tank mixer operates at 60% load.

The temperature control settings for sludge pasteurisation have a direct impact on the biogas consumption. The current temperature settings are appropriate for sludge pasteurisation and should not be changed to reduce biogas consumption. Any changes to the temperature range could on the classification of sludge as Class A.

Other parameters that impact energy usage during pasteurisation are dry solids (DS) content and volumes of sludge. The desired DS content of pasteurised sludge feed 5.5%. A higher DS content requires the sludge pumps to work harder leading to an increase in energy usage. The volume of sludge to be pasteurised is linked to the load received to the treatment plant. Volume of sludge to be pasteurised is directly proportional to the energy demand in this process component.

7.7 System 7 (Sludge Thickening)

Polymer is added to the digested sludge prior to pumping the sludge through the belt presses. The polymer is used to help bind the sludge and ensure a minimum dry-solids content from the belt press.

The dewatered sludge from the belt presses is conveyed into a hopper and then pumped from the hopper into skips.

The largest energy user in this system is the dewatered sludge feed pumps.

7.8 System 8 (Boiler House)

The boiler is fed biogas from the biogas storage system on-site. During 2011, there has been no requirement to operate the boilers on gas oil for any extended periods, with the exception of minor process interruptions or for maintenance.

Recent changes made by the site electrician would appear to have significantly improved the energy usage of the boiler system reducing the boiler water circulation pumps down to a load of 1.86 kW. This has been achieved by operating the boiler at a lower pressure whilst maintaining the heat requirements for the sludge pasteurisers.

7.9 System 9 (Biogas Balloon)

The electrical load on the biogas system is very low and has not been considered for any energy improvements at this point in time.

However, there is currently no monitoring of biogas generation on-site. There are three locations where monitoring can be considered, as follows:

a) Between the anaerobic digestion tank and the biogas balloon.
b) On the biogas line feeding the boilers
c) On the biogas line feeding the flare

In order to improve the efficiency of the biogas system and to quantify the volume of gas available AWI intend to install a biogas meter. This project is currently being progressed on-site.

From reviewing historical trend date of gas levels in the gas balloon, there is excess biogas available.

Potential uses of excess biogas include:

a) Office heating
b) Hot water
c) Sludge drying – dependent on biogas availability and payback from end user.
d) CHP

7.10 System 10 (Odour Control Unit)

The electrical load on the odour control unit is low and as such energy reduction measures have not currently been considered.

7.11 System 11 (Return Liquor Pumping Station)

The return liquor pumps operate on a duty / assist basis. If the flow into the sump is too high for one pump then the other pump will cut in. The effluent in the sump is pumped to the splitter chamber of the primary settlement tanks.

The effluent directed to this sump includes:

- Dewatering operations
- Belt cleaning
- Odour control – from water spraying operations
- Poly make-up area
- Condensate pump from biogas balloon area
- Overflows from various sludge holding tanks
- Inlet works area

The pumps would appear to be adequately sized for their intended operation.

7.12 System 12 (Final Effluent)

The final effluent pumps are used to maintain a constant pressure (7.4 bar) in the treated water mains line throughout the site. The actual rating of these pumps is lower than the installed power rating.

The final effluent is used at a number of locations throughout the site, however the main usage is for belt cleaning on the sludge dewatering belt presses.

This is an excellent use of treated effluent and reduces considerably the requirement to use groundwater or mains water (if there was a mains water supply at the site) which are considered a natural resource.

7.13 Others

Site Lighting

Up until recently site lighting was kept on throughout the night even though plant personnel leave the site around 6pm. Lights are now on a timer so that they are off when there are no personnel on-site. In the event of a callout at night-time the lights can be turned on by the operator.

Offices

Heating in the offices is supplied through electrical heaters. There is no insulation above the ceiling leading to high heat losses. Hot water is provided by an electric water heater.

There are areas for improvement within the office building such as insulation and potential use of the excess biogas for hot water. While they might not provide significant energy savings they are projects that should be given some consideration.

Compressed Air

Compressed air is not a major utility issue on-site. The compressed air that is used on-site is used for opening and closing pneumatic valves. The compressed air systems have been adequately designed.

Power Factor

There have been historical issues with the Power Factor on-site during 2010 and 2011. This issue has now been resolved since early 2012, following a change in capacitors. It is recommended that AWI monitor the power factor on an on-going basis through the monthly review of electricity bills and site observation.

8.0 Discussion

In order for a company to significantly reduce its energy usage it needs to understand where energy is used on-site and how it is used. The first step in any energy reduction programme is to identify a baseline that reflects a specific timeframe. For this audit report, the timeframe was Oct 2010 through to Sep 2011 (12 months).

Some initial work has been completed to determine an energy baseline that can be normalized using variables which affect energy use and/or consumption. It has been established that effluent volumes do not currently provide a direct correlation with energy usage while COD loading would appear to be a closer match to energy usage. Further monitoring work is required to determine the best energy baseline for the site.

The energy baseline is also required as a reference for calculation of energy savings (i.e. before and after the implementation of energy performance improvement actions).

It is critical for a company to identify the significant energy users for the site. The energy users accounting for substantial energy consumption should offer the best potential for energy performance improvement. For this reason, we split the site into different energy systems in order to better understand the energy requirements and to identify the significant energy users.

Attachment 1 indicates that the three main energy systems on-site (based on actual usage of equipment) are:

- Aeration system (43.1%)
- Primary settlement / stormwater holding (13.9%)
- Inlet works (13.6%)

Therefore, any recommendations for energy improvement at the site should concentrate on these areas at the moment. It has already been established that the blowers on the aeration tanks are the single largest significant energy users on-site.

In relation to monitoring energy consumption on an ongoing basis, it should be noted that this is currently being carried out by AWI on a regular basis through:

- Review of monthly invoices for power factor issues,
- Review of monthly invoices for tariff analysis, and
- Daily recording of plant power usage
- Daily checks of plant and equipment
- Regular monitoring of pump efficiencies undertaken as part of the on-site maintenance program.

9.0 Recommendations

As this is the first energy audit for the site, the recommendations are a mixture of energy reduction (cost and usage) measures as well as identifying improvements in monitoring and measuring in order to better understand the energy usage at the site.

By concentrating on the sub-metering of the three significant energy systems, identified in Section 8, it should be possible to identify specific capital projects that would improve the energy efficiency at the site. Sub-meters should be installed as soon as possible so that sufficient information can be gathered prior to the next energy audit which could then lead to the identification of the necessary capital projects.

It should be remembered that based on a €0.0923 / kWhr cost that, for every 1 kWhr you can reduce the site's base load by (over a 24/7/365 basis), then you can achieve a cost saving of €809/annum.

Recommendation 1

(Monitoring & Measuring)

Monitoring, measurement and analysis is key to understanding whether energy reduction projects have been successful. For this reason, it is recommended that the Licensee investigates implementing a monitoring, measurement and analysis programme in addition to the monitoring currently being undertaken that:

- Monitors the energy usage of the significant energy users
- Identifies the variables affecting the users
- Monitors actual energy usage against expected consumption
- Identifies key Energy Performance Indicators (EnPIs)
- Identifies energy improvement action plans
- Monitors any deviations and investigates their causes
- Evaluates the success or not of an energy reduction project

For example:

As previously identified earlier in the report there would appear to be some correlation between COD load and the site's electricity load. The most appropriate EnPI for this relationship (i.e. kWhr / kg of COD) based on existing data can be determined based on the average figure over the period of review. Any exceedance in excess of 15% of this figure should be investigated and the outcome of any investigation maintained on file. For most effect the kWhr should be monitored at a sub-meter to the aeration blowers.

In relation to sub-metering, it is recommended sub-meters are installed on the three significant energy systems:

- Aeration system (43.1%)
- Primary settlement / stormwater holding (13.9%)
- Inlet works (13.6%)

Recommendation 2

(Energy Reduction)

Additional investigative work is required on the operation of the blowers at the aeration basin. This equipment accounts for 43% of the site's load. There is a need to understand the variables of this system and how they interact with the energy usage (i.e. blower usage). AWI should continue discussions with leading suppliers of WWTP equipment to identify options to reduce blower usage while maintaining licence conditions.

Recommendation 3

(Monitoring & Measuring)

Install a biogas flow meter following its investigation for the most suitable location for the meter. This will help identify the quantity of biogas available for alternative uses.

Recommendation 4

(Cost Reduction)

Identify operations that could be completed between the hours of 11pm and 8am in order to utilise the lower night time electricity costs.

Recommendation 5

(Cost Reduction)

Consider reducing the MIC capacity for the site from 1,000 kVA down to 700 kVA. This would yield savings of approximately €5k per annum. This recommendation is has been implemented.

Recommendation 6

(Energy Reduction)

Throughout the plant a number of operating controls are set by operators through their experience of operating the plant. It is recommended that the Licensee review the operating controls for significant energy users to determine whether they can be altered in order to reduce the energy requirement.

As previously mentioned the three significant energy systems are:

- Aeration system (43.1%)
- Primary settlement / stormwater holding (13.9%)
- Inlet works (13.6%)

In these areas identify the set parameters controlling each system. Where a set parameter has an influence on energy usage then it is important to question its set points and whether

these can be changed to improve energy efficiency while maintaining licence compliance and treatment plant efficiencies.

Recommendation 7

(Energy Reduction)

As the plant is not operating to its full design capacity and is unlikely to do so in the short to medium term, consideration should be given to purchasing smaller motors, where possible, when replacements are being purchased. This may not apply in all areas but where it is possible an energy cost benefit analysis should be completed between the replacement with an existing motor and a smaller motor. The analysis should include costs and a payback period.

Obviously, any changes to motor sizes should bear in mind the proposed plant loading over the expected lifetime of any new motor and to ensure that it could cope with any unexpected increase in loading.

Finally, it is recommended that the Licensee maintains a register of energy saving projects that identifies the project and the energy savings made.

The treatment plant has been designed to a very good energy standard with the generation and use of biogas on-site and the reuse of treated effluent for some water applications. The next step for the Licensee is to identify an appropriate monitoring programme for the site, taking into account the recommendations above, and understand the variables that affect the significant energy users.

Attachment 1

Energy Systems – Electrical Usage

System 1 - Inlet Works & Belview Pumping Station

Description of Energy System

The inlet works are used to remove plastic, grit and other non-biodegradable items from the foul effluent.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage (hr/day/wk)
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	
A-1201A	M-1204A	Inlet Screen 1 Drive 1	Inlet Works Building	3.00		3		
A-1201B	M-1204B	Inlet Screen 2 Drive 1	Inlet Works Building	3.00		3		
A-1201C	M-1204C	Inlet Screen 3 Drive 1	Inlet Works Building	3.00		3		
P-1201	M-1207	Grit / Screening Washwater Sump Pump 1	Inlet Works Building	1.30		1.3		
P-1202	M-1208	Grit / Screening Washwater Sump Pump 2	Inlet Works Building		1.30		1.3	
	M-1205	Aerated Grit Channel 1 Surface Scraper	Inlet Works Building	0.55		0.55		
	M-1206	Aerated Grit Channel 2 Surface Scraper	Inlet Works Building		0.55		0.55	
A-1203A	M-1203A	Grit & Grease Blower 1	Inlet Works Building	15.00		9.1		
A-1203A	M-1201A	Blower 1 Enclosure Vent Fan 1	Inlet Works Building	0.41		0.41		
A-1203A	M-1202A	Blower 1 Enclosure Vent Fan 2	Inlet Works Building		0.41		0.41	
A-1203B	M-1203B	Grit & Grease Blower 2	Inlet Works Building		15.00		8.8	
A-1203B	M-1201B	Blower 2 Enclosure Vent Fan 1	Inlet Works Building	0.41		0.41		
A-1203B	M-1202B	Blower 2 Enclosure Vent Fan 2	Inlet Works Building		0.41		0.41	
N/A	N/A	Overhead Crane	Inlet Works Building	5		5		
T.B.C	M-1401	Screening Conveyor	Inlet Works Building	2.20		2.2		
A-1401	M-1404	Washer/Compactor	Inlet Works Building	5.50		5.5		
A-1402	M-1402	Grit Classifier Agitator	Inlet Works Building	0.37		0.37		
A-1402	M-1403	Grit Classifier Screw	Inlet Works Building	0.37		0.37		
A-2601	M-2601	Odour Control Unit 1 Fan 1	Inlet Works	22.00		22		
A-2601	M-2602	Odour Control Unit 1 Fan 2	Inlet Works	22.00	22.00		22	
P-1101A	M-1101A	Belview Pump 1	Belview Pumping Station	22.40		22.4		
P-1101B	M-1101B	Belview Pump 2	Belview Pumping Station		22.40		22.4	
			Total	**106.52**	**62.07**	**78.61**	**55.87**	

Variables for Inlet Works

1) Flow input
2) Stormwater grit
3) Foreign objects / plastic etc.
4) Weather - rainfall

System 2 - Primary Settlement / Stormwater Holding

Description of Energy System

The effluent from the inlet works is directed to two primary settlement tank. During periods of heavy rainfall excess effluent is diverted to two stormwater holding tanks. The effluent in the stormwater holding tanks is normally then diverted back into the primary settlement tanks once effluent flow levels recede.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage (hr/day/wk)
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	
P-1302A	M-1302A	Storm Tank 1 Pump	Storm Water Tank	13.10		13.10		
P-1301A	M-1301A	Storm Tank 1 Jet Mixer	Storm Water Tank	21.90		21.90		
P-1302B	M-1302B	Storm Tank 2 Pump	Storm Water Tank	13.10		13.10		
P-1301B	M-1301B	Storm Tank 2 Jet Mixer	Storm Water Tank	21.90		21.90		
T-1501A	M-1501A	Primary Settlement Tank 1 Scraper	Primary Settlement Tank	3.00		3.00		24/7
T-1501B	M-1501B	Primary Settlement Tank 2 Scraper	Primary Settlement Tank	3.00		3.00		24/7
P-1502A	M-1502A	Primary Sludge Pump 1	Plinth Between Storm Water Tanks	2.20		2.20		
P-1502B	M-1502B	Primary Sludge Pump 2	Plinth Between Storm Water Tanks	2.20		2.20		
P-1502C	M-1502C	Primary Sludge Pump 3	Plinth Between Storm Water Tanks		2.20		2.20	
			Total	**80.40**	**2.20**	**80.40**	**2.20**	

Variables for Primary Settlement / Stormwater Holding

1) Solids content of effluent
2) Timing of primary sludge pump outs
3) Rainfall leading to use of stormwater tanks

System 3 - Aeration Tanks

Description of Energy System

Effluent from the primary settlement tanks is directed through a selector unit and currently into 3 aeration basins (4 basins installed). Return activated sludge is pumped into the basins in order to assist growth of microbiological organisms contained in the primary settlement effluent. The overflow from the aeration basins is then sent for settlement.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	(hr/day/wk)
A-1601	M-1601	Submersible Mixer	ASP Selector tank	6.4		6.4		
P-1604A	M-1604A	Process Air Blower 1	Sludge Thickening & Dewatering Building	110.00		78		24/7/52
A-1601A	M-1605A	Process Air Blower 1 Enclosure Fan 1	Sludge Thickening & Dewatering Building	0.41		0.41		
A-1601A	M-1606A	Process Air Blower 1 Enclosure Fan 2	Sludge Thickening & Dewatering Building		0.41		0.41	
P-1604B	M-1604B	Process Air Blower 2	Sludge Thickening & Dewatering Building	110.00		78		24/7/52
A-1601B	M-1605B	Process Air Blower 2 Enclosure Fan 1	Sludge Thickening & Dewatering Building	0.41		0.41		
A-1601B	M-1606B	Process Air Blower 2 Enclosure Fan 2	Sludge Thickening & Dewatering Building		0.41		0.41	
P-1604C	M-1604C	Process Air Blower 3	Sludge Thickening & Dewatering Building	110.00		78		24/7/52
A-1601C	M-1605C	Process Air Blower 3 Enclosure Fan 1	Sludge Thickening & Dewatering Building	0.41		0.41		
A-1601C	M-1606C	Process Air Blower 3 Enclosure Fan 2	Sludge Thickening & Dewatering Building		0.41		0.41	
P-1604D	M-1604D	Process Air Blower 4	Sludge Thickening & Dewatering Building		110.00	0	78.00	24/7/52
A-1601D	M-1605D	Process Air Blower 4 Enclosure Fan 1	Sludge Thickening & Dewatering Building		0.41		0.41	
A-1601D	M-1606D	Process Air Blower 4 Enclosure Fan 2	Sludge Thickening & Dewatering Building		0.41		0.41	
P-1604E	M-1604E	Process Air Blower 5	Sludge Thickening & Dewatering Building		110.00	0	78.00	24/7/52
A-1601E	M-1605E	Process Air Blower 5 Enclosure Fan 1	Sludge Thickening & Dewatering Building		0.41		0.41	
A-1601E	M-1606E	Process Air Blower 5 Enclosure Fan 2	Sludge Thickening & Dewatering Building		0.41		0.41	
A-1602A	M-1602A	Aeration Tank 1 Mixer	Aeration Tank	4.70		4.70		
A-1603A	M-1603A	Aeration Tank 1 Mixer	Aeration Tank		4.70		4.70	
A-1602B	M-1602B	Aeration Tank 2 Mixer	Aeration Tank	4.70		4.70		
A-1603B	M-1603B	Aeration Tank 2 Mixer	Aeration Tank		4.70		4.70	
A-1602C	M-1602C	Aeration Tank 3 Mixer	Aeration Tank	4.70		4.70		
A-1603C	M-1603C	Aeration Tank 3 Mixer	Aeration Tank		4.70		4.70	
A-1602A	M-1602D	Aeration Tank 4 Mixer	Aeration Tank		4.70		4.70	
A-1603A	M-1603D	Aeration Tank 4 Mixer	Aeration Tank		4.70		4.70	
			Total	**345.34**	**246.40**	**249.34**	**182.40**	

Variables for Aeration

1) Dissolved Oxygen Concentration (maintain between 1.3 and 3.0 mg/l)
2) Salinity
3) Temperature of Effluent
4) Mixing

System 4 - Settlement

Description of Energy System

The effluent from the aeration tanks is directed to the settlement tanks in order to settle out the solids and allow the clear supernatant be discharged to the River as well as being used on-site.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	(hr/day/wk)
A-1701A	M-1701A	Final Settlement Tank 1 Scraper	Final Settlement Tank	3.00		3		24/7/52
A-1701B	M-1701B	Final Settlement Tank 2 Scraper	Final Settlement Tank	3.00		3		24/7/52
A-1701C	M-1701C	Final Settlement Tank 3 Scraper	Final Settlement Tank	3.00		3		24/7/52
A-1701D	M-1701D	Final Settlement Tank 4 Scraper	Final Settlement Tank		3.00		3	
P-1702A	M-1702A	RAS Pump 1	Plinth Outside Final Settlement Tanks	13.10		3.71		
P-1702B	M-1702B	RAS Pump 2	Plinth Outside Final Settlement Tanks		13.10		4.04	
P-1702C	M-1702C	RAS Pump 3	Plinth Outside Final Settlement Tanks	13.10		3.98		
P-1702D	M-1702D	RAS Pump 4	Plinth Outside Final Settlement Tanks		13.10	3.92		
P-1702E	M-1702E	RAS Pump 5	Plinth Outside Final Settlement Tanks	13.10			2.43	
P-1702F	M-1702F	RAS Pump 6	Plinth Outside Final Settlement Tanks		13.10	3.88		
P-1703A	M-1703A	SAS Pump 1	Plint Beside RAS Pipe	3.40		1.32		
P-1703B	M-1703B	SAS Pump 2	Plint Beside RAS Pipe		3.40		1.40	
			Total	**51.70**	**45.70**	**25.82**	**10.87**	

Variables for Settlement

1) Effluent volumes

System 5 - Sludge Holding

Description of Energy System

The sludge from the settlement tanks is pumped to a sludge thickening and holding system containing various tanks.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	(hr/day/wk)
	M-1807	Air Compressor	Sludge Thickening & Dewatering Building	4.00		4		
		Air Compressor	Sludge Thickening & Dewatering Building		4.00		4	
A-1802A	M-1804A	Gravity Belt Thickener 1 Belt Drive	Sludge Thickening & Dewatering Building	1.50		1.50		
A-1802A	M-1805A	Gravity Belt Thickener 1 Mixer	Sludge Thickening & Dewatering Building	1.10		1.10		
A-1802A	M-1806A	Gravity Belt Thickener 1 Ventilation	Sludge Thickening & Dewatering Building	0.16		0.16		
P-1803A	M-1803A	Thickened Sludge Pump	Sludge Thickening & Dewatering Building	1.50		1.50		
A-1802A	M-1804B	Gravity Belt Thickener 2 Belt Drive	Sludge Thickening & Dewatering Building	1.50		1.50		
A-1802A	M-1805B	Gravity Belt Thickener 2 Mixer	Sludge Thickening & Dewatering Building	1.10		1.10		
A-1802A	M-1806B	Gravity Belt Thickener 2 Ventilation	Sludge Thickening & Dewatering Building	0.16		0.16		
P-1803B	M-1803B	Thickened Sludge Pump	Sludge Thickening & Dewatering Building	1.50		1.50		
P-1802A	M-1802A	PFT Sludge Pump 1	Beside PFT Tank	4.00		4.00		
P-1802B	M-1802B	PFT Sludge Pump 2	Beside PFT Tank	4.00		4.00		
A-1901	M-1901	Sludge Buffer/Blending Tank Mixer	Sludge Buffer/Blending Tank	3.50		3.50		
A-1902	M-1902	Secondary Sludge Holding Tank Mixer	Secondary Sludge Holding Tank		8.70		8.70	
A-1903	M-1903	Primary Sludge Holding Tank Mixer	Primary Sludge Holding Tank		8.70		8.70	
			Total	**24.02**	**21.40**	**24.02**	**21.40**	

Variables for Sludge Holding

1) Operational problems
2) Run-dwell time for picket fence thickener pumps

System 6 - Sludge Pasteurisation

Description of Energy System

The sludge from the blending tanks is passed through a pasteurisation system and then into a sludge digester.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	(hr/day/wk)
P-1904A	M-1904A	Pasteurisation Feed Pump 1	Sludge Area	11.00		2.37		24/7
P-1904B	M-1904B	Pasteurisation Feed Pump 2	Sludge Area		11.00		2.35	24/7
P-1905A	M-1905A	Pasteurisation Feed Pump Macerator 1	Sludge Area	3.00		2.10		
P-1905B	M-1905B	Pasteurisation Feed Pump Macerator 2	Sludge Area		3.00		3.00	
P-2001A	M-2001A	Pasteuriser Tank 1 Mixer	Pasturiser Area	5.50		5.50		
P-2001B	M-2001B	Pasteuriser Tank 2 Mixer	Pasturiser Area	5.50		5.50		
P-2001C	M-2001C	Pasteuriser Tank 3 Mixer	Pasturiser Area	5.50		5.50		
P-2002A	M-2002A	Pasteurised Outlet Sludge Pump 1	Pasturiser Area	11.00		2.17		24/7
P-2002B	M-2002B	Pasteurised Outlet Sludge Pump 2	Pasturiser Area		11.00		2.15	
A-2101A	M-2101A	Digester 1 Mixer	Digester Area	7.50		3.75		24/7
A-2101B	M-2101B	Digester 2 Mixer	Digester Area		7.50		7.5	
A-2201	M-2201	Digested Sludge Holding Tank Mixer	Digested Sludge Holding Tank	21.00		12.6		
			Total	**70.00**	**32.50**	**39.48**	**15.00**	

Variables for Sludge Pasteurisation

1) Temperature of sludge
2) Filling / Emptying and Pasteurisation Times
3) Legislation / Best Practice

System 7 - Sludge Pressing

Description of Energy System

The pasteurised sludge is pressed in 2 belt presses.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage (hr/day/wk)
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	
P-2202A	M-2202A	Dewaterer Feed Pump 1	Sludge Thickening & Dewatering Building	3.00		3.00		
P-2202B	M-2202B	Dewaterer Feed Pump 2	Sludge Thickening & Dewatering Building	3.00		3.00		
A-2301A	M-2301A	Dewaterer 1 Belt Drive	Sludge Thickening & Dewatering Building	1.50		1.50		
A-2301A	M-2302A	Dewaterer 1 Mixer Drive	Sludge Thickening & Dewatering Building	0.75		0.75		
P-2304A	M-2304A	Dewaterer Sludge Pump 1	Sludge Thickening & Dewatering Building	7.50		7.50		
A-2301B	M-2301B	Dewaterer 2 Belt Drive	Sludge Thickening & Dewatering Building	1.50		1.50		
A-2301B	M-2302B	Dewaterer 2 Mixer Drive	Sludge Thickening & Dewatering Building	0.75		0.75		
P-2304B	M-2304B	Dewaterer Sludge Pump 2	Sludge Thickening & Dewatering Building	7.50		7.50		
A-2501	M-2501	Polymer Make Up Unit 1	Polyelectrolyte Make - Up package	1.00		1.00		
A-2502	M-2502	Polymer Make Up Unit 2	Polyelectrolyte Make - Up package	1.00		1.00		
P-2501A	M-2501A	Polyelectrolyte Dosing pump 1 (for thickening unit)	Sludge Thickening & Dewatering Building	0.37		0.37		
P-2501B	M-2501B	Polyelectrolyte Dosing pump 1 (for thickening unit)	Sludge Thickening & Dewatering Building	0.37		0.37		
P-2501A	M-2502A	Polyelectrolyte Dosing pump 1 (for dewatering unit)	Sludge Thickening & Dewatering Building	0.75		0.75		
P-2501B	M-2502B	Polyelectrolyte Dosing pump 1 (for dewatering unit)	Sludge Thickening & Dewatering Building	0.75		0.75		
			Total	**29.74**		**29.74**		

Variables for Sludge Pressing

1) Sludge water content

System 8 - Boiler House

Description of Energy System

The boiler house utilises the bio-gas generated on-site and provides the hot water for sludge pasteurisation process.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage (hr/day/wk)
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	
P-2801A	M-2801A	Boiler Water Circulation Pump 1	Boiler Room	11.00		1.86		
P-2801B	M-2801B	Boiler Water Circulation Pump 2	Boiler Room		11.00		11	
A-2801		Boiler Package	Boiler Room	-		-		
P-3101A	M-3101A	Boiler Plant Fuel Oil Feed Pump 1	Fuel Oil Storage Area	0.00				
P-3101B	M-3101B	Boiler Plant Fuel Oil Feed Pump 2	Fuel Oil Storage Area	0.00				
			Total	**11.00**	**11.00**	**1.86**	**11.00**	

Variables for Boiler House

System 9 - Bio-Gas Balloon

Description of Energy System

This stores bio-gas generated as part of the sludge digestion process.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage (hr/day/wk)
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	
P-2401A	M-2401A	Condensate Pump 1	Gas Holder Area	2.20		2.2		
P-2401B	M-2401B	Condensate Pump 2	Gas Holder Area		2.20		2.2	
P-2403A	M-2403A	Gas Bag Fan 1	Gas Holder Area	2.00		2		24/7
P-2403B	M-2403B	Gas Bag Fan 2	Gas Holder Area		2.00		2	24/7
A-2402		Gas Burner Package	Gas Holder Area	-		-		
			Total	**4.20**	**4.20**	**4.20**	**4.20**	

System 10 - Odour Control unit

Description of Energy System

This system removes odourous gases from the De-sludging area.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	(hr/day/wk)
A-2602	M-2603	Odour Control Unit 2 Fan 1	Sludge Area	7.50		7.5		24/7
A-2602	M-2604	Odour Control Unit 2 Fan 2	Sludge Area		7.50		7.5	24/7
			Total	**7.50**	**7.50**	**7.50**	**7.50**	

System 11 - Return Liquor Pumping Station

Description of Energy System

This system returns liquor from the sludge dewatering operation.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage (hr/day/wk)
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	
P-3001A	M-3001A	Liquors Return pump 1	Return Liquors Pumping Station	17.00		17.00		
P-3001B	M-3001B	Liquors Return pump 2	Return Liquors Pumping Station		17.00		17.00	
			Total	**17.00**	**17.00**	**17.00**	**17.00**	

System 12 - Final Effluent

Description of Energy System

Final effluent discharge to river and reuse on-site.

Item Tag No.	Motor Tag No.	Description	Item Location	Power Rating		Actual PR		Usage	Usage
				Duty (kW)	Standby (kW)	Duty (kW)	Standby (kW)	(hr/day/wk)	Run hours to date
P-2701A	M-2701A	Final Effluent Washwater Pump 1	Final Effluent Chamber	37.00			18.09		11,719
P-2701B	M-2701B	Final Effluent Washwater Pump 2	Final Effluent Chamber		37.00	20.17			10,809
A-2702-A	M-2703A	Final Effluent Filter Motor	In Proximity of Final Effluent Chamber	0.25		0.25			
A-2702-B	M-2703B	Final Effluent Filter Motor	In Proximity of Final Effluent Chamber		0.25		0.25		
			Total	**37.25**	**37.25**	**20.42**	**18.34**		

Variables for Final Effluent

Table 1 - Site Energy Usage

Energy Stream	Annual Quantity	Units	Period: Comments
Electricity Consumed Onsite	2,683,400	kWh	
Electricity Imported	2,683,400	kWh	
Electricity Generated Onsite (CHP sites only)	0	kWh	No electricity generation
Electricity Exported Offsite (CHP sites only)	0	kWh	No exporting possible.
Natural Gas Total	0	kWh (Gross CV)	
Natural Gas for CHP	0	kWh (Gross CV)	
Gasoil	1,000	litre	Estimated
LPG	0	litre	
Light Fuel Oil	0	litre	
Medium Fuel Oil	0	litre	
Heavy Fuel Oil	0	litre	
Other – please specify	0		

Appendix C

Environmental Liabilities Risk Assessment

Table 1 Environmental Sensitivity Assessment

Environmental Attribute	Attribute Score	Designated Score	Comment
Sensitivity of Receiving Water			
Class A (Q5, Q4-5, Q4)	3		
Class B (Q3-Q4)	2		
Class C (Q3, Q2-3)	1		
Class D (Q2, Q1-2, Q1)	0		
Designated Costal & Estuarine Waters	2		
Potentially Eutrophic Coastal & Estuarine	1	**2**	
Groundwater Protection			
Regionally Important Aquifer	2		
Locally Important Aquifer	1		
Poor Aquifer	0	**2**	
Vulnerability Rating - Extreme	3		
Vulnerability Rating - High	2		
Vulnerability Rating - Moderate	1		
Vulnerability Rating - Low	0	**1**	
Protected Ecological Sites and Species (Shortest distance from any discharge)			
Discharge within or directly bordering a designated site	2		
<1km	1		
>1km	0	**2**	
Human Health			
Discharge within or directly bordering a designated shellfish area			
0 - 5 km	1		
>5 km	0	**1**	
Designated Bathing Water			
WITHIN 0-5 km	1		
>5 km	0	**0**	
Drinking Water Source			
Within 0-10 km	1		
>10km	0	**1**	
Environmental Sensitivity Score		**1**	

Table 2 Risk Assessment Form

Risk ID	Process*	Potential Hazards	Environmental effect	Severity Rating	Basis of Severity	Occurrence Rating	Basis of Occurrence	Risk Score
1	Inlet works	Blockage	Untreated wastewater discharge to groundwater/ surface water	2	Duration would be short, blockage would be noticed. Bypass screens in place.	3	2 automatic screens and bypass screen. Screens are regularly inspected. Pumped flow to inlet.	**6**
2	Operation of plant under storm events	Storm water (continuous pumping of wastewater to plant) resulting in washout of bacteria.	Untreated dilute wastewater discharge to surface water	2	Wastewater feed to plant by a combination of gravity and pumped mains, storm water tanks.	2	No reports of storm events causing problems at site.	**4**
3	Biological Tank	Failure of aeration/ insufficient aeration capacity to treat incoming load	Receiving waters - Depletion of D.O., nutrient enrichment.	3	Remediation of river, and protected habitats.	4	Plant designed for carbonaceous oxidation, aeration system does not have capacity to achieve nitrogen limits set under licence for design load, D.O. monitors, monitoring of D.O. Standby blowers. Trained operatives onsite, monitoring of process.	**12**
4	Biological Tank	Washout of MLSS, failure/ insufficient biological treatment, discharge of untreated/ partially treated wastewater	Receiving waters - Depletion of D.O., nutrient enrichment, potential fish kill	3	Remediation of river, and protected habitats.	4	Plant designed for carbonaceous oxidation, plant does not have capacity to achieve nitrogen limits set under licence for design load, MLSS monitors, monitoring of D.O. Trained operatives onsite, monitoring of process.	**12**
5	Clarifier	Failure of critical equipment leading to solids carryover in effluent	Suspended solids concentration in the receiving water	3	Impact on receiving waters would be short	2	MLSS monitoring and monitoring of process, failure would be noticed.	**6**

Table 2 Risk Assessment Form

6	Sludge Exports	Spill onsite	Groundwater pollution - subsequent impact on watercourses	2	High volumes of sludge for transport offsite	3	High volume of sludge for transport on/off site. Experienced site personnel.	**6**
7	Sludge Treatment	Spill onsite	Groundwater pollution - subsequent impact on watercourses	4	High volumes of sludge onsite,	3	Constructed and last integrity tested in 2009/10. Regular inspection and maintenance. Experienced site personnel. Sludge Treatment area to be bunded with drainage directed to the return liquors system.	**12**
8	Biogas Production	Escape of biogas due to malfunction of flare or gas control system	Release of biogas to atmosphere,	4	release of biogas to atmosphere	3	SCADA control system, failure would be noticed. Experienced operatives onsite.	**12**
9	Biogas Production - Gas Holder	Explosion/ fire	Potential release of explosive gas, fire and firewater.	4	Fire at WWTP and potential release of firewater	3	Biogas produced onsite	**12**
10	Supernatant return	Failure of pumps	Groundwater pollution - subsequent impact on watercourses	3	Moderate quantities of high strength wastewater.	2	Pumps linked to plant SCADA, failure would be noticed.	**6**
11	General - chemical spill	Spill onsite	Groundwater pollution - subsequent impact on watercourses	2	2.4 tonnes powdered polyelectrolyte stored onsite (one weeks supply) for sludge thickening and dewatering.	3	Bunded polymer dosing area. Polymer stored with Sludge Building and any spillages will be washed and drained to the Liquors return pumping station.	**6**

Table 2 Risk Assessment Form

12	General - diesel spill	Spill onsite	Groundwater pollution - subsequent impact on watercourses	3	The capacity of boiler fuel tank is 10,000 litres diesel and the generator fuel tank also holds 10,000 litres diesel.	2	Double skin tanks, high level alarm experienced personnel onsite.	**6**
13	General - power failure	Power Failure - Washout of MLSS, failure of biological treatment, discharge of untreated wastewater	Receiving waters - Depletion of D.O., nutrient enrichment, potential fish kill	3	Backup generator onsite, no history of power failure onsite. Duration would be short.	1	No reported problem with ESB supply. Backup generator onsite.	**3**
14	General - tank failure	Tank failure	Groundwater pollution - subsequent impact on watercourses	4	Contamination could be ongoing for a long period of time if leak not detected. Possible need to pump and treat groundwater and soil.	2	Constructed and last integrity tested in 2006. Regular inspection and maintenance. Sludge Farm area is bunded.	**8**
15	General - pipe failure	Pipe Failure	Groundwater pollution - subsequent impact on watercourses	3	Contamination could be ongoing for a long period of time if leak not detected. Possible need to pump and treat groundwater and soil.	2	Constructed and last integrity tested in 2009/10. Regular inspection and maintenance.	**6**
16	WWTP operation	Fire at WWTP (firewater)	Groundwater pollution - subsequent impact on watercourses	4	Possible need to pump and treat groundwater.	3	Moderate quantities of hydrocarbons stored onsite.	**12**
17	WWTP site	Flooding	Receiving waters - Depletion of D.O., nutrient enrichment, potential fish kill. Risk to Groundwater	4	Remediation of soil, groundwater and estuarine habitats.	1	No history of flooding onsite.	**4**

Table 2 Risk Assessment Form

18	WWTP Influent	Variations in influent, which may impact on process performance e.g. increased salinity in the influent during high tide conditions	Failure of process, resulting in non-compliant discharges. Receiving waters - Depletion of D.O., nutrient enrichment.	3	Remediation of river, and protected habitats.	4	conditions have resulted in non-compliant discharges and mitigation measures are been taken.	**12**
19	WWTP Influent	Underloading of plant, or variations in influent temperature resulting in the growth of filamentous bacteria	Failure of process, resulting in non-compliant discharges. Receiving waters - Depletion of D.O., nutrient enrichment.	3	Remediation of river, and protected habitats.	4	conditions have resulted in non-compliant discharges and mitigation measures are been taken.	**12**

Table 3 Risk Matrix

Occurrence						
V. High	5					
High	4			3,4,18,19		
Medium	3		1,6,11		7,8,9,16	
Low	2		2	5,10,12,15	14	
V. Low	1			13	17	
		Trivial	Minor	Moderate	Major	Massive
		1	2	3	4	5
				Severity		

	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.
	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 Statement of Measures

Risk I.D.	Risk Score	Mitigation measure to be taken	Outcome	Action	Date for completion	Owner/ Contact Person
1	6	Continue regular maintenance and inspection.	Reduced risk of blockage and over spill.	Continue regular maintenance and inspection.	ongoing	Waterford City Council
2	4	Continue regular maintenance and inspection.	Reduced risk from storm events.	Continue regular maintenance and inspection.	ongoing	Waterford City Council
3	12	Continue regular maintenance and inspection, access aeration plant capacity to achieve nitrogen limits.	Reduced risk of aeration failure.	Continue regular maintenance and inspection. Access aeration system capacity to achieve nitrogen limits and improve infrastructure if required.	ongoing	Waterford City Council
4	12	Continue regular maintenance and inspection, access plant capacity to achieve nitrogen limits.	Reduced risk of failure of biological treatment.	Continue regular maintenance and inspection. Access plant capacity to achieve nitrogen limits and improve infrastructure if required.	ongoing	Waterford City Council
5	6	Continue regular maintenance and inspection.	Reduced risk of failure of clarifier.	Continue regular maintenance and inspection.	ongoing	Waterford City Council
6	6	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	Reduced risk of sludge spill onsite	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	ongoing	Waterford City Council
7	12	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	Reduced risk of sludge spill onsite	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	ongoing	Waterford City Council
8	12	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	Reduced risk of emission of biogas.	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	ongoing	Waterford City Council
9	12	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	Reduced risk of fire/ explosion due to storage of biogas onsite.	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	ongoing	Waterford City Council
10	6	Continue regular maintenance and inspection.	Reduced risk of failure of clarifier.	Continue regular maintenance and inspection.	ongoing	Waterford City Council

Table 4 Statement of Measures

Risk I.D.	Risk Score	Mitigation measure to be taken	Outcome	Action	Date for completion	Owner/ Contact Person
11	6	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	Reduced risk of spill/leak onsite	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	ongoing	Waterford City Council
12	6	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed.	Reduced risk of spill/leak onsite	Continue regular maintenance and inspection. Ensure staff training is up to date and SOPs are followed. Ferric chloride bunding to be provided.	ongoing	Waterford City Council
13	3	Put in place emergency procedures for prolonged power outage. Ensure staff training is up to date.	Reduced risk from power outage onsite.	Put in place emergency procedures for prolonged power outage. Ensure staff training is up to date.	ongoing	Waterford City Council
14	8	Continue regular maintenance and inspection.	Reduced risk from tank failure.	Continue regular maintenance and inspection.	ongoing	Waterford City Council
15	6	Continue regular maintenance and inspection.	Reduced risk from pipe failure.	Continue regular maintenance and inspection.	ongoing	Waterford City Council
16	12	Put in place emergency procedures for dealing with fire/firewater. Ensure staff training is up to date.	Reduced risk firewater.	Put in place emergency procedures for dealing with fire/firewater. Ensure staff training is up to date.	ongoing	Waterford City Council
17	4	None required	n/a	None required	n/a	n/a
18	12	Continue regular maintenance and inspection. Investigate source of saline infiltration, survey of sewers to identify sewers requiring rehabilitation.	Reduced risk of failure of biological treatment.	Survey of sewers for saline infiltration complete, report submitted to DEHLG for funding of proposed rehabilitation works to sewers.	ongoing	Waterford City Council
19	12	Continue regular maintenance and inspection, monitor loading to plant and biomass growth.	Reduced risk of failure of biological treatment.	To date the rate of return activated sludge draw-off from the Final Settlement Tanks has been adjusted and floating booms on the Aeration Tanks have been installed to control filamentous growth during underloading.	ongoing	Waterford City Council

Table 5 Risk Classification Table – Severity

Rating	Severity		
	Category	**Description**	**Cost of Remediation €**
1	Trivial	No damage or negligible change to the environment.	< 1,000
2	Minor	Minor impact/localised or nuisance	1,000 - 20,000
3	Moderate	Moderate damage to environment	20,000 -75,000
4	Major	Severe damage to local environment	100,000 - 175,000
5	Massive	Massive damage to a large area, irreversible in medium term	175,000 - 1,000,000

Table 6 Risk Classification Table – Occurrence

Rating	Occurrence		
	Category	**Description**	**Likelihood of Occurrence (%)**
1	Very Low	Very low chance (0-5%) of hazard occurring in 30 yr period *	0 – 5
2	Low	Low chance (5-10%) of hazard occurring in 30 yr period	5 - 10
3	Medium	Medium chance (10-20%) of hazard occurring in 30 yr period	10 - 20
4	High	High chance (20-50%) of hazard occurring in 30 yr period	20 - 50
5	Very High	Greater than 50% chance of hazard occurring in 30 yr period	>50

STATEMENT

Environmental Liability Risk Assessment (ELRA) for The Annual Environmental Report (AER) for Waste Licence WO244

I confirm the above are the measures which will be taken by the Local Authority in 2012

Signed: Colette Byrne Date 21/8/12

Name Colette Byrne, Director of Services

The appropriate Officer should sign the Programme of Measures

Appendix D

Residuals Management Plan

Waterford City WWTP (Sludge Treatment)
Springfield House, Gorteens, Co. Kilkenny
W0244-01

Residuals Management Plan

2012

Waterford City Council

Mott MacDonald

Waterford City WWTP (Sludge Treatment)
Springfield House, Gorteens, Co. Kilkenny
W0244-01

Residuals Management Plan

2012

Waterford City Council

Wallace House, Maritana Gate, Canada Street, Waterford City, Co. Waterford

Mott MacDonald, 5 Eastgate Avenue, Eastgate, Little Island, Cork, Co Cork, Ireland
T +353 (021) 4809 800 F +353 (021)4809 801 W www.mottmac.com

Mott MacDonald

Issue and revision record

Revision	Date	Originator	Checker	Approver	Description
A	Feb. 2011	A. Lambe	FMcG	FMcG	Draft Report
B	May 2011	A. Lambe	FMcG	FMcG	Issue following incorporation of WCC comments

T +353 (021) 4809 800 F +353 (021)4809 801 W www.mottmac.com

Content

1. Introduction

Condition 10 (Decommissioning and Residuals) of the Waste Licence states that:

Condition 10 Decommissioning & Residuals Management

10.1 Following termination, or planned cessation for a period greater than six months, of use or involvement of all or part of the site in the licensed activity, the licensee shall, to the satisfaction of the Agency, decommission, render safe or remove for disposal/recovery any soil, subsoil, buildings, plant or equipment, or any waste, materials or substances or other matter contained therein or thereon, that may result in environmental pollution.

10.2 Decommissioning Management Plan (DMP)

10.2.1 The licensee shall prepare, to the satisfaction of the Agency, a fully detailed and costed plan for the decommissioning or closure of the site or part thereof. This plan shall be submitted to the Agency for agreement within six months of the date of grant of the licence.

10.2.2 The plan shall be reviewed annually and proposed amendments thereto notified to the Agency for agreement as part of the AER. No amendments may be implemented without the agreement of the Agency.

10.2.3 The licensee shall have regard to the Environmental Protection Agency Guidance on Environmental Liability Risk Assessment, Decommissioning Management Plans and Financial Provision when implementing Condition 10.2.1 above.

10.3 The Decommissioning Management Plan shall include, as a minimum, the following:

(i) a scope statement for the plan;

(ii) the criteria that define the successful decommissioning of the activity or part thereof, which ensures minimum impact on the environment;

(iii) a programme to achieve the stated criteria;

(iv) where relevant, a test programme to demonstrate the successful implementation of the decommissioning plan; and

(v) details of the costings for the plan and the financial provisions to underwrite those costs.

10.4 A final validation report to include a certificate of completion for the Decommissioning Management Plan, for all or part of the site as necessary, shall be submitted to the Agency within three months of execution of the plan. The licensee shall carry out such tests, investigations or submit certification, as requested by the Agency, to confirm that there is no continuing risk to the environment.

This report is prepared in accordance with the EPA's Guidance on Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provision.

2. Site Evaluation

2.1 Description of Site

The facility is a wastewater treatment plant for Waterford City and its Environs to cater for domestic and industrial wastewater. It is located approximately 3km east of Waterford City in the townland of Gorteens, County Kilkenny. The facility is operated by Celtic Anglian Water on behalf of Waterford City Council and operates 24 hours/day and 365 days/year.

The wastewater treatment process consists of inlet screening, grit and grease removal, primary settlement, activated sludge process and final settlement. The facility includes infrastructure for the treatment of excess sludge generated by the wastewater treatment process. The maximum tonnage of sewage sludge to be treated is 95,100 tonnes per annum. No sludges or other wastes are permitted to be imported for treatment.

The sludge arising from wastewater treatment is thickened, pasteurised, treated in two anaerobic digesters and dewatered. Biogas from the digestion process is used for the on-site boilers, with any excess gas being flared. The wastewater preliminary treatment works and sludge dewatering works are located indoors, in the inlet works building and sludge building respectively. These areas are to be operated under negative air pressure with odours extracted to two odour control units for treatment.

2.2 Inventory of Site Plant and Raw Materials

The key infrastructural and process plant are as follows:

- Works Inlet Building
- Inlet Screens (Duty/Duty/Standby) and associated valves, isolation penstocks, and associated controls.
- Aerated grit channel and blowers and associated valves and control, surface scrapers, penstock Grit classifier and associated valves
- Grit screening washer and compactor, washwater sump and submersible pump, associated valves and control
- Odour Control System (OCU1)
  Biofilter, carbon filter, centrifugal fan, ducting exhaust stack, water supply
- Storm Tanks, submersible pumps and associated valves and control, jet mixer
- Flow measurement, flow splitter chamber
- Primary Settlement Tanks covered and clarifier scrapers, scum sump and submersible pump, sludge progressive cavity pumps and associated controls
- Selector Tank
- Inclined Bubble Aeration (IBA) Tanks, mixers, air blowers and associated valves and control equipment
- Final Settlement Tanks, scrapers, valves and associated control equipment
  RAS centrifugal pumps, valves, flow meter and associated controls (each tank has dedicated pump plus two common standby pumps)
  SAS centrifugal pumps, valves and associated controls
- Final Effluent Sampling and Washwater Pumping Station
- Sludge Building
- Sludge Thickening Belt Presses, Sludge Dewatering Belt Presses, Boilers, Generator, MCC, Electrical Switchgear
  OCU2- Biofilter, carbon filter, centrifugal fan, ducting exhaust stack, water supply

- Picket Fence Thickener, valves and associated controls
  Progressive cavity pumps (periodically waste sludge to sludge blending tank)
- Primary and Secondary Sludge Storage Tanks
- Thickened Sludge Blending Tank, mixer, valves and associated controls
- Pasteurisation System
  Pasteurisation Tanks, Progressive Cavity pumps, Macerator, valves, associated control, flow meters, heat exchangers
  Pasteurised Sludge Pumps
- Anaerobic Digestion
  Digester vessel, digester instruments, pressure / vacuum relief valves, digester mixer, sludge offtake
- Digested Sludge Tank, sludge dewater feed pumps, valves and associated controls
- Biogas holder (flexible membrane), condensate trap/chamber, pressure relief valves
- Flare Stack, control Valves and Burner
- Sludge Waste Storage Containers
- Liquor Sump, sludge liquors return pumps, valves and associated controls
- Liquid polymer bulk storage,
  polymer preparation plant and dosing plant
- diesel storage
- Administration Building

Biogas

Biogas produced onsite is stored in flexible membrane holder.

Diesel

Fuel, which is diesel, is stored on site for the generator and the boilers. The fuel storage tanks are located beside the Sludge Thickening, Dewatering and Digestion Control Building. The tanks are double skinned, which provide a second layer of protection.

Chemicals

Approximately 2.4 tonnes/week of polyelectrolytes are used in sludge thickening and dewatering. These are the only chemicals in the process.

Administration Building

The building contains standard office equipment.

2.3 Details of Site Wastes and Decontamination Requirements

The wastes generated are sludge bio-cake (41.1 t/day), screenings, grit, grease, mixed municipal waste, paper/card and plastic. No hazardous waste is generated.

2.4 Initial Screening and Operational Risk Assessment

2.4.1 Environmental Sensitivity

2.4.1.1 Human Occupation

There are residential areas to the west, northwest and northeast of the site. Residential areas are within 200 to 750m from the site boundary.

2.4.1.2 Groundwater Protection

The underlying geology of the site is comprised of shales and siltstones, which can be highly weathered in the upper layers and quite weak. The depth to bedrock ranges significantly in the area, ranging from 3.8 m BGL (Below Ground Level) to 16.6 m BGL in the vicinity of the site. Direction of groundwater flow appears to be from north to south, i.e. towards the River Suir.

The bedrock aquifer has been given a Groundwater Protection Zone classification by the GSI (as part of the Groundwater Protection Scheme for Co. Kilkenny) of Rf/M – Regionally Important of Moderate Vulnerability.

Well card data from the GSI Well Card Database (a record of wells drilled in Ireland) shows a number of wells within a 3 km radius of the WWTP site. From these records, the underlying bedrock in the area has been shown to be capable of yields ranging from moderate (40 – 100 m3/day) to excellent (>400 m3/day).

The IDA Park, located directly to north of the site, contains a borehole within the IDA Park for the purposes of water supply for the area until a public water supply is put in place by the Local Authority. It is understood that the IDA has permission to abstract approximately 10,100 gallons per hour. A public water supply has been constructed to the entrance to the IDA Park.

There are no direct emissions to groundwater. The only emissions to ground waters will be from the surface water runoff from the roads. Swales along the northern access road through the site, will allow some percolation into the ground. The balance of the road runoff is drained via a stormwater drainage system, discharging to a stream at the south east corner of the site. The swales are a SUDS (Sustainable Urban Drainage Systems) component and are grassed depressions for surface water drainage. The underlying soil is sandy clay with sandy gravelly clay in places. The underlying geology of the site is comprised of shales and siltstones.

2.4.1.3 Sensitivity of the Receiving Waters

The site is bounded by the Lower Suir Estuary to the south, and a small unnamed stream to the east. The Lower Suir Estuary was designated as Good Status (SERBD Transitional and Coastal Waters Action Programme 2009-2015). There is no information on the unnamed stream which runs alongside the site.

The Lower Suir Estuary is not designated as sensitive under the Urban Waste Water Treatment Regulations, 2001 (S.I. No. 254 of 2001) and subsequent amendments. The Middle Suir Estuary located upstream of the site is designated as sensitive under the Urban Waste Water Treatment Regulations, 2001 (S.I. No. 254 of 2001) and subsequent amendments. The Middle Suir Estuary was designated as Moderate Status (SERBD Transitional and Coastal Waters Action Programme 2009-2015).

Waterford Harbour is a designated shellfish water (2008) located >1km downstream of site.

Duncannon Beach is a designated bathing waters situated >5km downstream of the site. In 2009, the bathing waters were compliant with EU Mandatory Values.

2.4.1.4 Protected Ecological Sites and Species

The WWTP site overlaps with the Lower River Suir SAC boundary as the boundary of the SAC extends into the salt marsh and runs parallel to the shoreline. The infrastructure does not impinge on the designated site and there will be no impact during operation of the facility.

The Lower River Suir SAC (Site Code 002137) extends from freshwater stretches of the River Suir immediately south of Thurles, to the tidal stretches as far as the confluence with the Barrow/Nore immediately east of Cheekpoint in Co. Waterford. The site is a SAC selected for the presence of the priority habitats on Annex I of the E.U. Habitats Directive - alluvial wet woodlands and Yew Wood. The site is also selected as a SAC for floating river vegetation, Atlantic salt meadows, Mediterranean salt meadows, old oak woodlands and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive - Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon and Otter.

Other sites designated under the Habitats and Birds Directives within 5km of the site include the River Barrow and Nore SAC (Site Code 002162) that joins the Suir less than 5km downstream.

2.4.1.5 Air Quality and Topography

The site is situated on the banks of the River Suir at an elevation of approximately 10m OD. Sensitive receptors are located at elevations greater than 20m OD. Therefore the terrain is classified as intermediate terrain, i.e. where the elevations lie between the stack tip elevation and the plume rise elevation.

An assessment of the baseline air quality in the region of the facility was carried out by reference to suitable EPA long-term monitoring data (Updated EIS, April 2008). Air quality monitoring programs have been undertaken in recent years by the EPA and Local Authorities. The most recent annual report on air quality entitled “Air Quality Monitoring Annual Report 2006” (EPA, 2007), details the range and scope of monitoring undertaken throughout Ireland. The EIS (2008) for the facility concluded that existing baseline levels of NO2, SO2, CO, benzene, PM10 and PM2.5 were below ambient air quality limit values in the vicinity of the site.

The predominant wind direction is south-westerly with an average wind speed of approximately 4-6 m/s.

2.4.1.6 Sensitive Agricultural Receptors

The agricultural land surrounding the site is identified as pasture by the EPA Corine landcover dataset. There were no fruit, vegetable or dairy farming identified within 150m of the site.

2.4.2 Compliance Record

The Waterford City WWTP is a newly licensed facility and has been operating since July 2010. Therefore the facility is classified as Compliant/New Facility with a score of 1.

2.4.3 Operation Risk Assessment

Table 2.5.1 Operation Risk Assessment

Complexity	Complexity Band	Score	
Activity Class:			
Class 6 - Biological treatment not referred to elsewhere in this Schedule which results in final compounds or mixtures which are disposed of by means of any activity referred to in this Schedule	G3	-	
Schedule 4 No. 2 "Recycling or reclamation of organic substances which are not used as solvents (including compositing and other biological processes)."	G4	4	Where more than one scheduled activity is located at a facility, then the highest Complexity Band is applied.
Environmental Sensitivity	**Sub Matrix Score**	**Score**	
Human Occupation			
- Located 50-250m from Site	3		
Groundwater Protection			
- Regionally Important Aquifer	2		
- Moderate Vulnerability	1		
Sensitivity of Receiving Waters			
- Good Status Waters	2		
Protected Ecological Sites and Species			
- Lower River Suir SAC overlaps site boundary	2		
Air Quality and Topography			
- Intermediate terrain	1		
Sensitive Agricultural Receptors			
- Fruit, vegetable or dairy farming >150m from activity footprint	0		
Total Environmental Sensitivity	11	2	
Compliance Record		**Score**	
Compliance/New Facility		1	
OVERALL RISK SCORE / RISK CATEGORY			
OVERALL RISK SCORE Complexity x Environmental Sensitivity x Compliance Record	4x2x1 =	8	
RISK CATEGORY		Category 2	

3. Residual Management Plan Scope and Criteria

3.1 Introduction and Scope of Plan

"10.1 Following termination, or planned cessation for a period greater than six months, of use or involvement of all or part of the site in the licensed activity, the licensee shall, to the satisfaction of the Agency, decommission, render safe or remove for disposal/recovery, any soil, subsoils, buildings, plant or equipment, or any waste, materials or substances or other matter contained therein or thereon, that may result in environmental pollution."

The scope of this plan addresses the key issues, which would occur in an orderly shutdown of the activity or part thereof over the closure period of 4 months (for a full closure). Refer to Table 3.1.1 for closure programme. The closure programme details the cessation of activities and makes an allowance for the shutting downing of processing activities and for the removal of the sludges/ wastewater from site. This time period may be reduced depending on production.

The scope of the plan includes the following major activities:

- Setting up a management structure to oversee the Residuals Management Plan.
- Cessation of all treatment activities
- Removal of all remaining raw materials and final products from the site
- Cleaning and decontamination of all equipment and buildings
- Demolition of Buildings
- Groundwater monitoring.

A residual includes any potentially contaminating material and includes chemicals, wastes, buildings and equipment. In general, specialist equipment will be sold or distributed to other plants in the event of a shut down.

It is envisaged that suitably qualified employees at Waterford City Council will manage and oversee the Residuals Management Plan. Outside contractors required for demolition, cleaning, recycling activities or waste disposal would be licensed and approved.

This section details the plant, buildings, equipment and other materials, which require consideration as part of the closure process. The closure is detailed with regard to the closure of process areas/ activities, with further details regarding the overall residuals present onsite. Details of residuals which require decontamination and the proposed method of decontamination are provided.

It is expected that clean closure will be achieved; a benchmark set of criteria for clean closure for Waterford City WWTP is set out in Section 3.2.

Process Equipment

Upon implementation of the Residuals Management Plan, the transfer of wastewater to the site will cease. Once the final wastewater has been processed, and sludge removed from the site, decommissioning of the process equipment commence.

The processing plant will be isolated from the power source. The plant will then be drained of any oils/chemicals and taken offsite for reuse or sale. If this is not viable, the plant will be dismantled and sold as scrap metal.

The process tanks will be decontaminated and the washings will be tankered from site for treatment. Once the process tanks have been cleaned, the reinforced concrete tanks will be demolished and disposed of by a suitable contractor. The storage tanks onsite will be decommissioned and removed from the site. Reuse of the storage tanks should be considered where appropriate. Any process tanks not suitable for reuse will be dismantled and sold as scrap metals or sent for recycling.

Buildings and Infrastructure

The decommissioning of activities in the respective buildings (Inlet Works Building, Sludge Building, and Administration Building) is discussed above. Once the plant, chemicals, process residuals are removed and the buildings are washed, a final walkthrough inspection of the buildings will be undertaken.

The buildings will be demolished by an approved contractor followed by appropriate disposal.

Ancillary Services

Ancillary services areas such as the Administration Building will be decommissioned in a timely manner.

Office equipment will be isolated from electricity supply. Suitable office equipment will be redistributed to another site, sold for reuse or recycled as scrap materials and disposed of by a licensed contractor.

Canteen equipment and furniture will be sold for reuse or recycled as scrap materials and disposed of by a licensed contractor as appropriate.

Chemicals and Fuel

The quantities of bulk chemicals onsite will be monitored in accordance with the scheduled shut down of the site. Bulk chemicals will be returned to the vendor. Any raw materials which cannot be returned to the supplier whether due to minimal volume constraints or failure to find a suitable user for the material will be treated as a waste product and treated accordingly as outlined in the section of this plan detailing waste handling and disposal.

The bulk chemical storage tanks will be decommissioned and will either be distributed to another site or sold as scrap metal, once they have been decontaminated.

The ordering and supply of diesel to the site will be inline with the planned cessation of activities onsite. Diesel residuals remaining onsite in the bunded storage area will be returned to the vendor or reused in other sites. The bunded diesel storage area will be jetted and cleaned by a specialist contract. The washings will be removed from site and treated by a licensed contractor.

Waste

Existing environmental policies regarding recycling and waste disposal will continue to apply during plant decommissioning. Existing Environmental practises regarding the disposal of waste will be implemented during plant shutdown.

Any plant which cannot be redistributed to another plant or sold for reuse or sold as scrap metals (or materials) will be treated as waste. A contingency is allowed in the costing of the plan to allow for this occurrence where reuse or recycling is not appropriate.

Any chemicals or fuels which cannot be returned to the supplier whether due to minimal volume constraints or failure to find a suitable user will be treated as a waste product and treated accordingly. These chemicals will be disposed of utilising a hazardous waste contractor.

Chemical and fuel wastes outlined above include:

- Polyelectrolyte
- Diesel
- Biogas (it is envisaged that the biogas will be utilised completely, or flared in the process prior to plant shutdown)

Groundwater Monitoring

Groundwater monitoring, will be undertaken in accordance with the licence requirements at the onset of the plant shut down, and again at the completion of the plant shutdown. No further monitoring is anticipated, unless requested by EPA.

Table 3.1.1 Programme

	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16
Cessation of receipt of wastewater	x															
Cessation of wastewater/sludge processing	x	x														
Removal of Sludge		x	x													
Process tanks cleaning			x													
Chemicals and fuel removal				x												
Plant inventory					x											
Plant decontamination, decommissioning and removal						x	x	x	x							
Removal of Tanks										x	x	x				
Removal of General Wastes													x			
Building decontamination, inspection													x			
Demolition and Removal Building materials														x	x	
Groundwater Monitoring	x															x

3.2 Criteria for successful decommissioning

Clean Closure is envisaged for this site and the criteria for successful decommissioning are as follows:

1. All plant and buildings safely decontaminated using standard procedures and authorised contractors.

2. All Wastes handled, packaged, temporarily stored and disposed or recovered in a manner which complies the regulatory requirements:

    a. All hazardous materials should be classified in accordance with European Communities (Classification, Packaging, Labelling and Notification of Dangerous Substances) Regulations, 1994.

    b. Handling and transport of waste should be undertaken in accordance with the Waste Management Act 1996.

3. All relevant records relating to waste and materials movement and transfer or disposal were managed and retained throughout the closure process.

4. Remove all potential sources of effluent generation from the site and minimise water use and release quantities during decommissioning

5. There was no soil or groundwater contamination at the site. This was verified using monitoring data and a soil/groundwater assessment at the time of closure.

4. Residual Management Plan Costs

The Residual Management Plan Costs are set out in Table 4.1.1., expenditure includes man-hours, transport costs, disposal costs, specialist contractors and groundwater testing.

Table 4.1.1 Cost of Plan

Residual	Action/Disposal	Costs incurred	Cost
			Total
-	Management of RMP	man-hours	30,000
Waste	Implement existing operational practice. Reuse or recycle where possible. Utilise best practice and comply with regulatory requirements.	man-hours disposal costs	5,000
Chemicals and Fuel	Return to vendor where possible. Dispose of remainder as waste, utilising best practice and complying with Regulatory Requirements.	man-hours disposal costs	3,000
	Decontaminate bunds by specialist contractor. Dispose and treat washings at a licensed facility.	specialist contractor disposal costs	10,000
Process Plant and Equipment	Follow decommissioning programme as set out in Section 3. Decontaminate tanks, demolish tanks, disposal of waste by a licensed contractor Remove pipes and disposal by licensed contractor Utilise specialist contractors for removal of gas/chemicals. Decontaminate plant and sell to another site or sell remainder as scrap.	man-hours specialist contractor disposal costs	206,000
	Office Equipment	man-hours disposal costs	2,000
Buildings and Infrastructure	Follow decommissioning programme as set out in Section 3. Decontaminate buildings. Demolish Buildings.	man-hours disposal costs	27,000
Groundwater	groundwater monitoring and groundwater report	At start of closure period and following completion of RMP	12,000
Environmental Reports			10,000
Contingency			30500
TOTAL			335,500