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WASTEWATER TREATMENT PLANT AT SPRINGFIELD HOUSE, GORTEENS. CO. KILKENNY AND ASSOCIATED WORKS

UPDATE OF ENVIRONMENTAL IMPACT STATEMENT

Technical Report Prepared For

Waterford City Council

Technical Report Prepared By

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Our Reference

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EXECUTIVE SUMMARY

The proposed urban Wastewater Treatment Plant (WWTP) to serve Waterford City and its environs is currently under construction. An Environmental Impact Statement (November 1998) was submitted with the planning application for the WWTP. The project was granted permission in January 2000, An Bord Pleanala Planning Reference PL 10.111331.

The WWTP requires an EPA Waste Licence under current legislation. Following discussions with the EPA, it was requested by the EPA that relevant sections of the EIS should be updated in order to ensure that the Waste Licence application is complete and takes into account any relevant environmental legislative changes, and the subsequent implications or requirements stemming from those changes or new legislation.

It was agreed with the EPA that it would be sufficient and appropriate to update only the environmental aspects of the EIS that may have an impact on the current situation. These include Air Quality (including Odour) & Climate, Noise, Water Quality and Ecology (Flora and Fauna). The report is therefore an Addendum to the EIS and should be read in conjunction with the EIS document.

In terms of air quality and climate, there are potential impacts from the construction phase, however, if a satisfactory dust minimisation plan is implemented, the effect of construction on air quality will be slight and in terms of climate, insignificant. There will be no significant impacts on the air quality environment as a result of the operation of the WWTP.

There are a number of odour sources within the site boundary, with the inlet works and the sludge treatment works being predicted to generate the highest concentrations of odour (mainly hydrogen sulphide). A odour dispersion model for the facility predicts that with the odour abatement measures in place, i.e. 2 no. odour control units, the odour impact at the nearest sensitive receptors will be imperceptible and the odour concentrations at the boundary of the facility will be low.

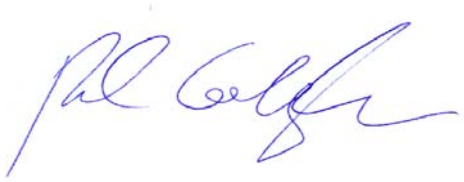
A noise model for the site has been carried out, which contains over thirty individual noise sources for a range of items throughout the site. A baseline survey of current noise levels had been conducted and the predicted noise levels at nearby noise-sensitive locations have been calculated. The predicted noise levels are all below the 45dB(A) night-time criterion typically used by the EPA. Moreover, the noise levels are below background night-time noise levels measured during the survey. It can therefore be expected that while noise from the WWTP may be audible during quiet periods at some locations, it is not expected to be unduly intrusive.

For the water environment, the hydrogeological environment has been assessed, as it was not assessed in the previous EIS. The underlying bedrock aquifer is shown to be classed as regionally important and moderately vulnerable. The water quality status appears to have deteriorated in the Suir Estuary, as shown by the most up to date monitoring data from the SERBD (Southeast Regional Basin District) project. The Water Framework Directive requirements will ensure that appropriate ongoing monitoring of the water quality will be carried out and the predicted impact of the WWTP facility and outfall will be significant - positive.

In terms of ecology, the permitted development site overlaps with an cSAC boundary as the boundary extends half-way into the salt marsh and runs parallel to the shoreline. A site visit showed that none of the areas affected by construction of the plant appear to have significantly affected the salt marsh. The exception to this would be the construction of the

hardcore road across the salt marsh at the eastern end of the site which encroaches a small degree upon the edge of the cSAC.

Report Prepared By: **Report Checked By:**



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CONTENTS **Page**

1.0 INTRODUCTION

As part of the Waterford Main Drainage Scheme, Waterford Corporation (City Council) plans to construct and operate a new urban WWTP and outfall pipeline on an 18ha portion of land located at Springfield House, Gorteens, Co. Kilkenny. The purpose of the development is to provide Waterford City and its Environs with appropriate primary and secondary treatment for a population equivalent of 189,000.

An Environmental Impact Statement (November 1998) (herein referred to as EIS) was submitted with the planning application for the WWTP. The project was granted permission in January 2000, An Bord Pleanala Planning Reference PL 10.111331.

The WWTP requires an EPA Waste Licence, under the Waste Management Acts, 1996 – 2005 and the Protection of the Environment Act, 2003 (S.I. 27 of 2003). Legislative requirements for a waste licence application are largely set out in the Waste Management (Licensing) Regulations, 2004 (S.I. No. 395 of 2004).

Following discussions with the EPA (Meetings on 05/12/07 and 15/02/08), it was requested by the EPA that the relevant sections of the EIS should be updated in order to ensure that the Waste Licence application (which the EIS is submitted as part of) is complete and takes into account any relevant environmental legislative changes, i.e. new legislation, and the subsequent implications or requirements stemming from those changes or new legislation.

Due to the significant time lapse from the submission of the original EIS to the time of the application for a Waste Licence, there are a number of sections of the EIS that are not current, including census data, development plans etc. However, for the purpose of the Waste Licence application, it was agreed with the EPA (meeting of 05/12/07 and 15/02/08, with Jonathan Durham and Marian Doyle) that it would be sufficient and appropriate to update only the environmental aspects of the EIS that may have an impact on the current situation.

Thus, the environmental aspects of the WWTP that are covered in this report are as follows:

- Air Quality (including Odour) & Climate
- Noise
- Water
- Ecology (Flora and Fauna)

The report is therefore an Addendum to the EIS and should be read in the context of the EIS document.

This EIS update takes note of the methodology specified by the Environmental Protection Agency (EPA) [1, 2].

2.0 AIR QUALITY (INCLUDING ODOUR) & CLIMATE

2.1 Introduction

AWN Consulting Limited has been commissioned to conduct an assessment into the likely impact on air quality (including odour) and climate associated with the proposed Waterford WWTP. This is an update of the original EIS for the facility.

2.1.1 Ambient Air Quality Standards

In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health- or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Tables 2.1 - 2.3 and Appendix 2.1).

Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations 2002, which incorporate EU Directives 1999/30/EC and 2000/69/EC (see Tables 2.1 - 2.2). Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Appendix 2.1).

The European Commission sponsored report "Second Position Paper on Particulate Matter - Final" (2004) recommended that the principal metric for assessing exposure to particulates should be $PM_{2.5}$ rather than PM_{10} after 2010. The report also suggested that the annual average should be in the range 12 - 20 µg/m^3 which should be compared with the PM_{10} annual limit value, to be complied with in 2005, of 40 µg/m^3. In relation to the maximum 24-hour limit value, a starting point for discussion was set at 35 µg/m^3 as a 90th%ile. These indicative limit values were to be reviewed in the light of further information on health and environmental effects, technical feasibility etc.

Following on from this report, proposed Directive COM(2005) 447 on Ambient Air Quality and Cleaner Air for Europe (21/09/2005) has recently outlined proposals to revise and combine several existing Ambient Air Quality Standards including Council Directives 96/62/EC, 1999/30/EC and 2000/69/EC. A recent Common Position has been adopted by the EU Council (COM(2007) 320, dated 29/06/07) with a view to adoption of this Directive. In regards to existing ambient air quality standards, it is not proposed to modify the standards but to strengthen existing provisions to ensure that non-compliances are removed. In addition, it is proposed to set new ambient standards for $PM_{2.5}$.

The proposed approach for $PM_{2.5}$ is to establish a target value of 25 µg/m^3, as an annual average (to be attained by 2010), coupled with a non-binding target to reduce human exposure generally to $PM_{2.5}$ between 2010 and 2020. This exposure reduction target is currently proposed to be on a sliding scale of 7 -13 µg/m^3 based on the average exposure indicator (AEI). The AEI is based on measurements taken in urban background locations averaged over a three year period.

Pollutant	Regulation	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	1999/30/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year	40% until 2003 reducing linearly to 0% by 2010	200 $\mu g/m^3$ NO_2
		Annual limit for protection of human health	40% until 2003 reducing linearly to 0% by 2010	40 $\mu g/m^3$ NO_2
		Annual limit for protection of vegetation	None	30 $\mu g/m^3$ NO + NO_2
Lead	1999/30/EC	Annual limit for protection of human health	60% until 2003 reducing linearly to 0% by 2005	0.5 $\mu g/m^3$
Sulphur dioxide	1999/30/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year	90 $\mu g/m^3$ until 2003, reducing linearly to 0 $\mu g/m^3$ by 2005	350 $\mu g/m^3$
		Daily limit for protection of human health - not to be exceeded more than 3 times/year	None	125 $\mu g/m^3$
		Annual & Winter limit for the protection of ecosystems	None	20 $\mu g/m^3$
Particulate Matter (as PM_{10}) Stage 1	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year	30% until 2003 reducing linearly to 0% by 2005	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health	12% until 2003 reducing linearly to 0% by 2005	40 $\mu g/m^3$ PM_{10}
Particulate Matter (as PM_{10}) Stage 2[Note1]	1999/30/EC	24-hour limit for protection of human health - not to be exceeded more than 7 times/year	Not to be exceeded more than 28 times until 2006, 21 times until 2007, 14 times until 2008, 7 times until 2009 and zero times by 2010.	50 $\mu g/m^3$ PM_{10}
		Annual limit for protection of human health	50% from 2005 reducing linearly to 0% by 2010	20 $\mu g/m^3$ PM_{10}
$PM_{2.5}$	COM (2005) 447	Annual concentration cap designed to limit unduly high risks to the population	None. Limit value applicable in 2010	25 $\mu g/m^3$ $PM_{2.5}$

Note 1 **EU 1999/30/EC states *"Indicative limit values to be reviewed in the light of further information on health and environmental effects, technical feasibility and experience in the application of Stage 1 limit values in the Member States"*. Proposed EU Directive COM (2005) 447 will *"replace the indicative limit values for PM_{10} for the year 2010 by a legally binding "cap" for the annual average concentrations of $PM_{2.5}$ of 25 µg/m3 to be attained by 2010"*.**

Table 2.1 Air Quality Standards Regulations 2002 (based on EU Council Directive 1999/30/EC)

Pollutant	Regulation	Limit Type	Margin of Tolerance	Value
Benzene	2000/69/EC	Annual limit for protection of human health	100% until 2006 reducing linearly to 0% by 2010	5 $\mu g/m^3$
Carbon Monoxide	2000/69/EC	8-hour limit (on a rolling basis) for protection of human health	60% until 2003 reducing linearly to 0% by 2005	10 mg/m^3 (8.6 ppm)

Table 2.2 Air Quality Standards Regulations 2002 (based on EU Council Directive 2000/69/EC)

Substances	Time-weighted Average	Averaging Time
Lead	0.5 $\mu g/m^3$	1 year
Nitrogen dioxide	200 $\mu g/m^3$ 40-50 $\mu g/m^3$	1 hour annual
Carbon monoxide	100 $\mu g/m^3$ 60 $\mu g/m^3$ 30 $\mu g/m^3$ 10 $\mu g/m^3$	15 minutes 30 minutes 1 hour 8 hour
Benzene	Note 1	
Particulate matter (PM_{10})	Note 2	

Note 1 No safe level recommended owing to carcinogenicity.
Note 2 No specific guideline recommended because no obvious exposure concentration and duration that could be judged a threshold and decreased by uncertainty factors to avoid risk.

Table 2.3 WHO Guidelines for Air Quality Europe 2000

2.1.2 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002[1,2]. For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2007 to 2012[3,4]. The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as Emissions Trading and burden sharing. The most recent Conference of the Parties (COP13) to the agreement was convened in Bali in December 2007.

2.1.3 Methodology

The assessment of air quality (excluding odour) has been carried out using a phased approach as recommended by the UK DEFRA[5,6]. The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment, an initial scoping of possible key pollutants was carried out. An examination of recent EPA and Local Authority data in Ireland[7-9] (see below under "Available Background Data"), has indicated that SO_2, smoke and CO are unlikely to be exceeded at a location such as the current one.

The scoping assessment also indicated that the pollutants NO_2, PM_{10}, $PM_{2.5}$ and benzene are also unlikely to be exceeded thus the current assessment focused on identifying the existing baseline levels of these pollutants in the region of the proposed development by analysis of suitable EPA monitoring data. Thereafter, a

qualitative assessment on air quality and climate was carried out based on the nature, size and location of the proposed development.

2.2 Description of the Existing Environment

2.2.1 Meteorological Data

A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels)[10]. Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a non-linear function of wind speed.

The nearest representative weather station collating detailed weather records is Rosslare Meteorological Station, which is located approximately 50 km east of the site. Data from Rosslare Meteorological Station has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Figure 2.1). For data collated during five representative years (2000 - 2004), the predominant wind direction is south-westerly with an average wind speed of approximately 4-6 m/s.

2.2.2 Baseline Air Quality

An assessment of the baseline air quality in the region of the proposed development has been carried out by reference to suitable EPA long-term monitoring data. 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)[7,8], details the range and scope of monitoring undertaken throughout Ireland.

As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes[7,9]. Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 15 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000 is defined as Zone D. In terms of air monitoring, Waterford City is categorised as Zone C[8]. EPA monitoring was carried out at the Zone D town of Ferbane and the Zone C towns of Ennis, Wexford, Bray and Limerick using continuous monitors in 2006.

Long term NO_2 monitoring carried out in Bray, Wexford, Limerick and Ennis in 2006[7,8] gave a range of annual average levels from 12 to 16 µg/m^3. Based on the above information, a conservative estimate of 2008 background NO_2 concentration for the Waterford region is 15 µg/m^3.

Long-term SO_2 monitoring is carried out at the two rural Zone D locations, Shannon Estuary and Kilkitt[7]. Shorter term monitoring was carried out at the Zone C locations of Ennis and Bray. The SO_2 annual average in 2006 for the sites ranged from 2 µg/m^3 to 9 µg/m^3. The results of SO_2 monitoring carried out at the urban Zone D location in

Ferbane in 2006 indicated an average SO_2 concentration of 2 µg/m^3[3(8)], with no exceedences of the 1-hour or 24-hour limit values. Hence long-term average concentrations measured at these locations were significantly lower than the annual average limit value for the protection of ecosystems of 20 µg/m^3. Based on the above information, a conservative estimate of the background SO_2 concentration for the Waterford region in 2008 is 5 µg/m^3.

With regard to benzene, continuous monitoring was carried out at Mountrath in 2004/05[(7)], with a long-term average of 0.3 µg/m^3 respectively. The results of monitoring carried out in the Zone C locations of Ennis and Bray in 2006 indicated a long-term average of 0.6 and 0.3 µg/m^3 respectively[(7)]. Based on the above information, a conservative estimate of the background benzene concentration for the Waterford region in 2008 is 0.5 µg/m^3.

PM_{10} monitoring was carried out at Bray, Galway, Wexford and Ennis in 2006 (Zone C locations)[(7,8)]. The annual average for these sites ranged from 17 to 32 µg/m^3. Data from Phoenix Park provides a good indication of urban background levels. The annual average in 2006 was 14 µg/m^3. Based on the available data, a conservative estimate of 2008 background PM_{10} concentration for the Waterford region is 20 µg/m^3.

The results of $PM_{2.5}$ monitoring in Cork in 2006 indicated average $PM_{2.5}/PM_{10}$ ratio of 0.6[(7,8)]. Based on this information, a conservative ratio of 0.6 was used to generate a current background $PM_{2.5}$ concentration in the Waterford region of 12 µg/m^3.

The results of CO monitoring carried out in Ferbane in 2006 (urban Zone D) showed no exceedences of the 8-hour limit value[(7)] with an average level of 0.2 mg/m^3. Data for the Zone C station in Wexford and Bray in 2006 indicated a long-term average of 0.5 and 0.3 mg/m^3 respectively[(7)]. Based on the above information, a conservative estimate of the background CO concentration for the Waterford region in 2008 is 0.5 mg/m^3.

In summary, existing baseline levels of NO_2, SO_2, CO, benzene, PM_{10} and $PM_{2.5}$ are below ambient air quality limit values in the vicinity of the proposed development.

2.2.3 Odour Baseline

A baseline odour survey was carried out by Bord na Mona in April 2007 at the site and surrounding area (Report Ref. ECS2363).

Hydrogen sulphide and meteorological measurements were made over a two day period in the vicinity of the WWTP site and also at selected sensitive receptors. Monitoring was carried out at over 75 locations on each day.

The hydrogen sulphide levels recorded during the baseline survey ranged from 2.33 parts per billion (ppb) to 4.00ppb for the first day of monitoring, and ranged from 5.00ppb to 9.00ppb on the second day of monitoring, giving an average of 4.62ppb for the overall survey. The ambient measurements were compiled and odour contour plots were generated. The Bord na Mona report determined that the levels measured during the survey were comparable to previous ambient background concentrations measured during sampling programmes carried out in Wales in 2003 and 2004.

It should be noted that whilst baseline odour surveys can give ambient odour levels for the time of the survey, they only represent the period of time in which the survey was performed, and other baseline odours may be present at different times of year,

or depending on the meteorological conditions. It should also be noted that not all odour originating from the operation of a WWTP are from hydrogen sulphide emissions. However, only hydrogen sulphide was monitored for this baseline survey.

2.3 Characteristics of the Proposed Development

2.3.1 Air Quality

As stated above, road traffic would be expected to be the dominant source of emissions of NO_X, PM_{10}, benzene and CO in the region of the development and thus is the focus of the current assessment.

Particulate emissions may arise from road traffic with on-site movement and activities an additional minor source of particulate emissions.

2.3.2 Climate

Road traffic would be expected to be the dominant source of greenhouse gas emissions as a result of the development. Vehicles will give rise to CO_2 and N_2O emissions near the proposed development.

Wastewater is a potential source of methane (CH_4) when treated or disposed anaerobically (digested) if releases into the environment are likely, however in this instance anaerobic digestion followed by combustion of the methane to produce heat is proposed, and the risk of methane being released to the atmosphere is considered negligible. Wastewater can also be a minor source of nitrous oxide (N_2O) emissions. Carbon dioxide (CO_2) emissions from wastewater treatment are not considered in the *IPCC Guidelines* because these are of biogenic origin and are thus carbon neutral[11].

2.3.2 Odour

The WWTP will include a number of buildings and plant items that will operate 365 days per year. It is considered that there are a number of areas within the site that will generate odours during the operational phase of the facility. The areas of the facility where odour may be produced are the Belview Pumping Station, the storm tanks, the selector and aeration tanks, the final settlement tanks, the digested holding tank, the inlet works and preliminary treatment works and the sludge treatment works.

The odours from the inlet and primary treatment works and the sludge treatment works will be directed to 2 no. odour control units (OCU), each with a stack. OCU 1 will discharge air from the inlet works and primary treatment works at a velocity of 13,815 m^3/hr and 19 ppm H_2S. OCU will discharge air from the sludge treatment works at a velocity of 5,042 m^3/hr and 49 ppm H_2S.

2.4 Predicted Impact of the Proposal

2.4.1 Air Quality

The assessment of baseline air quality in the region of the proposed development has shown that current levels of key pollutants are significantly lower that their limit values.

Due to the size, nature and location of the Waterford WWTP development, which will lead to a small increase in road traffic emissions, the proposed development is expected to have an imperceptible impact on air quality in terms of NO_2, SO_2, benzene and CO.

Particulate emissions from road traffic will also be insignificant due to the existing low levels of traffic and with a small increase in road traffic emissions envisaged as a result of this development. Particulate emissions due to the on-site activity will also be expected to be insignificant.

2.4.2 Climate

Greenhouse gas emissions, as a result of this development, will be imperceptible in terms of Ireland's obligations under the Kyoto Protocol[1,2]. Any CH_4 which is formed through anaerobic digestion will be collected, stored and used as a fuel to heat the boilers for the pasteurization process.

2.4.3 Odour

Due to the nature of the activity, i.e. wastewater treatment, there is the potential to generate odours from the facility that are significant. There is a potential impact on the sensitive receptors, i.e. domestic dwellings, in the area surrounding the site.

As mentioned in Section 2.3.2, there are a number of areas within the facility that could generate odours. There are a number sources of odour that have been identified. These are shown in Table 2.3.

Table 2.3 Odour Sources from the WWTP

No.	Odour Source	No. Within Source
1	Odour Control Unit 1	1
2	Odour Control Unit 2	1
3	Belview Pumping Station	1
4	Selector Tank Distribution Chamber	9
5	Aeration Tanks	24
6	Storm Tanks	9
7	Final Settlement Tanks	9
8	Digested Sludge Holding Tank	9

An odour dispersion model was generated to predict the direction and concentration of odours from the WWTP facility. All odour sources were modeled and meteorological data for the area was included in the model. The full odour model report is included as Appendix 2.2. The short-term odour concentrations were assumed to be a factor of ten greater than the hourly averages predicted by the model.

Maximum odour concentrations at the site boundaries and the closest sensitive receptors were predicted, for both short-term and long-term periods, from the results of the model.

The results showed that, under normal operating conditions, the isopleths (contours) corresponding to 3 ou_E/m^3 (95^{th} percentile, 1-hour average) and 5 ou_E/m^3 (95^{th} percentile, anytime) does not extend to, or beyond the site boundary (See Appendix 2.2).

Similarly, at the nearest receptors, i.e. domestic dwellings (being more distant from the site boundaries), the isopleth corresponding to 0.3 ou_E/m^3 (95^{th} percentile, 1-hour average) and 0.5 ou_E/m^3 (95^{th} percentile, anytime) does not extend to their location (See Appendix 2.2).

Therefore, provided the odour abatement systems (Odour Control Units 1 & 2) are installed and operating to the design specification, there will be odours generated at

the WWTP facility, however the impact will be long term - imperceptible at the nearest receptors.

2.5 Mitigation Measures to Reduce Adverse Effects

2.5.1 Air Quality

Mitigation measures in relation to traffic-derived pollutants have focused generally on improvements in both engine technology and fuel quality. Recent EU legislation, based on the EU sponsored Auto-Oil programmes, has imposed stringent emission standards for key pollutants (Euro IV (98/69/EC) for passenger cars to be complied with in 2006 and Euro IV and V for diesel HGVs introduced in 2006 and 2008). In relation to fuel quality, a recent EU Fuel Directive (98/70/EC) has introduced significant reductions in both sulphur and benzene content of fuels.

2.5.2 Climate

CO_2 emissions will be reduced to 120 - 125 g/km by 2012 through EU legislation. This measure will reduce CO_2 emissions from new cars by an average of 25% in the period 1995 to 2007/2009 whilst 15% of the necessary effort towards the overall climate change target of the EU will be met by this measure alone[12]. Additional fuel efficiency measures include VRT and Motor Tax rebalancing to favour the purchases of more fuel-efficient vehicles, the National Car Test and Fuel Economy Labelling[12,13].

2.5.3 Odour

Measures have been adopted to reduce odour escape from the various parts of the WWTP. As the main areas of the WWTP that will generate odours are the inlet works and primary treatment works, and also the sludge treatment works, these areas will be contained and connected to 2 no. odour control units (OCU). The odour reduction across the treatment stage for each of these OCUs is 99% of H_2S, which is 97% of total odour emissions.

2.6 CONSTRUCTION IMPACTS AND MITIGATION MEASURES

This sub-section has been included for completeness, even though the construction phase of the development is already underway.

2.6.1 Local Construction Impacts

Air Quality

There is the potential for a number of emissions to the atmosphere during the construction of the development. In particular, the construction activities may generate quantities of dust. Construction vehicles, generators etc., will also give rise to some exhaust emissions.

A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential

source and any impacts from dust deposition will typically be within several hundred metres of the construction area.

In order to ensure that no dust nuisance occurs, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface while any un-surfaced roads shall be restricted to essential site traffic only. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.

Vehicles using site roads shall have their speed restricted, and this speed restriction must be enforced rigidly. Indeed, on any un-surfaced site road, this shall be 20 km per hour, and on hard surfaced roads as site management dictates. Vehicles delivering material with dust potential shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

All vehicles exiting the site shall make use of a wheel wash facility, preferably automatic, prior to entering onto public roads, to ensure mud and other wastes are not tracked onto public roads. Public roads outside the site shall be regularly inspected for cleanliness, and cleaned as necessary.

Material handling systems and site stockpiling of materials shall be designed and laid out to minimise exposure to wind. Water misting or sprays shall be used as required if particularly dusty activities are necessary during dry or windy periods.

Furthermore, during movement of the soil both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to ensure no potential for dust emissions.

At all times, the procedures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, satisfactory procedures will be implemented to rectify the problem.

The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practise and procedures.

Climate

There is the potential for a number of greenhouse gas emissions to atmosphere during the construction of the development. Construction vehicles, generators etc., may give rise to CO_2 and N_2O emissions.

2.6.2 Air Quality & Climate

If a satisfactory dust minimisation plan is implemented, the effect of construction on air quality will be slight and in terms of climate, insignificant.

2.6.3 Odour

There will be no odour impacts from the construction phase and therefore, no mitigation measures are required.

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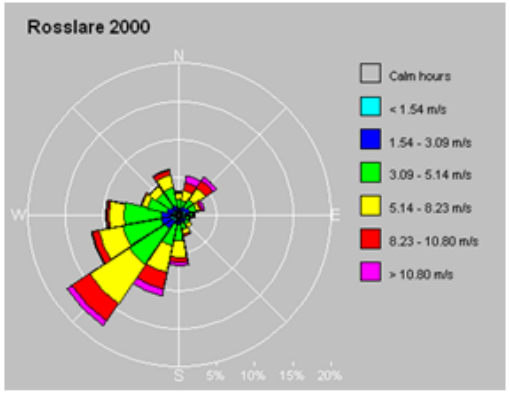

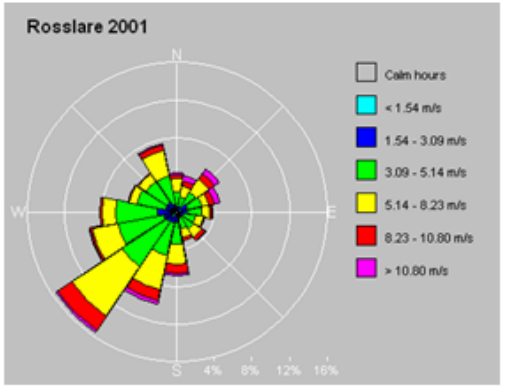

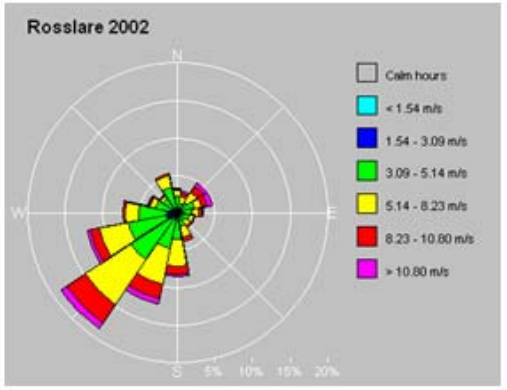

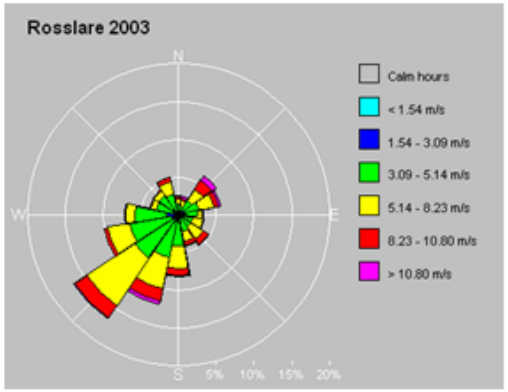

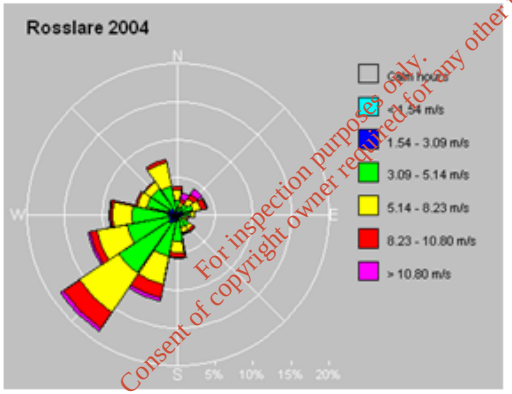

Project

Waterford WWTP EIS Update

Reference

07/4084R01

Figure 2.1

Rosslare Windrose

2000 - 2004

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3.0 NOISE

This section was compiled by AWN Consulting Ltd and assesses and updates the noise impacts of the facility.

This section presents the results of a survey of baseline noise survey carried out in March 2007 by Bord na Mona [1]. It should be noted that all measured sound level data used in this section is from this baseline assessment. Using the updated baseline assessment, a computer-based noise model of the site was generated and an assessment of the resulting noise impact at nearby noise-sensitive locations was carried out.

Consideration has been given to the requirements of European Communities (Waste Water Treatment)(Prevention of Odours and Noise) Regulations 2005 (S.I. No. 787 of 2005), which has come into effect since the original EIS was submitted.

3.1 Description of Existing Environment

An environmental noise survey was conducted in order to quantify the existing noise environment. The survey was conducted in general accordance with ISO 1996: 1982: Acoustics – Description and measurement of environmental noise. Specific details are set out below.

3.1.1 Dates & Times of Surveys

For the purpose of this document, daytime is taken to be between 08:00hrs and 22:00hrs, whilst night-time is between 22:00hrs and 08:00hrs. Noise measurements were conducted over the course of the following periods:

- Noise-Sensitive Locations: Daytime – 16:32hrs to 20:04 on 13 March 2007;
- Noise-Sensitive Locations: Night-time– 22:10hrs on 13 March to 00:14hrs 14 March 2007;
- Boundary Locations: Daytime – 17:53hrs to 20:03hrs on 14 March 2007;
- Boundary Locations: Night-time– 22:13hrs to 23:54hrs on 14 March 2007;

The daytime measurements cover a typical period that was selected in order to provide a typical snapshot of the existing noise climate.

The night-time period provides a measure of existing background noise levels.

3.1.2 Personnel and Instrumentation

Bord na Móna personnel conducted the noise level measurements during both daytime and night-time periods.

The noise measurements were performed using a Brüel & Kjær Type 2260 Sound Level Analyzer. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

3.1.3 Measurement Locations

Twelve measurement locations were selected, five at nearby noise-sensitive receptors and seven in the vicinity of the site boundaries.

Noise-sensitive locations are described in Table 3.1 and shown in Figure 3.1. Boundary locations are described in Table 3.2 and shown in Figure 3.2.

Ref.	Description
NM-01	Residential Area to west of site
NM-02	Residence at top of road leading to Prospect House, 200m from northwest corner of site
NM-03	Residential Area to northeast, approx. 750m from northeast corner of site boundary
NM-04	Residential Area to northeast, approx. 500m from northeast corner of site boundary
NM-05	Nearest residence to northeast, approx. 250m from northeast corner of site boundary

Table 3.1 Noise Monitoring Locations at Nearby Sensitive Receptors

Ref.	Description
NM-06	Northwest corner
NM-07	Midway along northern site boundary
NM-08	Northeast corner
NM-09	Adjacent to the eastern boundary stream, approx 250m from the northeast corner of the proposed site boundary
NM-10	Midway along eastern site boundary
NM-11	Centre of site
NM-12	Midway along western site boundary

Table 3.2 Noise Monitoring Locations at Site Boundaries

3.1.4 Survey Methodology

Measurements were conducted over two daytime periods and two night-time periods. Two sets of measurements were made at the noise-sensitive locations and one set at the locations on-site. All daytime monitoring was conducted between the hours of 16:30hrs and 22:00hrs, as access was prohibited before 16:30hrs. All night-time monitoring was conducted between 22:00hrs and 00:15hrs.

Sample periods for the noise measurements were generally 15 minutes at each location. The results were noted onto a Survey Record Sheet immediately following each sample, and were also saved to the instrument memory for later analysis if required. Survey personnel noted the primary noise sources contributing to noise build-up.

3.1.4 Weather

The weather during the daytime and night-time survey periods was dry and calm, with wind speeds below 5m/s at all times.

3.1.5 Measurement Parameters

The noise survey results are presented in terms of the following five parameters:

L_{Aeq} is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period. It is typically used as a descriptor for ambient noise.

L_{A10} is the sound level that is exceeded for 10% of the sample period. It is typically used as a descriptor for traffic noise.

L_{A90} is the sound level that is exceeded for 90% of the sample period. It is typically used as a descriptor for background noise.

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are described in terms of A-weighted levels.

3.1.6 Survey Results

Location NM-01

Table 3.3 below presents the noise levels measured at this location.

Time (hrs)	Measured Noise Levels, dB		
	L_{Aeq}	L_{A10}	**L_{A90}**
16:32 - 16:47	49	45	**36**
18:36 - 18:51	51	54	**37**
22:10 - 22:20	42	40	**34**
23:18 - 23:28	**50**	**40**	**35**

Table 3.3 Measured Noise Levels at Location NM-01

Audible noise sources at this location during daytime survey periods included occasional passage of cars, distant traffic and birdsong. Noise levels were in the range 49 to 51dB L_{Aeq} and 36 to 37dB L_{A90}.

During the night-time periods, distant traffic was the dominant source of noise. Measured noise levels were in the range 42 to 50dB L_{Aeq} and 34 to 35dB L_{A90}.

Location NM-02

Table 3.4 below presents the noise levels measured at this location.

Time (hrs)	Measured Noise Levels, dB		
	L_{Aeq}	L_{A10}	**L_{A90}**
16:51 - 17:06	49	52	**41**
18:53 - 19:08	42	45	**39**
22:23 - 22:33	41	42	**39**
23:30 - 23:40	**40**	**42**	**39**

Table 3.4 Measured Noise Levels at Location NM-02

Audible noise sources at this location during daytime survey periods included occasional passage of cars, distant traffic and birdsong. Noise levels were in the range 42 to 49dB L_{Aeq} and 39 to 41dB L_{A90}.

During the night-time periods, water in a nearby stream was the dominant source of noise. Measured noise levels were in the range 40 to 41dB L_{Aeq} and of the order of 39dB L_{A90}.

Location NM-03

Table 3.5 below presents the noise levels measured at this location.

Time (hrs)	Measured Noise Levels, dB		
	L_{Aeq}	L_{A10}	**L_{A90}**
17:12 - 17:27	61	53	**44**
19:14 - 19:29	47	48	**41**
22:37 - 22:47	49	52	**42**
23:45 - 23:55	**41**	**42**	**37**

Table 3.5 Measured Noise Levels at Location NM-03

The dominant source of noise during daytime periods at this location was road traffic on the N29. A tractor passed close to the microphone position during the first measurement period. Other audible noise sources included Belview port and distant industrial noise. Noise levels were in the range 47 to 61dB L_{Aeq} and 41 to 44dB L_{A90}.

During the night-time periods, traffic on the N29 and activity at the port were the dominant sources of noise. Measured noise levels were in the range 41 to 49dB L_{Aeq} and 37 to 42dB L_{A90}.

Location NM-04

Table 3.6 below presents the noise levels measured at this location.

Time (hrs)	Measured Noise Levels, dB		
	L_{Aeq}	L_{A10}	**L_{A90}**
17:58 - 18:13	52	49	**38**
19:32 - 19:45	46	41	**36**
22:49 - 22:59	40	42	**35**
23:57 - 00:07	**40**	**38**	**32**

Table 3.6 Measured Noise Levels at Location NM-04

The dominant source of noise during daytime periods at this location was distant road traffic on the N29. A helicopter passed overhead during the first measurement period. Other audible noise sources included Belview port and bird song. Noise levels were in the range 46 to 52dB L_{Aeq} and 36 to 38dB L_{A90}.

During the night-time periods, distant road traffic on the N29 and activity at the port were the dominant sources of noise. Measured noise levels were of the order of 40dB L_{Aeq} and in the range 32 to 35dB L_{A90}.

Location NM-05

Table 3.7 below presents the noise levels measured at this location.

Time (hrs)	Measured Noise Levels, dB		
	L_{Aeq}	L_{A10}	**L_{A90}**
18:15 - 18:30	44	47	**38**
19:49 - 20:04	37	41	**36**
23:02 - 23:12	41	43	**34**
00:09 - 00:19	**37**	**40**	**34**

Table 3.7 Measured Noise Levels at Location NM-05

The dominant source of noise during daytime periods at this location was distant road traffic on the N29. Distant train noise was audible during the second measurement period. Other audible noise sources included Belview port and bird song. Noise levels were in the range 37 to 44dB L_{Aeq} and 36 to 38dB L_{A90}.

During the night-time periods, distant road traffic on the N29 and activity at the port were the dominant sources of noise. Measured noise levels were of the order of 40dB L_{Aeq} and in the range 32 to 35dB L_{A90}.

Boundary Locations

Locations NM-06, NM-07, NM-08, NM-10, NM-11 and NM-12 were within the boundaries of the site. The main audible sources of noise included traffic accessing Belview Port and Waterford City traffic in the distance. Other sources included birdsong and water in flowing in streams.

Location NM-09 was along a local road leading to the site. Audible sources of noise during the daytime period at this location were a temporary generator at Springfield house and water in a nearby stream.

Table 3.9 below presents the noise levels measured at these locations.

Location	Time (hrs)	Measured Noise Levels, dB		
		L_{Aeq}	L_{A10}	**L_{A90}**
NM-06	17:53 - 18:03	52	55	**47**
NM-07	18:13 - 18:28	45	48	**41**
NM-08	18:33 - 18:48	51	50	**40**
NM-09	18:51 – 19:06	46	44	**49**
NM-10	19:08 - 19:23	39	39	**38**
NM-11	19:29 - 19:44	39	39	**37**
NM-12	19:48 - 20:03	40	42	**36**
NM-06	22:13 - 22:23	40	41	**38**
NM-07	22:26 - 22:36	39	40	**37**
NM-08	22:42 - 22:52	38	40	**37**
NM-09	22:56 – 23:06	37	39	**36**
NM-10	23:09 - 23:19	37	37	**36**
NM-11	23:35 - 23:45	37	37	**35**
NM-12	**23:44 - 23:54**	**40**	**40**	**38**

Table 3.9 Measured Noise Levels at Boundary Locations

3.2 Operational Noise Criteria

This section presents the noise level criteria used in this assessment. These have been chosen having regard to S.I. No. 787 of 2005 European Communities (Waste Water Treatment) (Prevention of Odours and Noise), and to previous pollution control licence applications prepared for other sites.

Typical IPPC Licence documents contain the following paragraphs on noise limits:

Noise from the activity shall not give rise to sound pressure levels ($L_{eq,15min}$) measured at the specified noise sensitive locations which exceed the limit value(s).

Activities on-site shall not give rise to noise levels off-site, at noise sensitive locations, which exceed the following sound pressure limits ($L_{eq,15min}$)

Daytime: *55 dB (A)*
Night-time: *45 dB (A)*

There shall be no clearly audible tonal component or impulsive component in the noise emission from the activity at any noise sensitive location.

As the WWTP site runs on a 24-hour basis, compliance with the night-time noise level condition will therefore be the main focus of this assessment.

3.3 Noise Level Prediction Methodology

3.3.1 ***Predictor Noise Modeling Software***

Brüel & Kjær Type 7810 *Predictor* is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. *Predictor* predicts noise levels in different ways depending on the selected prediction standard. The resultant noise level is generally calculated taking into account a range of factors affecting the propagation of sound, including:

- the magnitude of the noise source in terms of sound power;
- the distance between the source and receiver;
- the presence of obstacles such as screens or barriers in the propagation path;
- the presence of reflecting surfaces;
- the hardness of the ground between the source and receiver;
- attenuation due to atmospheric absorption, and
- meteorological effects such as wind gradient, temperature gradient and humidity (these have significant impact at distances greater than approximately 400m).

Prediction calculations have been performed using *Predictor* in accordance with ISO9613:1996 *Acoustics – Attenuation of sound during propagation outdoors*. The degree of accuracy associated with this prediction method is shown in the Table 3.10 below.

Height, h	**Distance, d**	
	0 < d < 100m	**100m < d < 1,000m**
0<h<5m	±3dB	**±3dB**
5m<h<30m	**±1dB**	**±3dB**

Table 3.10 Estimated Accuracy for Broadband Noise of $L_{AT(DW)}$

Where: h is the mean height of the source and receiver, and
d is the mean distance between the source and receiver.

Note: these estimates have been made from situations where there are no effects due to reflections or attenuation due to screening.

3.3.2 *Input Source Noise Levels*

Sound power levels for each significant noise-generating item on the site, including fans, pumps, cooling towers, compressors etc. have been taken from manufacturers data or derived from the power rating of the item using engineering methods [2].

The noise sources included in the model are as follows:

Item	Sound Pressure Level at 1m, dB(A)
Belview Pump	**83**
Grit/Grease Blower	**70**
Storm Water Tank Pump (2 no.)	**81**
Storm Water Mixer (2. no)	**80**
Air Compressor	**95**
Process Air Blowers (4. no)	**70**
RAS Pump (4. no)	**80**
Sludge Mixers (3. no)	**75**
Pasteurisation Feed Pump	**80**
Pasteurisation Tank Mixer (3 no.)	**78**
Pasteurisation Outlet Pump	**80**
Digester Outlet Mixer (2 no.)	**75**
Digested Sludge Mixer	**82**
Odour control unit Fan (2.no)	**80**
Final Effluent Washwater Pump	**86**
Liquors Return Pump	**82**

Table 3.11 Noise sources and Sound Pressure Level at 1m

3.4 Predicted Noise Levels

The noise model has been used to predict noise levels at the various boundary and noise-sensitive locations. An additional location has been included which represents a recently granted planning application adjacent to Prospect House.

Table 3.12 presents the noise levels predicted at noise-sensitive locations and compares each to the EPA criterion for night-time noise.

Ref	Noise Level, L_{Aeq}		
	Predicted Noise Level from WWTP	EPA night-time criterion	**Exceeds**
NM-01	27	45	**No**
NM-02	33	45	**No**
NM-03	21	45	**No**
NM-04	24	45	**No**
NM-05	29	45	**No**
Prospect House Boundary	**37**	**45**	**No**

Table 3.12 Predicted Noise Levels compared to EPA criterion

The predicted noise levels range from 21dB(A) at NM-03 to 37dB(A) at the Prospect House boundary. Thus, noise levels at noise-sensitive locations are all within the night-time noise criterion.

Table 3.13 presents the predicted noise levels and compares them with the night-time L_{A90} values measured during the baseline noise survey.

Ref	Noise Level, L_{Aeq}		
	Predicted Noise Level from WWTP	Measured night-time L_{A90} range	**Difference**
NM-01	27	34, 35	**7-8dB below**
NM-02	33	39	**6dB below**
NM-03	21	37, 42	**>10dB below**
NM-04	24	32, 35	**>10dB below**
NM-05	**29**	**34**	**5dB below**

Table 3.13 Predicted Noise Levels compared to measured night-time LA90

Predicted noise levels at the locations in Table 3.13 are below the measured night-time L_{A90} values in all cases. It is therefore concluded that the overall impact on noise-sensitive locations will not be significant.

The EPA License Criteria refer to noise levels at noise-sensitive locations only. For completeness, the predicted noise levels for the boundary locations are also presented in Table 3.14 below.

Ref	Noise Level, L_{Aeq}
	Predicted Noise Level from WWTP
NM-06	**40**
NM-07	**37**
NM-08	**35**
NM-09	**25**
NM-10	**39**
NM-11	**45**
NM-12	**40**

Table 3.14 Predicted Noise Levels compared to measured night-time LA90

The predicted noise levels range from 25dB(A) at NM-09 along the local road leading to the site to 45dB(A) to NM-11 near the administration building.

3.4 Conclusions

The site noise model contains over thirty individual noise sources for a range of items throughout the site. Taking account of the distances to noise sensitive locations and the topography of the finished site, the noise levels at nearby noise-sensitive locations have been calculated. The predicted noise levels are all below the 45dB(A) night-time criterion typically used by the EPA. Moreover, the noise levels are below background night-time noise levels measured during the survey. It can therefore be expected that while noise from the Waste Water Treatment Plant may be audible during quiet periods at some locations, it is not expected to be unduly intrusive.

References

1. A Baseline Noise Survey at the Proposed Waterford City WWTP on behalf of EPS Ireland Ref: ECS2364, Bord na Mona, April 2007

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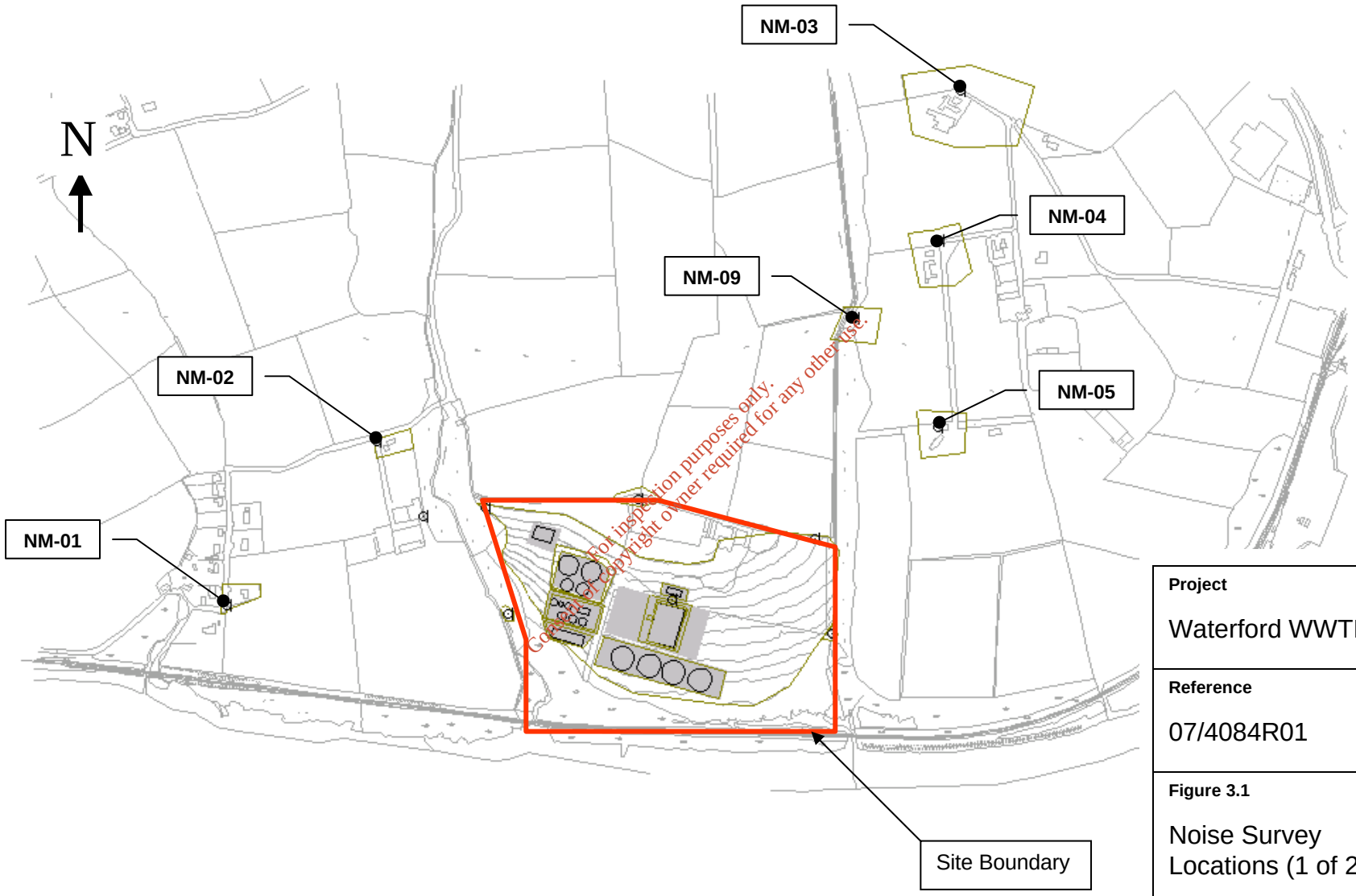

Project

Waterford WWTP

Reference

07/4084R01

Figure 3.1

Noise Survey Locations (1 of 2)

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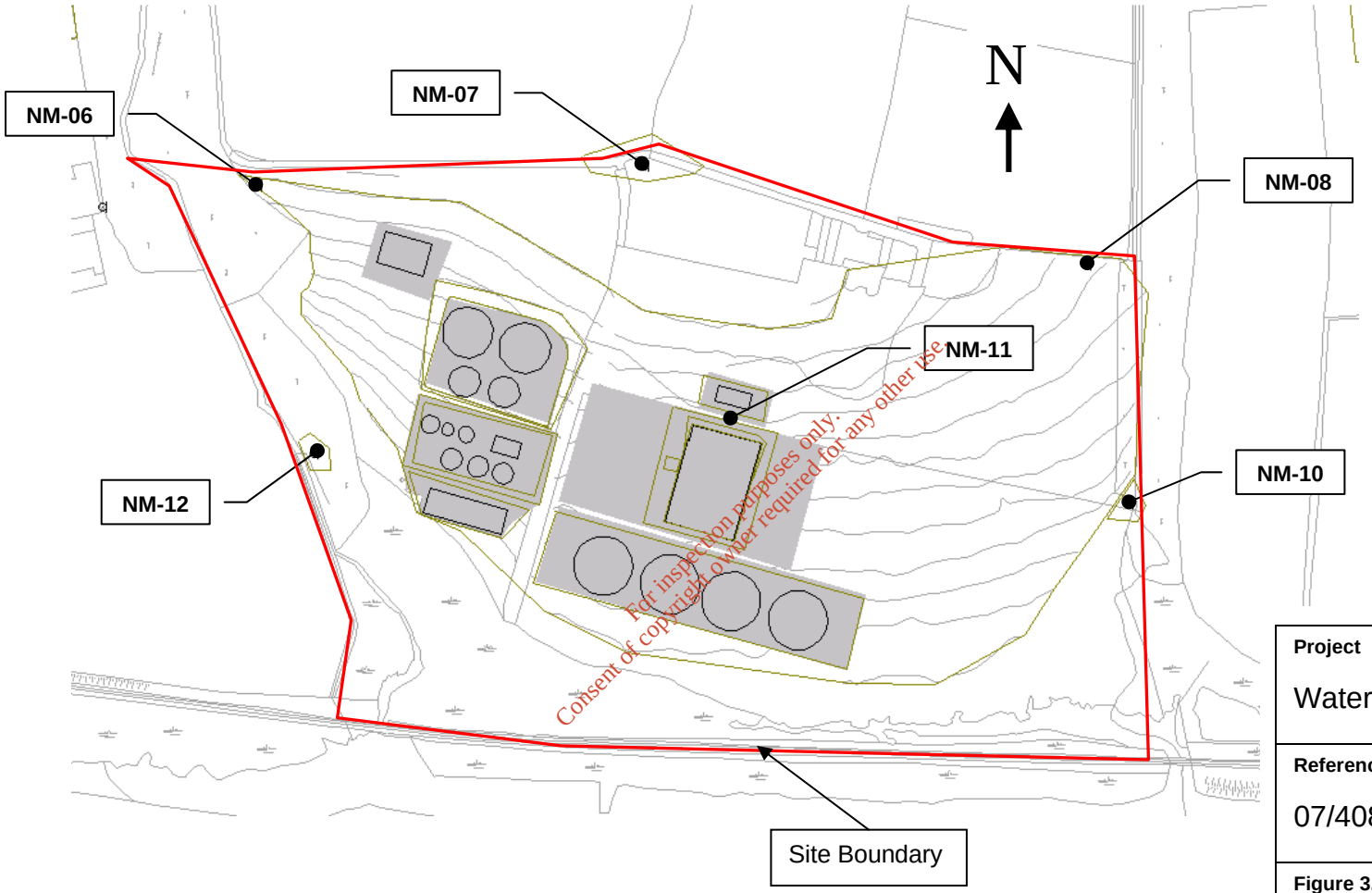
The Tecpro Building, Clonshaugh Business and Technology Park, Dublin 17
T: +353 1 847 4220 F: +353 1 847 4257



Project

Waterford WWTP

Reference

07/4084NR01

Figure 3.2

Noise Survey Locations (2 of 2)

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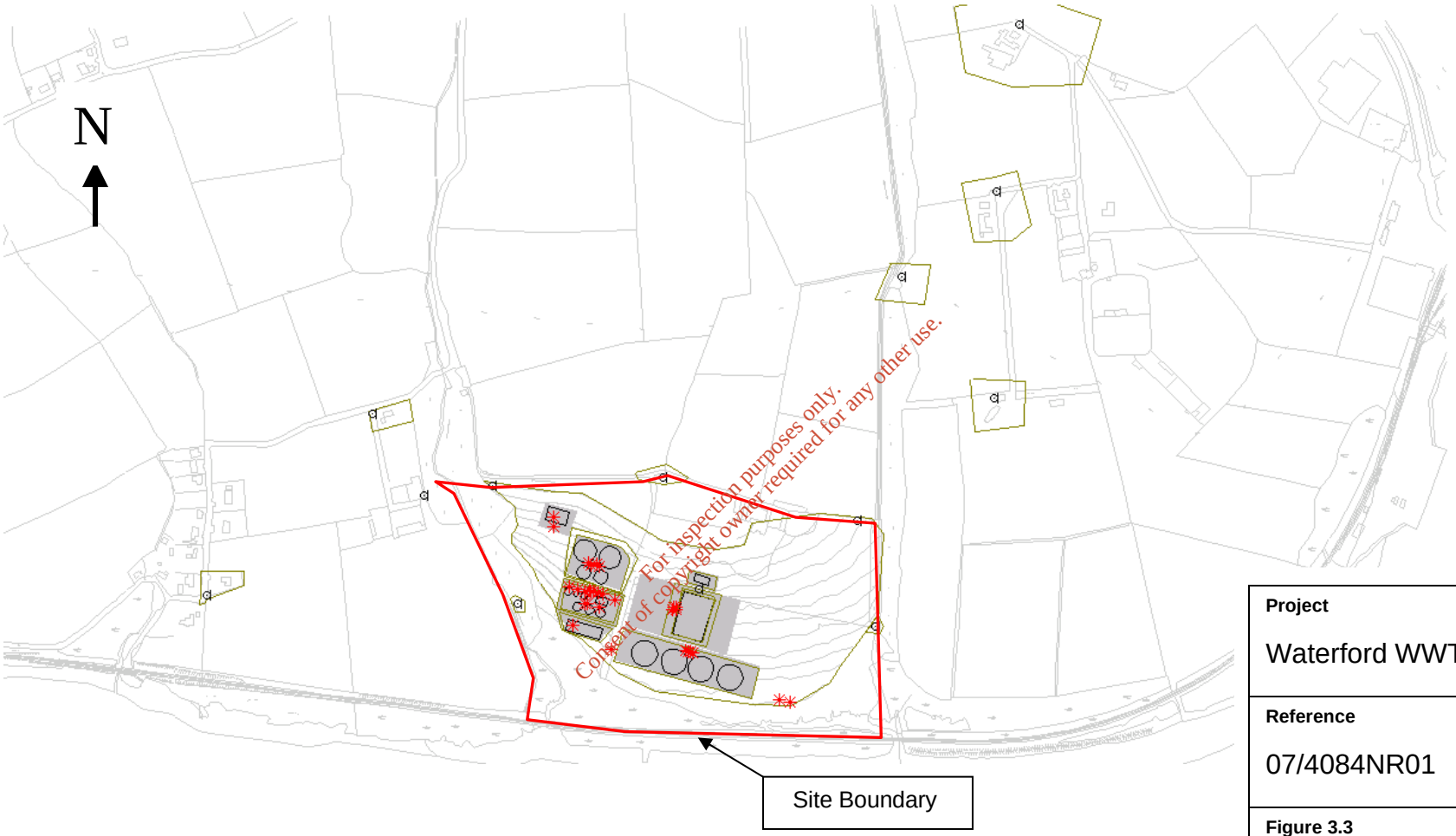
The Tecpro Building, Clonshaugh Business and Technology Park, Dublin 17
T: +353 1 847 4220 F: +353 1 847 4257



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Waterford WWTP

Reference

07/4084NR01

Figure 3.3

Extent of Noise Model

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4.0 WATER

4.1 Introduction

This assessment section of the report updates the baseline data and potential impacts of the proposed WWTP facility at Gorteens, Co. Kilkenny, on the water (hydrology and hydrogeology) environment of the site and surrounding area.

It should be noted that this report is focused on the update of existing baseline data for the hydrological and hydrogeological environments on the subject site and the surrounding area. Any potential impacts on the water environment, in addition to those already provided in the original EIS for the project, are discussed. Mitigation measures are not discussed in this report because the same measures, which were outlined in the original EIS, apply.

4.2 Methodology

The assessment of the potential impact of the proposed development on the hydrology and hydrogeology environments was carried out according to the methodology specified by the Environmental Protection Agency (EPA) [1, 2].

The baseline assessments involved a review of recent desktop information (Geological Survey of Ireland (GSI), Southeast River Basin District (SERBD) water quality database and data supplied by Waterford City Council for the discharge from existing sewage outfalls to the Suir Estuary).

4.3 Update on Receiving Environment

4.3.1 Hydrogeological Environment

The original EIS, issued in 1998, does not assess the existing groundwater environment, with the focus on the hydrological environment. The existing hydrogeological environment has been included in this update, in order to assess any potential impact on the groundwater environment that may occur as a result of groundwater abstraction that may be required for the operation of the waste water treatment plant, or from leakage or malfunction of the facility.

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, based on existing data for the site and surrounding area. The depth to bedrock at a site located within the IDA Park, directly to the north of the subject site, ranges from 3.8 m BGL (Below Ground Level) to 16.6 m BGL [3]. Direction of groundwater flow appreas to be from north to south, i.e. towards the River Suir.

This underlying bedrock is known geologically as the Campile Formation, belonging to the Duncannon Group. The Campile Formation comprises siltstones and shales, with volcanic rock known as rhyolites (or rhyolitic tuffs/agglomerates) in grey and brown slates with occasional andesites (grey fine grained volcanic rock) [2].

The GSI, EPA and the Department of Environment and Local Government (DoELG) have developed a programme of Groundwater Protection Schemes, which applies a risk assessment approach to groundwater protection and sustainable development.

The Groundwater Protection Scheme divides a chosen area into a number of Groundwater Protection Zones, according to the degree of protection required for the aquifer. These zones are based on both aquifer vulnerability and the degree of importance the aquifer holds; regional, local or not important.

The Groundwater Protection Scheme for County Kilkenny [3] has been completed. The bedrock aquifer has been classified by the GSI as Regionally Important – fissured bedrock with good development potential (See Figure 4.1). The vulnerability of the aquifer is moderate (See Figure 4.2). The resulting groundwater protection zone (GPZ) for the majority of the site is Rf/M – Regionally Important of Moderate Vulnerability (See Figure 4.3).

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 (See Figure 4.4). The well card data was recently requested by AWN from the GSI.

Table 4.1 GSI Well Card Data

AWN Ref.	GSI Well Ref.	Easting	Northing	Townland	Depth to bedrock	Usage	Yield Class
					M (bgl)		
1	2611sww119	26294	11437	Kilmurry	2.4	U	Good
2	2611sww132	26456	11459	Drumdowney Lower	39.6	B	Mod.
3	2611sww140	26226	11271	Newtown	7.6	I	Good
4	2611sww142	26253	11262	Newtown	9.1	I	Good
5	2611sww143	26249	11271	Newtown		U	
6	2611sww145	26269	11276	Rathculliheen	12.2	I	Excl.
7	2611sww146	26284	11297	Rathculliheen	18.3	I	Excl.
8	2611sww149	26345	11307	Kilmurry		U	
9	2611sww150	26530	11371	Gorteens	4	U	M
10	2611sww151	26571	11347	Gorteens	12.2	B	
11	2611sww152	26533	11492	Drumdowney Lower	15	P	Excl.
12	2611sww153	26435	11288	Gorteens	3	P	Excl.
13	2611sww154	26326	11277	Kilmurry	32	P	Excl.
14	2611sww155	26574	11289	Gorteens	2	I	Good
15	2611sww156	26591	11309	Gorteens	1.7	I	

B – Agriculture & Domestic, P – Public, I – Industrial, U - Unknown

From the GSI well records, the underlying bedrock in the area has been shown to be capable of yields ranging from moderate (40 – 100 m^3/day) to excellent (>400 m^3/day), with groundwater usage including public supply, industrial, agricultural and domestic. The bedrock geology in the area is quite diverse, and the bedrock types recorded in the surrounding wells include a mixture of slate, shale, mudstone and siltstone. All the wells shown in Table 4.1 are within the Campile Formation, and are predominantly rhyolitic volcanics, shales and slates.

The GSI well card data indicates that the depth to bedrock in the surrounding area ranges from 2 – 12.2 m BGL (below ground level) to the east of the site, from 7.6 – 18.3 m BGL to the west of the site and 2.4 – 32 m BGL to the north of the site. All of the GSI wells in the area, for which there is depth to bedrock information, extend into the bedrock indicating that groundwater abstracted in the area is from the bedrock aquifer, and not an overlying quaternary aquifer. It should be noted that there are a

number of fractures and faults in the vicinity of the site, which would affect the depth to bedrock and also the groundwater regime in the area.

The IDA Park, located directly to north of the site, is currently installing 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 (GPH) .

4.3.2 Hydrology (Surface Water) Environment

There is a stream located to the west of the site, which enters the Suir Estuary south of the subject site. The stream takes field drainage from surrounding land and discharges into the Suir Estuary, which is the main hydrological body in the vicinity of the subject site, at the southeast corner of the site. No flow readings or monitoring data were available for the stream at the time of writing this report.

In terms of tidal water levels in the Suir Estuary, the mean high and low water spring values have not changed from the original EIS.

One of the main pieces of legislation to have come into effect since the original baseline assessment and impact assessment for the WWTP was carried out (1998) is the European Water Framework Directive (WFD) (2000/60/EC). This Directive covers all rivers, lakes, transitional waters (estuaries), coastal waters, groundwaters and dependant wetlands.

The targets of the WFD are that, by 2015, all waters should have achieved at least 'good status' and deterioration in existing water quality status is not acceptable.

Ireland has been sub-divided into 8 no. River Basin Districts (RBDs) and the South Eastern River Basin District (SERBD) Project has been set up to support the implementation of the Water Framework Directive for the South East RBD. The project commenced in April 2002 and has been extended until December 2008.

As part of this project, ongoing monitoring of the water quality of the surface water bodies within the SERBD is carried out. The River Suir and the Suir Estuary are included with this river basin district.

SERBD data is detailed in Appendix 4.1 showing the water quality monitoring data for the Suir River and Estuary, from Waterford City Bridge to downstream at Cheekpoint, which is part of the Suir/Barrow/Nore Estuary. The information available includes water quality data for a number of sampling periods from 2005 to 2007. Summary water quality data showing average values for each sampling location are shown in Table 4.2. It should be noted that the data available for the Suir River and Estuary is extensive and, therefore, only representative and relevant data for the subject site is detailed in this report.

Table 4.2 SERBD Water Quality Monitoring Data for Suir River & Estuary 2005-2007

Station No.	Location	DO	BOD	pH	Ammonia	Ortho-Phosphate	Nitrate	Total Coliforms	Faecal Coliforms
		% Sat	mg/l O_2	pH Units	mg/l N	mg/l P	mg/l N	Count	Count
		Surface						/100ml	/100ml
50	R. Suir at Waterford Br.	88.87	2.04	8.04	0.17	0.03	2.34	16895	2629
51.2	R. Suir at Abbeylands	90.20	1.55	7.98	0.19	0.03	2.24	18389	4552
53	Waterford Castle	83.47	1.82	7.98	0.22	0.03	1.44	9183	859
58	R. Suir at King's Channel	84.25	1.87	7.98	0.22	0.03	1.23	8317	1237
59	R. Suir at Belview Port	95.25	1.88	8.05	0.19	0.04	2.30	17618	1597
61	Estuary - Cheekpoint	92.24	2.05	8.07	0.15	0.03	1.54	6449	581

The above water quality data in Table 4.2 was compared with water quality data included in the original EIS, which included EPA data gathered between 1993 and 1997 as shown in Table 4.3.

Table 4.3 EPA Water Quality Monitoring Data for Suir River & Estuary 1993-1995

Sampling Location	DO	BOD	pH	Ammonia	Ortho-Phosphate	Nitrate	Total Coliform	Faecal Coliform
	% Sat	mg/l O_2	pH Units	mg/l N	mg/l P	mg/l N	Count	Count
	Surface						/100ml	/100ml
Giles Quay	89.17	1.4	8.12	0.08	0.05	-	16850	22983
Little Island	91.5	1.35	8.13	0.006	0.04	-	-	-
King's Channel	91.83	1.15	8.15	0.06	0.04	-	-	-

The EPA sampling locations are not identical to the SERBD monitoring stations. However, they are similar to those used by the SERBD monitoring programme. Water quality data for Giles Quay (EPA) may be compared to Waterford Bridge (SERBD), Little Island (EPA) to Waterford Castle (SERBD) and King's Channel (EPA) to R. Suir at King's Channel (SERBD).

The comparison of the EPA water quality data with the SERBD data indicates that the dissolved oxygen levels have decreased for the two downstream sampling areas, with an increase in BOD (Biological Oxygen Demand) and ammonia concentrations at all locations. Orthophosphate concentrations, however, have decreased slightly. Total coliforms were only measured by the EPA at Giles Quay in the Waterford city centre, and when compared with the SERBD data, the levels were similar. Faecal coliform levels were significantly decreased from the EPA 1993-1997 data to the SERBD 2005-2007 data. As coliforms were only sampled at one location, it is impossible to say whether this was an anomaly or point source occurrence.

Water quality monitoring data carried out by Waterford City Council in November 2007 is shown in Table 4.4 and the sampling locations are detailed in Table 4.5. The surface water sampling locations are different from the EPA and SERBD monitoring

locations and, therefore, are not directly comparable with the data in Tables 4.2 and 4.3. Many of the parameters measured also differ .

Overall, the available water quality data indicates that the water quality for the Suir Estuary has deteriorated slightly over a period of 10-15 years.

Table 4.4 Waterford City Council Surface Water Quality Monitoring Data 2007

Sampling Ref.	Parameter														
	Total Nitrogen	Total Phosphorus	Suspended Solids	BOD	COD	Conductivity	pH	Cyanide	Ammonium	Nitrate	Nitrite	Phosphate	Sulphate	Phenol	Fluoride
	mg/l	mg/l	mg/l	mg/l	mg/l	uS/cm	pH Units	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	mg/l
ML-1	<1	0.3	73	<3	19	19190	7.4	<5	0.269	<0.12	0.03	0.03	1207	<1.0	1210
ML-2	1	0.5	75	<3	40	21300	7.4	<5	0.433	<0.12	0.02	0.02	1260	<1.0	1050
ML-3	<1	0.6	101	<3	38	21700	7.4	<5	0.429	<0.12	0.02	0.04	1441	<1.0	1170
ML-4	<1	0.4	79	<3	34	23700	7.5	<5	0.635	<0.12	0.02	0.08	1728	<1.0	950
ML-5	1	0.3	166	<3	45	24500	7.5	<5	0.707	<0.12	0.02	0.02	1355	<1.0	1100
ML-6	<1	0.6	134	<3	60	26400	7.5	<5	0.822	<0.12	0.02	0.04	1981	<1.0	1260

Table 4.5 Waterford City Council Surface Water Quality Monitoring Locations

Sampling Ref.	Sampling Location
Surface Water	
ML-1	Upstream SW4-SW5
ML-2	Downstream SW4-SW5
ML-3	Downstream SW1, Upstream SW7-SW13
ML-4	Downstream SW7-SW13
ML-5	Upstream SW14-SW19
ML-6	Downstream SW14 - SW19

Waterford City Council has been carrying out water quality monitoring in the past number of months on the discharges from the 17 no. current wastewater outfalls/discharge points to the Suir Estuary. Summary monitoring data is shown in Table 4.6, sampling locations are detailed in Table 4.7, and the full data set is presented as Appendix 4.2.

Table 4.6 Waterford City Council Wastewater Monitoring Data

Sampling Ref.	Total Nitrogen	Total Phosphorus	Suspended Solids	BOD	COD	Conductivity	pH	Cyanide	Ammonium	Nitrate	Nitrite	Phosphate	Sulphate	Phenol	Fluoride
	mg/l	mg/l	mg/l	mg/l	mg/l	uS/cm		mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	ug/l	mg/l
SW1	50	4.7	204	<3	542	1754	6.3	21	14.53	<0.12	0.05	2.48	182.2	<2.5	310
SW4	20	6.5	185	<3	249	560	6.6	<5	5.92	<0.12	0.02	1.17	219	<2.5	190
SW5	37	5.4	230	123	346	754	7.1	<5	22.60	<0.12	0.02	2.55	69	<2.5	470
SW6	40	5	115	90	394	754	6.9	<5	22.37	<0.12	0.04	3.82	85	<2.5	<10
SW7	65	13	105	363	675	951	6.5	6	71.33	<0.12	0.07	8.81	44	<2.5	100
SW8	55	7.8	63	18	280	821	6.9	<5	46.86	<0.12	<0.13	5.68	20	<2.5	90
SW9	70	9.5	144	<3	399	950	6.8	10	69.85	<0.12	0.07	9.52	42.8	<2.5	650
SW10	41	10.1	185	190	380	4180	6.9	<5	35.74	<0.12	0.07	7.17	262.8	<2.5	290
SW11	45	7.7	210	<3	206	784	9	<5	28.23	0.24	0.12	0.79	64	<2.5	420
SW12	28	3.3	135	95	225	493	6.6	<5	20.85	<0.12	0.05	2.87	69	<2.5	80
SW13	39	4.5	120	53	255	561	6.9	<5	19.96	<0.12	0.03	3.91	64	<2.5	510
SW14	53	8	270	39	355	5790	6.8	5	43.24	<0.12	0.05	7.62	330	<2.5	600
SW15	38	51	100	183	287	581	6.8	6	27.72	<0.12	0.06	4.21	44	<2.5	160
SW16	81	74	570	332	1444	1214	6.9	15	37.86	<0.12	0.13	11.5	169	<2.5	<10
SW17	51	10.4	215	<3	434	738	6.9	8	45.67	<0.12	0.07	6.55	87	<2.5	380
SW18	75	15	390	122	602	1041	6.9	10	71.86	<0.12	0.06	13.2	404	<2.5	450
SW19	51	8.4	185	221	615	884	6.7	7	31.51	<0.12	0.06	6.6	102	<2.5	<10

Table 4.7 Waterford City Council Wastewater Monitoring Locations

Sampling Ref.	Sampling Location
Outfalls	
SW1	Near Waterpark Pumping Station
SW4	Near Ferrybank Pumping Station
SW5	Near Abbeylands
SW6	Near Rocklands Pumping Station
SW7	Near Newtown
SW8	Near Slieverue Pumping Station
SW9	Near Glenville
SW10	Near Glenville
SW11	Near Freshfields
SW12	Maypark Hospital
SW13	Maypark Pumping Station
SW14	King's Channel
SW15	King's Channel
SW16	Maypark Septic Tank
SW17	Powerscourt
SW18	Volan Septic Tank
SW19	Island View

Updated discharge volumes were not available for the current outfalls. Due to the extensive development within Waterford City and its environs over the past decade or more, it is understood that the discharge volumes from the outfalls mentioned above have increased significantly. The deterioration in water quality in the Suir Estuary is likely to be at least partially as a result of this increase of untreated wastewater discharge.

4.4 Update on Current Water Legislation

The relevant water-related legislation that has come into effect since 1998 is as follows:

European

Directives

- Drinking Water Directive 98/83/EC
- Water Framework Directive 2000/60/EC
- Bathing Water Directive 71/160/EC
- Groundwater Directive 2006/60/EC

Decisions

- Decision No. 2455/2001/EC – Established list of priority substances in the field of water policy and amending Directive 2000/60/EC

National

- EC (Drinking Water) Regulations S.I. No. 439 of 2000
- EC (Quality of Water intended for Human Consumption)(Amendment) Regulations S.I. No. 177 of 2000
- Quality of Bathing Waters (Amendment) Regulations S.I. No. 22 of 2001
- EC (Water Policy) Regulations S.I. No. 722 of 2003 (Amended by S.I. No. 413 of 2005)
- EC (Quality of Shellfish Waters) Regulations S.I. No. 268 of 2006

As mentioned in Section 4.3, the major piece of legislation that has come into force since the original EIS was submitted is the Water Framework Directive. This was transposed into Irish law by the EC (Water Policy) Regulations in 2003, which put in place competent authorities and provisions for the implementation of the WFD.

4.5 Predicted Impact of WWTP Facility

4.5.1 Groundwater

Emissions to groundwater are not expected during the construction or operational phase of the facility. A SUDS (Sustainable Urban Drainage Systems) will form part of the surface water drainage systems. Two no. swales, which will be located in the northern part of the site, will take surface water drainage from the impermeable road surfaces and direct them to the trunk drainage pipe that discharges to the stream to the east of the site.

Some runoff will permeate into the ground through the swales, reducing the volume of water that would need to be discharged to the stream. No negative impact on the ground environment from the surface runoff is predicted.

The water supply route for the WWTP has not yet been finalised. However, it is understood (based on information from the operator of the WWTP and the IDA) that

the water supply will be obtained from an abstraction borehole within the IDA lands (that is currently under construction), adjacent to the WWTP site. A spur to the WWTP from the IDA water supply connection will be used for water supply, with assurance from the IDA that the required water supply is available. Therefore, there is no predicted impact on the groundwater environment assuming that the maximum yield of the abstraction well is not exceeded.

It is understood (based on informal discussions with Kilkenny County Council) that a piped water supply may be in place to serve the site by approximately 2010, which would negate the need for the water supply from the IDA Park borehole.

4.5.2 Hydrology

The construction works for the WWTP, the rising mains and outfall pipe from the WWTP will require dredging and trenching of the river. Temporary slight localised impacts on water quality will occur, as described in the original EIS. Construction methodologies have been put in place to ensure that the impacts from the construction phase are minimized.

The current water quality status of the River Suir appears to have deteriorated over the past 10-15 years. However, as mentioned in Section 4.3.2, the cause of the deterioration is likely to have been due, at least in part, to the wastewater discharges from the 17 no. current outfalls in the area.

The hydrological modelling, included as Appendix A of the original EIS, indicates that the operation of the Waterford WWTP will result in a significant increase in water quality status on a local and regional scale. This will be as a result of the primary and secondary treatment of all untreated wastewater (once the facility is operational), which currently discharges into the River Suir through the identified outfalls/pipes. The monitoring requirements for the final treated effluent discharge from the Waterford WWTP will ensure that the quality of the discharge from the outfall pipe will be maintained to the required standard [6] as detailed in Table 4.8.

Table 4.8 Final Effluent Discharge Requirements

Parameter	Unit	Standard		Compliance Criteria	
		Target A	Target B	Target A	Target B
BOD	mg/l	25	50	No more than 3 daily samples per 60 days with a value for any one parameter or all parameters to be greater than the standards	No samples with a value for any one parameter to be greater than the standard
COD	mg/l	125	250		
Suspended Solids	mg/l	35	87.5		

It should be noted that there will be an intermediate period for the start-up of the WWTP. This will occur when discharge from the existing outfalls (that discharge into the Suir or tributaries of the Suir) is terminated and the discharge is re-directed through the new outfall (SW-02 for the purpose of this application) for the WWTP.

During this period, there may be little to no treatment of the wastewater as the plant is commissioned. This period will last no longer than 3-4 months and will constitute no change in the wastewater that is currently being discharged into the Suir River/Estuary, other than changing the discharge point. It will be a very short period before the wastewater undergoes increased levels of treatment and almost immediately the quality of the discharge will begin to improve.

However, the potential of the discharge of this combined volume at one point in the estuary has a potential risk to the water quality of the watercourse. It is not expected that all the current discharges will be directed to the new outfall at the same time, and also there will be an increasing degree of treatment for the discharges from the beginning of this start-up period. Therefore, there may be a decrease in water quality locally, however this will be for a short period of time only and is not expected to have an overall negative impact on the Suir Estuary water quality.

4.6 Conclusions

It can be concluded that, whilst the baseline hydrological environment may have deteriorated in the past 10-15 years, based on available monitoring data, the predicted impact of the WWTP and associated outfall will have a significant positive impact on the water quality of the Suir River and Estuary.

There is no predicted impact on the groundwater environment from the proposed development and its operations.

References

1. EPA Advice Notes on Current Practice (in the preparation of Environmental Impact Statements), Environmental Publications, 17 Duke Street, Dublin 2, 2003

2. EPA Guidelines on the Information to be Contained in Environmental Impact Statements, Environmental Publications, 17 Duke Street, Dublin 2, 2002
3. Site Investigation for a Confidential Site, IDA Park, Co. Kilkenny, 2006

4. Geology of South Wexford. D. Tietzsch-Tyler, A.G. Sleeman, GSI/Department of Transport, Energy & Communication, 1994

5. Groundwater Protection Scheme for Kilkenny, Geological Survey of Ireland

6. Waterford Main Drainage Scheme – Phase 2 Contract No. 5 Waterford City WWTP, Volume 4 – Employer's Requirements Particular Requirements for Design

5.0 ECOLOGY (FLORA & FAUNA)

5.1 Introduction

This section of the report has been prepared by Scott Cawley Ltd, Environmental Consultants to update the ecological information provided in the EIS published in 1998 in relation to the Waterford Waste Water Treatment Plant.

The following aspects of the development have been updated:

- Update on ecology baseline data where relevant, based upon a site visit undertaken in March 2008.
- Update on nature protection legislation relevant to the development.

5.2 Methodology

A qualitative baseline study of the subject site was carried out on the 3rd March 2008 to verify the condition of the site. The previous surveys were carried out by the Aquatic Services Unit in June 1998 and are described in Appendix E of the Environmental Impact Statement. The permitted development has been constructed since February 2007 and is almost complete. The 2008 surveys examined areas remaining around the construction area and compared it to descriptions made in the 1998 Report.

During the 2008 surveys, the site visit included a study of the floral and faunal composition encountered. This, combined with desktop consultations of the following resources produced this Addendum as presented.

- O.S. maps for Co. Waterford and Kilkenny.
- Site layout plans.
- National Parks and Wildlife Service Database of designated areas and protected and threatened species.

The proposed development site was surveyed using the methodology of the Heritage Council Habitat Survey Guidelines (Draft 2005). The principal habitats present within the site were identified and classified using the Heritage Council's A Guide to Habitats in Ireland (Fossitt, 2000). Since the site was surveyed in winter it was impossible to identify all floral species occurring within the site so only the identifiable flora have been recounted in this report.

Floral nomenclature follows An Irish Flora (Webb, Parnell & Doogue, 1996) for Latin names and the Census Catalogue of the Flora of Ireland (Scannell & Synnott, 1987) for common names. Nomenclature for horticultural species follows the Royal Horticultural Society's Encyclopaedia of Garden Plants (Brickell, 1998).

Faunal identifications were confirmed using the following sources:

The Macmillan Guide to Birds of Britain & Europe, Macmillan 1998,
The Complete Guide to Ireland's Birds (2002), Dempsey E. & O'Cleary. M. Gill & Macmillan.
Exploring Irish Mammals, Dúchas The Heritage Service 2001.

As opposed to floral investigations, the surveying of faunal usage of subject lands cannot be based upon direct sightings alone. The presence of fauna is substantiated through the detection of field signs such as tracks, habitats, markings, feeding signs, and droppings, as well as by direct observation. Likewise, bird species present on site are recorded along with any notable avifauna habitats, droppings, or tracks. The likely species were assessed in relation to the habitats present within the site.

5.3 Update on Receiving Environment

5.3.1 Records of Designated Sites

The 1998 Report summarised in the EIS acknowledges the proposed Natural Heritage Areas near Island View and Belmont House covering salt marsh adjacent to the site. However these sites have been superseded by the designation of the entire channel of the River Suir as the Lower River Suir candidate Special Area of Conservation (cSAC) under the Habitats Directive. Excerpts from the site synopsis for this site (which was designated in 2005) are provided below:

"The Lower Suir cSAC site consists of the freshwater stretches of the River Suir immediately south of Thurles, the tidal stretches as far as the confluence with the Barrow/Nore immediately east of Cheekpoint in Co. Waterford and many tributaries including the Clodiagh in Co. Waterford, the Lingaun, Anner, Nier, Tar, Aherlow, Multeen and Clodiagh in Co. Tipperary.

The site is a candidate 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 candidate 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.

Salt meadows occur below Waterford City in old meadows where the embankment is absent, or has been breached, and along the tidal stretches of some of the in-flowing rivers below Little Island. There are very narrow, non-continuous bands of this habitat along both banks. More extensive areas are also seen along the south bank at Ballynakill, the east side of Little Island, and in three large salt meadows between Ballynakill and Cheekpoint. The Atlantic and Mediterranean sub types are generally intermixed. The species list is extensive and includes Red Fescue (Festuca rubra), Oraches (Atriplex spp.), Sea Aster (Aster tripolium), Sea Couch Grass (Elymus pycnanthus), frequent Sea Milkwort (Glaux maritima), occasional Wild Celery (Apium graveolens), Parsley Water-dropwort (Oenanthe lachenalii), English Scurvygrass (Cochlearia anglica) and Sea Arrowgrass (Triglochin maritima). These species are more representative of the Atlantic sub-type of the habitat. Common Cord-grass (Spartina anglica), is rather frequent along the main channel edge and up the internal channels. The legally protected (Flora (Protection) Order, 1999) Meadow Barley (Hordeum secalinum) grows at the landward transition of the saltmarsh. Sea Rush (Juncus maritimus), an indicator of the Mediterranean salt meadows, also occurs.

The site is of particular conservation interest for the presence of a number of Annex II animal species, including Freshwater Pearl Mussel (Margaritifera margaritifera and M. m. durrovensis), Freshwater Crayfish (Austropotamobius pallipes), Salmon (Salmo salar), Twaite Shad (Alosa fallax fallax), three species of Lampreys - Sea Lamprey (Petromyzon marinus), Brook Lamprey (Lampetra planeri) and River

Lamprey (Lampetra fluviatilis) and Otter (Lutra lutra). This is one of only three known spawning grounds in the country for Twaite Shad.

Parts of the site have also been identified as of ornithological importance for a number of Annex I (EU Birds Directive) bird species, including Greenland White-fronted Goose (10), Golden Plover (1490), Whooper Swan (7) and Kingfisher. Figures given in brackets are the average maximum counts from 4 count areas within the site for the three winters between 1994 and 1997. Wintering populations of migratory birds use the site. Flocks are seen in Coolfinn Marsh and also along the reedbeds and saltmarsh areas of the Suir. Coolfinn supports nationally important numbers of Greylag Geese on a regular basis. Numbers between 600 and 700 are recorded.

Other species occurring include Mallard(21), Teal (159), Wigeon (26), Tufted Duck (60), Pintail (4), Pochard (2), Little Grebe (2), Black-tailed Godwit (20), Oystercatcher (16), Lapwing (993), Dunlin (101), Curlew (195), Redshank (28), Greenshank (4) and Green Sandpiper (1). Nationally important numbers of Lapwing (2750) were recorded at Faithlegg in the winter of 1996/97. In Cabragh marshes there is abundant food for surface feeding wildfowl which total at 1,000 or so in winter. Widgeon, Teal and Mallard are numerous and the latter has a large breeding population - with up to 400 in summer.

In addition, less frequent species like Shoveler and Pintail occur and there are records for both Whooper and Bewick's swans. Kingfisher, a species that is listed on Annex I of the EU Birds Directive, occurs along some of the many tributaries throughout the site Landuse at the site consists mainly of agricultural activities including grazing, silage production, fertilising and land reclamation. The grassland is intensively managed and the rivers are therefore vulnerable to pollution from run-off of fertilisers and slurry. Arable crops are also grown. Fishing is a main tourist attraction on stretches of the Suir and some of its tributaries and there are a number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. The Aherlow River is a designated Salmonid Water under the EU Freshwater Fish Directive. Other recreational activities such as boating, golfing and walking are also popular.

Several industrial developments, which discharge into the river, border the site including three dairy related operations and a tannery.

The Lower River Suir contains excellent examples of a number of Annex I habitats, including the priority habitat Alluvial Forest. The site also supports populations of several Annex II animal species and a number of Red Data Book animal species. The presence of two legally protected plants (Flora (Protection) Order, 1999) and the ornithological importance of the river adds further to the ecological interest of this site."

The permitted development site overlaps with the cSAC boundary as the boundary extends half-way into the salt marsh and runs parallel to the shoreline. However none of the areas affected by construction of the plant appear to have significantly affected the salt marsh. The exception to this would be the construction of the hardcore road across the salt marsh at the eastern end of the site which encroaches a small degree upon the edge of the cSAC.

Of greater significance is the construction of the discharge pipe and the discharge itself. The permission to discharge may require the completion of an 'appropriate assessment' under Article 6 of the Habitats Directive. This type of assessment

requires the competent authority to assess the impact of the development on the conservation objectives for the cSAC. The National Parks and Wildlife Service have prepared Conservation Management Plans for most cSACs which contain the Management Objectives for each site.

Other sites designated under the Habitats and Birds Directives within 5km of the site include the River Barrow and Nore cSAC that joins the Suir less than 5km downstream. The King's Channel, less than 3km downstream to the south west is a proposed Natural Heritage Area under the Wildlife Act 1976 as amended in 2000.

5.3.2 Records of Protected Species

Reference to the NPWS database of protected species was not made in the 1998 Ecology Report. The report does record several species that are noted as nationally-rare including the Hard-rush hybrid (*Juncus x diffusus*) and the Hybrid Sea Couch (formerly called *Elytrigia x oliveri* and now called *Elytrigia x drucei*). Neither of these species is protected under the Flora Protection Order 1999 which replaces early Orders in 1980 and 1987.

Species records for protected flora within the 10km x 10km square (S61) occupied by the site as shown in Table 5.1.

Table 5.1: Species Records in the Vicinity of the Shellfish Site

Species	Common Name	Location	Full grid	Recorded date	Red Data Book
Groenlandia densa	Opposite-leaved Pondweed	Gauls Mill	S61	1866	Vulnerable
Hordeum secalinum	Meadow Barley	Blenheim Hill	S645104	04/10/1994	Vulnerable
Hordeum secalinum	Meadow Barley	River Barrow Rochestown	S6919	05/07/1990	Vulnerable
Hordeum secalinum	Meadow Barley	River Barrow Ballinlaw ferry	S671169	12/08/1992	Vulnerable
Hordeum secalinum	Meadow Barley	River Barrow Ballinlaw ferry	S671169	1889	Vulnerable
Hordeum secalinum	Meadow Barley	Blenheim Hill	S645104	1889	Vulnerable
Hordeum secalinum	Meadow Barley	Belmont House	S634117	1972	Vulnerable
Hordeum secalinum	Meadow Barley	Fisherstown	S6817	1982	Vulnerable
Hordeum secalinum	Meadow Barley	Blenheim Hill	S645104	1993	Vulnerable
Hordeum secalinum	Meadow Barley	King's Channel	S642109	1996	Vulnerable
Hordeum secalinum	Meadow Barley	Fisherstown	S6817	25/06/1990	Vulnerable
Hordeum secalinum	Meadow Barley	River Barrow Rochestown	S6919	26/07/1995	Vulnerable
Hordeum secalinum	Meadow Barley	Belmont House	S634117	29/07/1991	Vulnerable
Puccinellia fasciculata	Tufted Salt-marsh Grass	Ringville	S676180	1997	Rare
Stachys officinalis	Betony	Rochshire Hill	S6010	1906	Vulnerable
Stachys officinalis	Betony	Waterford	S6010	1856	Vulnerable

Whilst all of these are protected by law, none have been recorded in the 1998 or 2008 studies.

5.3.3 Habitats present in 2008 Surveys

Habitats present in 1998 included hedgerows, wet grassland, agricultural grassland, wet woodland, salt marsh (Upper and Lower) and a freshwater stream.

The access road to the site from the entrance to the IDA lands to the north has been constructed. The site itself to the south of Springfield House has been almost entirely covered in development or in screening bunds to the south east and south of the development. Therefore the main habitats lost as a result of the development are the areas of poached meadow to the south of Springfield House. The photographs below show the site in March 2008.

Photo 1: South west corner of site showing upper salt marsh.

Photo 2: Looking north from southern edge of site to Springfield House.

Photo 3: Carr habitat around impounded lagoon with new hardcore route along path of discharge pipe on right.

It is not the purpose of this Addendum to audit the predictions of the 1998 EIS and due to the very wet conditions on site in the salt marsh, access to this area was not permitted by the Contractor company for health and safety reasons. Also, the time of year of the 2008 survey would preclude against accurate identification of the Couch and Hard Rush hybrids.

5.4 Update on Legislation protecting Habitats and Species

The following legislation exists in Ireland to protect against harm to valuable habitats or species:

- Wildlife Act 1976
- Wildlife (Amendment) Act 2000
- EC Habitats Directive 92/43/EEC
- EC Birds Directive 79/409/EEC
- European Communities (Natural Habitats) Regulations 1997 (amended 2005)
- Shellfish Waters Directive (79/923/EEC)
- Flora Protection Order 1999
- Live Bivalve Molluscs (Production Areas) Designation, 2006

Other legislation pertaining to Environmental Impact Assessment (e.g. EC 97/11/EC) has also been enacted within Ireland since the previous EIS was published.

The regulations that are relevant to the permitted development are described in Table 5.2.

Table 5.2 Current Legislation applicable to the WWTP – Ecology Related

Instrument	Requirement	Relevant Activity	Implications
European Communities (Natural Habitats) Regulations 1997 (Para. 15) – implements the EC Habitats Directive.	Activity within cSAC requires assessment to be made of effects on site's conservation objectives.	Discharge of treated effluent and any other works in cSAC area e.g. laying pipe.	Appropriate Assessment may be required before National Parks and Wildlife Service can approve activity. Screening Study and consultation with NPWS is recommended.
Forthcoming designation of Cheekpoint as Shellfish Waters under Shellfish Waters Directive (79/923/EEC)	Required to meet certain water quality standards in certain areas.	Effects of discharge of treated effluent and run-off from site.	The designation process has just commenced and therefore there is no information on the geographic limits of the proposed designation or the specific standards that will be required. However the standards are likely to be those stated in the Shellfish Waters Directive which is used as one of the standards in the EIS. The EIS states that this standard will be met in all shellfish beds areas downstream of the discharge.
Live Bivalve Molluscs (Production Areas) Designation, 2006.	Designates Waterford Harbour as an area where molluscs may be taken for human consumption by hand and sets certain coliform limits on their content. Bivalves from Waterford Harbour must be cleaned prior to human consumption.	Effects of discharge of treated effluent.	The 1998 EIS states that the status of the bivalves in the Waterford Harbour will not be altered by the proposed development.

In relation to the forthcoming designation of parts of the Suir Estuary, such as Cheekpoint, as Shellfish Waters under the Shellfish Waters Directive (79/923/EEC), the designations have not yet been confirmed and were not available for the purpose of this assessment.

Discussions on the 13th March, 2008, between Paul Scott of Scott Cawley Ltd and Dr Karen Creed (EPA), who is on the Working Group for the designations of the new Shellfish Waters. Dr Creed indicated that the general locations were identified but have not been mapped out in detail and are not yet available to the public. According to Dr Creed (*pers comm*) the designation process has started and she is meeting colleagues in Brussels in the near future to discuss these designations.

However the implications and requirements of this legislation (Live Bivalve Molluscs (Production Area), 2006) are shown in the table above.

In relation to the initial start-up period (3-4 months), the potential for the change in location of wastewater discharge from the existing discharge points to the new outfall to result in a negative impact on the ecology of the area was considered. Although the designations of the shellfish waters have not yet been confirmed, it appears that Cheekpoint will be the closest designation, and it is not believed that the change in the discharge location so far upstream (approximately 3 km) will have a negative impact over this short period.

6.0 CONCLUSIONS

For the update of the original EIS (1998), four areas were considered to require updating and have been examined for the purpose of this report. These include: air quality & odour, noise, water and ecology.

In terms of air quality and climate, there are potential impacts from the construction phase, however, if a satisfactory dust minimisation plan is implemented, the effect of construction on air quality will be slight and in terms of climate, insignificant. There will be no significant impacts on the air quality environment as a result of the operation of the WWTP.

There are a number of odour sources within the site boundary, with the inlet works and the sludge treatment works being predicted to generate the highest concentrations of odour (mainly hydrogen sulphide). The revised impact assessment showed that the predicted odour impact at the nearest sensitive receptors will be imperceptible and the odour concentrations at the boundary of the facility will be low.

A revised baseline noise survey was carried out and the predicted noise levels at nearby noise-sensitive locations were calculated. The predicted noise levels are all below the 45dB(A) night-time criterion typically used by the EPA and are below background night-time noise levels measured during the survey. It can therefore be expected that while noise from the WWTP may be audible during quiet periods at some locations, it is not expected to be unduly intrusive.

For the water environment, the hydrogeological environment has been assessed, as it was not assessed in the previous EIS. There is no predicted negative impact on the groundwater environment. The predicted impact of the WWTP facility and outfall on the surface water environment will be significant and positive.

In terms of ecology, the permitted development site overlaps with an cSAC boundary as the boundary extends half-way into the salt marsh and runs parallel to the shoreline. The predicted impact of the WWTP on the terrestrial ecological environment is imperceptible and the impact on the riverine/estuarine ecology will be positive.

APPENDICES

APPENDIX 2.1

Ambient Air Quality Standards

National standards for ambient air pollutants in Ireland have generally ensued from Council Directives enacted in the EU (& previously the EC & EEC) (see Table 2.1 - 2.3). The initial interest in ambient air pollution legislation in the EU dates from the early 1980s and was in response to the most serious pollutant problems at that time. In response to the problem of acid rain, sulphur dioxide, and later nitrogen dioxide, were both the focus of EU legislation. Linked to the acid rain problem was urban smog associated with fuel burning for space heating purposes. Also apparent at this time were the problems caused by leaded petrol and EU legislation was introduced to deal with this problem in the early 1980s.

In recent years the EU has focused on defining a basis strategy across the EU in relation to ambient air quality. In 1996, a Framework Directive, Council Directive 96/62/EC, on ambient air quality assessment and management was enacted. The aims of the Directive are fourfold. Firstly, the Directive's aim is to establish objectives for ambient air quality designed to avoid harmful effects to health. Secondly, the Directive aims to assess ambient air quality on the basis of common methods and criteria throughout the EU. Additionally, it is aimed to make information on air quality available to the public via alert thresholds and fourthly, it aims to maintain air quality where it is good and improve it in other cases.

As part of these measures to improve air quality, the European Commission has adopted proposals for daughter legislation under Directive 96/62/EC. The first of these directives to be enacted, Council Directive 1999/30/EC, has been passed into Irish Law as S.I. No 271 of 2002 (Air Quality Standards Regulations 2002) and has set limit values which came into operation on 17th June 2002. Council Directive 1999/30/EC, as relating to limit values for sulphur dioxide, nitrogen dioxide, lead and particulate matter, is detailed in Table 2.1. The Air Quality Standards Regulations 2002 detail margins of tolerance, which are trigger levels for certain types of action in the period leading to the attainment date. The margin of tolerance varies from 60% for lead to 30% for 24-hour limit value for PM_{10}, 40% for the hourly and annual limit value for NO_2 and 26% for hourly SO_2 limit values. The margin of tolerance commenced from June 2002, and will start to reduce from 1 January 2003 and every 12 months thereafter by equal annual percentages to reach 0% by the attainment date. A second daughter directive, EU Council Directive 2000/69/EC, has recently published limit values for both carbon monoxide and benzene in ambient air as set out in Table 2.2. This has also been passed into Irish Law under the Air Quality Standards Regulations 2002.

Although the EU Air Quality Limit Values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions. The Alert Threshold is defined in Council Directive 96/62/EC as "a level beyond which there is a risk to human health from brief exposure and at which immediate steps shall be taken as laid down in Directive 96/62/EC". These steps include undertaking to ensure that the necessary steps are taken to inform the public (e.g. by means of radio, television and the press).

The Margin of Tolerance is defined in Council Directive 96/62/EC as a concentration which is higher than the limit value when legislation comes into force. It decreases to meet the limit value by the attainment date. The Upper Assessment Threshold is defined in Council Directive 96/62/EC as a concentration above which high quality measurement is mandatory. Data from measurement may be supplemented by information from other sources, including air quality modeling.

An annual average limit for both NO_x (NO and NO_2) is applicable for the protection of vegetation in highly rural areas away from major sources of NO_x such as large conurbations, factories and high road vehicle activity such as a dual carriageway or motorway. Annex VI of

EU Directive 1999/30/EC identifies that monitoring to demonstrate compliance with the NOx limit for the protection of vegetation should be carried out distances greater than:

- 5 km from the nearest motorway or dual carriageway
- 5 km from the nearest major industrial installation
- 20 km from a major urban conurbation

As a guideline, a monitoring station should be indicative of approximately 1000 km^2 of surrounding area.

EU Council Directive 96/62/EC on ambient air quality and assessment has been adopted into Irish Legislation (S.I. No. 33 of 1999). The act has designated the Environmental Protection Agency (EPA) as the competent authority responsible for the implementation of the Directive and for assessing ambient air quality in the State. Other commonly referenced ambient air quality standards include the World Health Organisation. The WHO guidelines differ from air quality standards in that they are primarily set to protect public health from the effects of air pollution. Air quality standards, however, are air quality guidelines recommended by governments, for which additional factors, such as socio-economic factors, may be considered.

Enpure Ltd
Odour Dispersion Report
Waterford WwTW
C1197

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Contents **Page No.**

Figures **Page No.**

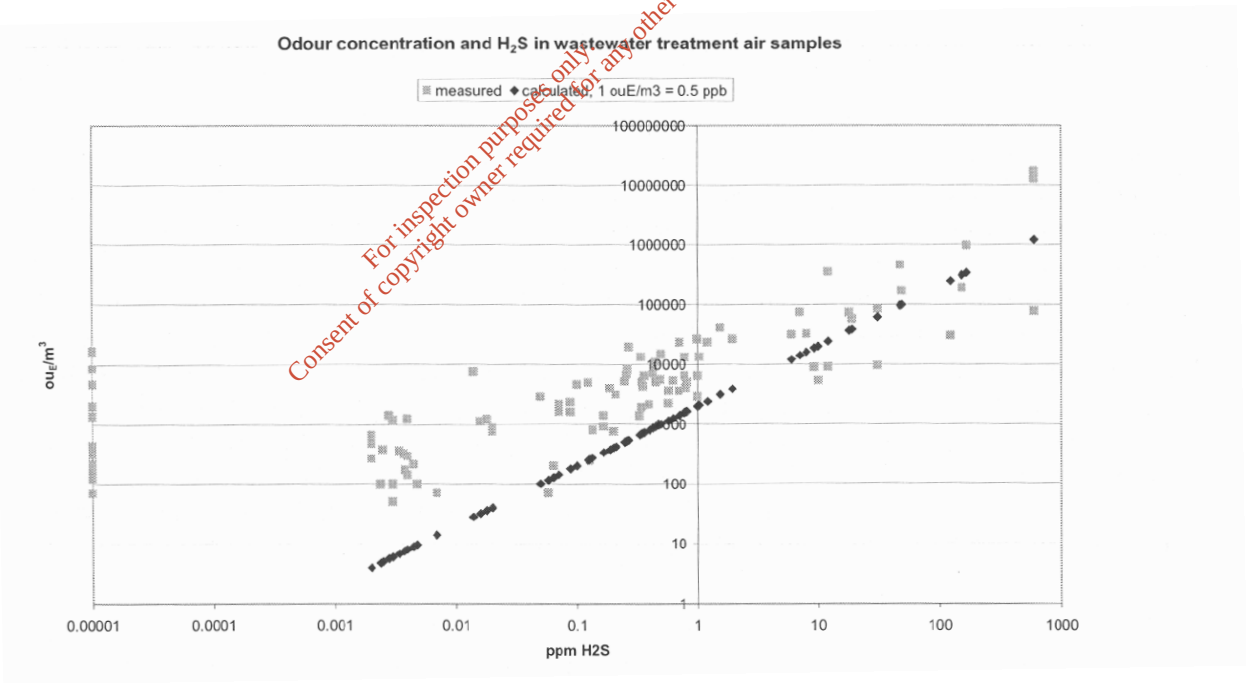
Tables **Page No.**

1. BACKGROUND AND SCOPE

Waterford WwTW will be installed on a new site at Gorteens, County Kilkenny, Republic of Ireland. An odour consent has been specified as a short-term average of 3 ou_E m^{-3} and 5 ou_E m^{-3} at the site boundary (or any receptor position), as a 95th percentile and at any time figure respectively, above background odour. In addition, there is a requirement to achieve 10 times less than these hourly-average short term concentrations at the nearest sensitive receptors. That is 0.3 ou_E m^{-3} as a 95th percentile and 0.5 ou_E m^{-3} at any time.

Note that a background hydrogen sulphide odour survey was carried out prior to construction with the results presented in the appendix. Traditionally, odour units have been converted to an H_2S equivalent. The commonly used conversion is 0.5 ppb of H_2S equates to 1 ou_E m^{-3}. This does however; assumes that all odours are caused by H_2S which is obviously not the case. Figure 1-1 shows that below 10 ppb if H_2S is converted to odour using this ratio, the concentration of odour can be under estimated. Using the lowest mean value recorded during the survey (2.86 ppb) and applying an odour threshold of 0.5 ppb to 1 ou_E m^{-3} this equates to 6 ou_E m^{-3}. When analysed in a laboratory using olfactometry testing, odour concentrations can typically range from 15 – 200 ou_E m^{-3}.

Figure 1-1 - The relationship between H_2S and odour concentration in wastewater treatment and sludge air samples, for the full range of 0.1 to 600 ppm. H_2S below detection threshold has been plotted as 0.01 ppb.



From: Chemicals as Odour Predictors: What Causes the Odour Deficit?, AP van Harreveld & M Stoaling, OdourNet UK Ltd, Odours. What a Nuisance Conference, 2002.

1.1. OLFACTOMETERY

Olfactometry is the measurement of the response of human assessors to olfactory stimuli and so can be highly subjective; different people find different odours offensive at different concentrations. For human assessors a combination of physiological reception and psychological interpretation convert an odour into an odour impression. In order to increase the reproducibility and objectivity of odour impressions, selected and screened human receptors are used. The CEN/TC264/WG2 (prEN 17325) standard sets out repeatability

requirements which are expressed as a log factor and, in simple terms, the standard permits a repeatability factor of up to 3 for 95% of analyses. In effect this means that the difference between the results of analyses of two identical samples should not vary by more than a factor of about three. The CEN standard defines a robust procedure where an odour sample is collected and progressively diluted and tested to the point that half of the panel detect an odour, this is defined as the odour threshold or 1 $ou_E\ m^{-3}$. The panel reply either 'yes' or 'no' to the question 'can you detect an odour?'. This makes it increasingly difficult to accurately determine odour concentrations much below 20 $ou_E\ m^{-3}$ without large numbers of samples. Some olfactometers are unable even to dilute samples down to these low concentrations.

1.2. DISPERSION MODELLING

Dispersion modelling aims to predict the impact to a receptor of an odour source or sources by calculating the theoretical transport of gaseous odorants. Following an emission into the atmosphere, two factors are important in determining the extent of the subsequent dispersion; wind velocity and atmospheric stability. Due to the number of calculations required to predict odour dispersion the modelling is carried out using a computer model. The model used by ENPURE Ltd is ADMS 3.3, developed by Cambridge Environmental Research Consultants (CERC).

ADMS 3.3 is a Gaussian dispersion model which predicts concentration profiles in the y (crosswind) and z (height) directions. ADMS 3.3 includes the facility to model the effect of buildings, local topography, multiple sources, exit velocity and meteorology. Other users of ADMS 3.3 include the Environmental Agency (EA) in England and Wales, and the Scottish Environmental Protection Agency (SEPA) in Scotland.

2. MODEL PARAMETERS

Waterford WwTW is assumed to be on the line of latitude 52:15:27N with surface roughness = 0.3 (equivalent to agricultural).

All gaseous odour emissions are assumed to have a temperature of the ambient conditions, specific heat capacity (Cp) = 1,012 J kg^{-1} $°C^{-1}$, molecular weight (MW) = 28.96 g $mole^{-1}$ and density (ρ) = 1.225 kg m^{-3}.

2.1. BUILDINGS

Buildings are defined as any structure which has a significant effect on the dispersion of pollutants. The main effect is to entrain pollutants into the cavity region in the immediate leeward side of the building, bringing them rapidly down to ground level. As a consequence, concentrations near the buildings are increased but decreased further away.

ADMS 3.3 models multiple buildings as one single equivalent building for each wind direction in the .met file, the height of which is the height of the building specified as the main building.

Table 2-1: Waterford WwTW Buildings

	X_c [m]	Y_c [m]	Height [m]	Length [m]	Width [m]	Angle[1] [°]
Inlet building	112168	265211	8	30.4	20.6	107.2
Sludge building	112206	265049	7	51	15.8	105.9
Admin building	112375	265122	7	21.8	9.2	105.9
Sludge holding tanks	112238	265070	9	28.8	12	107.4
Sludge digesters	112206	265079	13	30.1	13.3	107.4

[1] As measured from North, clockwise to the longest edge.

Importantly, where buildings are selected, as is often the case for WwTW, area sources must be input as equivalent point sources.

2.2. SOURCES AND EMISSIONS

It is proposed to cover or house all equipment, pumping stations, etc. associated with the inlet works and preliminary treatment facilities to contain odorous releases. The primary tanks are also covered and extracted. A connection from the covers or housing is routed to a common ductwork header and extracted to the odour abatement equipment (OCU1). A separate system is used to extract and treat odours arising from the sludge treatment process (OCU2).

The inputted odour sources to the model are; Belview pumping station, the storm tanks, selector and aeration tanks, final settlement tanks, digested sludge holding tank and two odour control unit outlet stacks. The Model does not take into account odorous emissions that might arise from existing areas of plant or equipment outside the site boundary.

The air discharge rate from the odour abatement systems are calculated from extraction rates from individual odorous sources based on various methodologies, the sum of which would be the total discharged to atmosphere. In this case, the air stream discharge rates are 13815 m^3 h^{-1} and 5042 m^3 h^{-1} from OCU1 and OCU2 respectively under normal operating conditions. The proposed stack locations are adjacent to the preliminary treatment building

and adjacent to the pasteurization plant, the exact location of which can be seen in drawing No. C1197-3002.

A limitation of the ADMS 3.3 model is that it cannot simultaneously model large area sources (e.g. aeration ditches, primary sedimentation tanks, storm tanks, etc.) and buildings. The model used in this study simulated the large area source (storm water tank) as a series of point sources. This process has been verified as an equivalent method of modelling.

There are six main sources of odour considered by the dispersion model:

- Odour control stacks which emits treated air at high velocity. The discharge air of stack 1 is the remains of foul air drawn from the inlet works, screening and grit handling and primary settlement tanks after odour treatment. The odour control design flow and load to this unit is 13815 $m^3 h^{-1}$ and 19 ppm H_2S, equivalent to 63533 $ou_E m^{-3}$. The reduction of odour across the treatment stage has been guaranteed as 99% as H_2S; this equates to an odour removal of 97%. A design emission of 28663 $ou_E m^{-2} s^{-1}$ has been selected as the model input. Therefore the odour release with a stack height of 10 m and exit velocity 15.0 m s^{-1} has been modelled from the stack 1.

The discharge air of stack 2 is the remains of foul air drawn from the sludge holding tanks, sludge thickeners, sludge dewaterers and liquor return PS after odour treatment. The odour control design flow and load to this unit is 5042 $m^3 h^{-1}$ and 49 ppm H_2S, equivalent to 97976 $ou_E m^{-3}$. The reduction of odour across the treatment stage has been guaranteed as 99% as H_2S; this equates to an odour removal of 95%. A design emission of 69317 $ou_E m^{-2} s^{-1}$ has been selected as the model input. Therefore the odour release with a stack height of 8 m and exit velocity 14.1 m s^{-1} has been modelled from the stack 2.

Table 2-2: Odour Stack Point Source

	Source Height [m]	Diameter [m]	X_p [m]	Y_p [m]
OCU1 Stack	10	0.57	112172	265163
OCU2 Stack	8	0.36	112252	265089

- Belview pumping station is vented by a tank breather pipe and is modelled as single point source due to the presence of buildings. The vent pipe is modelled as 1 point sources with design emission of 1850 $ou_E m^{-2} s^{-1}$. The odour release rate has been modelled as 0.1 $m^3 s^{-1}$ and the emission rate as 33 $ou_E s^{-1}$.

Table 2-3: Belview Pumping Station Point Source

	Source Height [m]	Diameter [m]	X_p [m]	Y_p [m]
Belview Pumping Station	0.1	0.15	112403	265133

- Selector tank distribution chamber (Sel) is an area source and is modelled as a group of point sources due to the presence of buildings. The distribution chamber is modelled as 9 point sources with design emission of 0.2 ou_E m^{-2} s^{-1}. The odour release rate has been modelled as 0.021 m^3 s^{-1} and the emission rate as 4 ou_E s^{-1} per point.

Table 2-4: Selector Tank Distribution Chamber Point Sources

Point Source	Source Height	Equivalent circular diameter	X_p	Y_p
	[m]	[m]	[m]	[m]
SEL1	2	5.2	112324	265083
SEL2	2	5.2	112337	265079
SEL3	2	5.2	112334	265069
SEL4	2	5.2	112321	265072
SEL5	2	5.2	112331	265081
SEL6	2	5.2	112328	265071
SEL7	2	5.2	112323	265078
SEL8	2	5.2	112329	265076
SEL9	2	5.2	112336	265074

Aeration tank (AS) is an area source and is modelled as a group of point sources due to the presence of buildings. The tank is modelled as 24 point sources with design emission of 0.2 ou_E m^{-2} s^{-1}. The odour release rate has been modelled as 0.094 m^3 s^{-1} and the emission rate as 19 ou_E s^{-1} per point.

Table 2-5: Aeration Tank Point Sources

Point Source	Source Height	Equivalent circular diameter	X_p	Y_p
	[m]	[m]	[m]	[m]
AS1	1	10.9	112351	265101
AS2	1	10.9	112389	265090
AS3	1	10.9	112373	265032
AS4	1	10.9	112335	265043
AS5	1	10.9	112359	265099
AS6	1	10.9	112366	265097
AS7	1	10.9	112374	265094
AS8	1	10.9	112381	265092
AS9	1	10.9	112346	265082
AS10	1	10.9	112353	265079
AS11	1	10.9	112361	265077
AS12	1	10.9	112368	265075
AS13	1	10.9	112376	265073
AS14	1	10.9	112384	265071
AS15	1	10.9	112340	265062
AS16	1	10.9	112348	265060
AS17	1	10.9	112356	265058
AS18	1	10.9	112363	265056
AS19	1	10.9	112371	265054
AS20	1	10.9	112378	265051
AS21	1	10.9	112343	265041
AS22	1	10.9	112350	265039
AS23	1	10.9	112358	265036
AS24	1	10.9	112365	265034

- Storm tanks (ST) is an area source and is modelled as a group of point sources due to the presence of buildings. The two tanks are modelled as 9 point sources with design emission of 0.125 ou_E m^{-2} s^{-1}. The odour release rate has been modelled as 0.64 m^3 s^{-1} and the emission rate as 4.8 ou_E s^{-1} per point.

Table 2-6: Storm Tank Point Sources

Point Source	Source Height	Equivalent circular diameter	X_p	Y_p
	[m]	[m]	[m]	[m]
ST11	1	7	112206	265131
ST12	1	7	112197	265131
ST13	1	7	112215	265131
ST14	1	7	112199	265124
ST15	1	7	112206	265122
ST16	1	7	112213	265124
ST17	1	7	112199	265138
ST18	1	7	112206	265140
ST19	1	7	112213	265138
ST21	1	7	112231	265124
ST22	1	7	112222	265124
ST23	1	7	112240	265124
ST24	1	7	112224	265117
ST25	1	7	112231	265115
ST26	1	7	112238	265117
ST27	1	7	112224	265131
ST28	1	7	112231	265133
ST29	1	7	112238	265131

- FST is an area source and is modelled as a group of point sources due to the presence of buildings. The four FST's are modelled as 9 point sources with design

emissions of 0.1 ou_E m^{-2} s^{-1}. The odour release rate has been modelled as 0.23 m^3 s^{-1} and the emission rate as 11 ou_E s^{-1} per point.

Table 2-7: Final Settlement Tank Point Sources

Point Source	Source Height	Equivalent circular diameter	X_p	Y_p
	[m]	[m]	[m]	[m]
FST1A	1	12	112293	265015
FST2A	1	12	112277	265015
FST3A	1	12	112309	265015
FST4A	1	12	112282	265004
FST5A	1	12	112293	264999
FST6A	1	12	112304	265004
FST7A	1	12	112282	265026
FST8A	1	12	112293	265031
FST9A	1	12	112304	265026
FST1B	1	12	112331	265004
FST2B	1	12	112315	265004
FST3B	1	12	112347	265004
FST4B	1	12	112320	264993
FST5B	1	12	112331	264988
FST6B	1	12	112342	264993
FST7B	1	12	112320	265015
FST8B	1	12	112331	265020
FST9B	1	12	112342	265015
FST1C	1	12	112373	264993
FST2C	1	12	112357	264993
FST3C	1	12	112389	264993
FST4C	1	12	112362	264982
FST5C	1	12	112373	264977
FST6C	1	12	112384	264982

FST7C	1	12	112362	265004
FST8C	1	12	112373	265009
FST9C	1	12	112384	265004
FST1D	1	12	112417	264973
FST2D	1	12	112401	264973
FST3D	1	12	112433	264973
FST4D	1	12	112406	264962
FST5D	1	12	112417	264957
FST6D	1	12	112428	264962
FST7D	1	12	112406	264984
FST8D	1	12	112417	264989
FST9D	1	12	112428	264984

- Digested sludge holding tank (DSHT) is an area source and is modelled as a group of point sources due to the presence of buildings. The DSHT is modelled as 9 point sources with design emission of 14 ou_E m^{-2} s^{-1}. The odour release rate has been modelled as 0.29 m^3 s^{-1} and the emission rate as 239 ou_E s^{-1} per point.

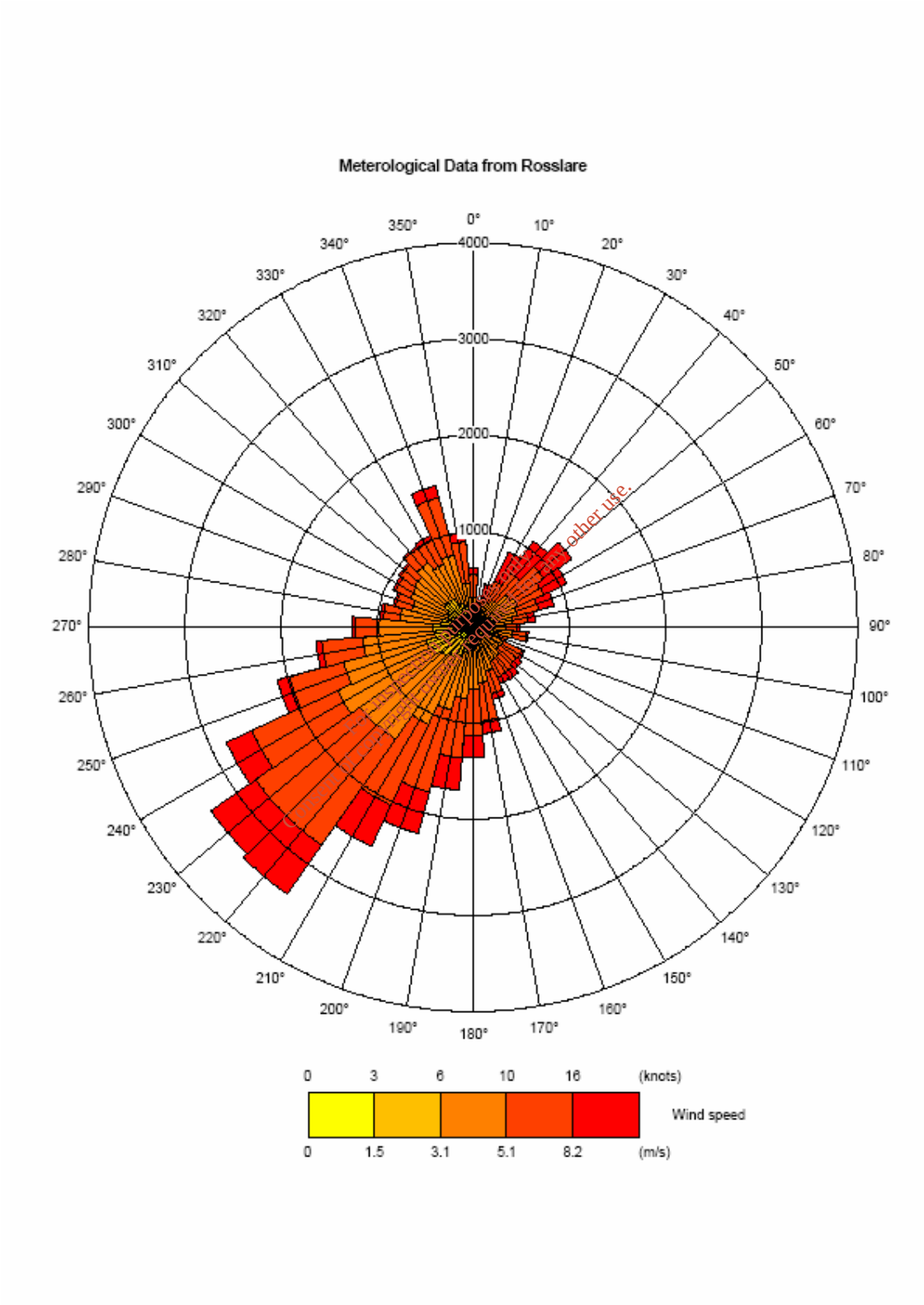
Table 2-8: Digested Sludge Holding Tank Point Sources

Point Source	Source Height	Equivalent circular diameter	X_p	Y_p
	[m]	[m]	[m]	[m]
DSHT1	9	4.7	112230	265073
DSHT2	9	4.7	112224	265073
DSHT3	9	4.7	112236	265073
DSHT4	9	4.7	112226	265069
DSHT5	9	4.7	112230	265067
DSHT6	9	4.7	112234	265069
DSHT7	9	4.7	112226	265077
DSHT8	9	4.7	112230	265079
DSHT9	9	4.7	112234	265077

2.3. METEOROLOGICAL DATA

The chosen synoptic station; that is one that records data on an hourly basis, such as air and soil temperatures, rainfall, wind, pressure, weather, cloud, visibility, humidity, sunshine is at Rosslare, County Wexford, Republic of Ireland. Although there are closer weather recording stations to the site, these are climate stations; which only record meteorological elements on a daily basis, such as rainfall, maximum and minimum temperatures and some record soil and earth temperatures, sunshine, solar radiation and evaporation. Five years of historical data are available spanning November 2001 to October 2006 inclusive. Figure 2-1 shows a summary of the meteorological data as a wind rose.

Figure 2-1: Wind Rose for Rosslare Met Weather Station



3. RESULTS AND CONCLUSIONS

The odour abatement equipment is designed so that, during operation of the works, the air discharged from the site shall not increase the short-term odour concentration by more than 3 $ou_E\ m^{-3}$ as the 95th percentile and 5 $ou_E\ m^{-3}$ at anytime, at the nearest sensitive receptor or anywhere on the boundary of the site. The specification states the short-term odour concentration at the receptor positions shall be assumed to be a factor of ten greater than the hourly-averages predicted by the dispersion model. It follows that the maximum allowable hourly-averaged odour concentration at the receptor positions shall be a factor of ten less than the guaranteed short-term average values. Therefore a long term limit ten times less than stipulated has been used as the desired condition at three receptor positions, A, B and C. This represents 0.3 $ou_E\ m^{-3}$ as a 95th percentile and 0.5 $ou_E\ m^{-3}$ at any time.

This model has also be used to determine the maximum allowable odour emission rate from the stack, which shall be converted to a hydrogen sulphide (H_2S) concentration and a suitable stack discharge height for effective dispersion. The H_2S concentration shall used to monitor and satisfy the performance requirements for the take-over tests of the odour abatement equipment, according to the equation below: -

$$C_s = C_t \times E/UK$$

Where:
- C_s - hydrogen sulphide concentration in stack gas, ppb
- C_t - threshold concentration of hydrogen sulphide, 0.5 ppb
- E - maximum allowable odour emission rate (OU/s)
- U - flow rate of the air from the stack (m^3/s)
- K - ratio of the total TON of the stack air to the TON contributed by the H_2S in the stack air

(Equation taken from Employer's Requirements, Volume 4, Section 7.11.2.)

Preliminary and Primary Treatment Odour Control Unit

$C_s = 0.5 \times 7314/ (3.84 \times 5)$ OCU 1

$C_s = 190$ ppb

Therefore the short term stack hydrogen sulphide emission will be < 50 ppb.

Sludge Treatment Odour Control Unit

$C_s = 0.5 \times 6861/ (1.4 \times 5)$ OCU 2

$C_s = 490$ ppb

Therefore the short term stack hydrogen sulphide emission will be < 50 ppb.

The short term concentrations of hydrogen sulphide in the stack gas shall be automatically and continuously and periodically recorded. The upper 98 percentile value of these stack sample readings shall be less than the C_s shown above (Employer's Requirements, Volume 4, Section 7.11.2).

The contour plots (as shown on drawings C1197-3008/9) show that under normal operating conditions, the isopleths corresponding to 3 $ou_E\ m^{-3}$ (95th percentile, 1-hour average) and 5 $ou_E\ m^{-3}$ (anytime, 1-hour average) does not extend to or beyond the site boundary.

Similarly, at Receptors A and B (C being more distant from the site, beyond Receptor A) the contour plots show that under normal operating conditions, the isopleth corresponding to 0.3 $ou_E\ m^{-3}$ (95th percentile, 1-hour average) does not extend to their location. Also the receptors are within the isopleth for 0.5 $ou_E\ m^{-3}$ (anytime, 1-hour average), indicating it is not exceeded.

Therefore it can be concluded that simple dispersion following odour abatement equipment treating the collected odours will be sufficient to prevent any odour nuisance from occurring outside the works.

Odour dispersion modelling has demonstrated that for the stated emission rates from the odour control unit outlet stacks, the odour levels at the boundary and at specific receptors will be compliant. Therefore the stack locations chosen give good dispersion.

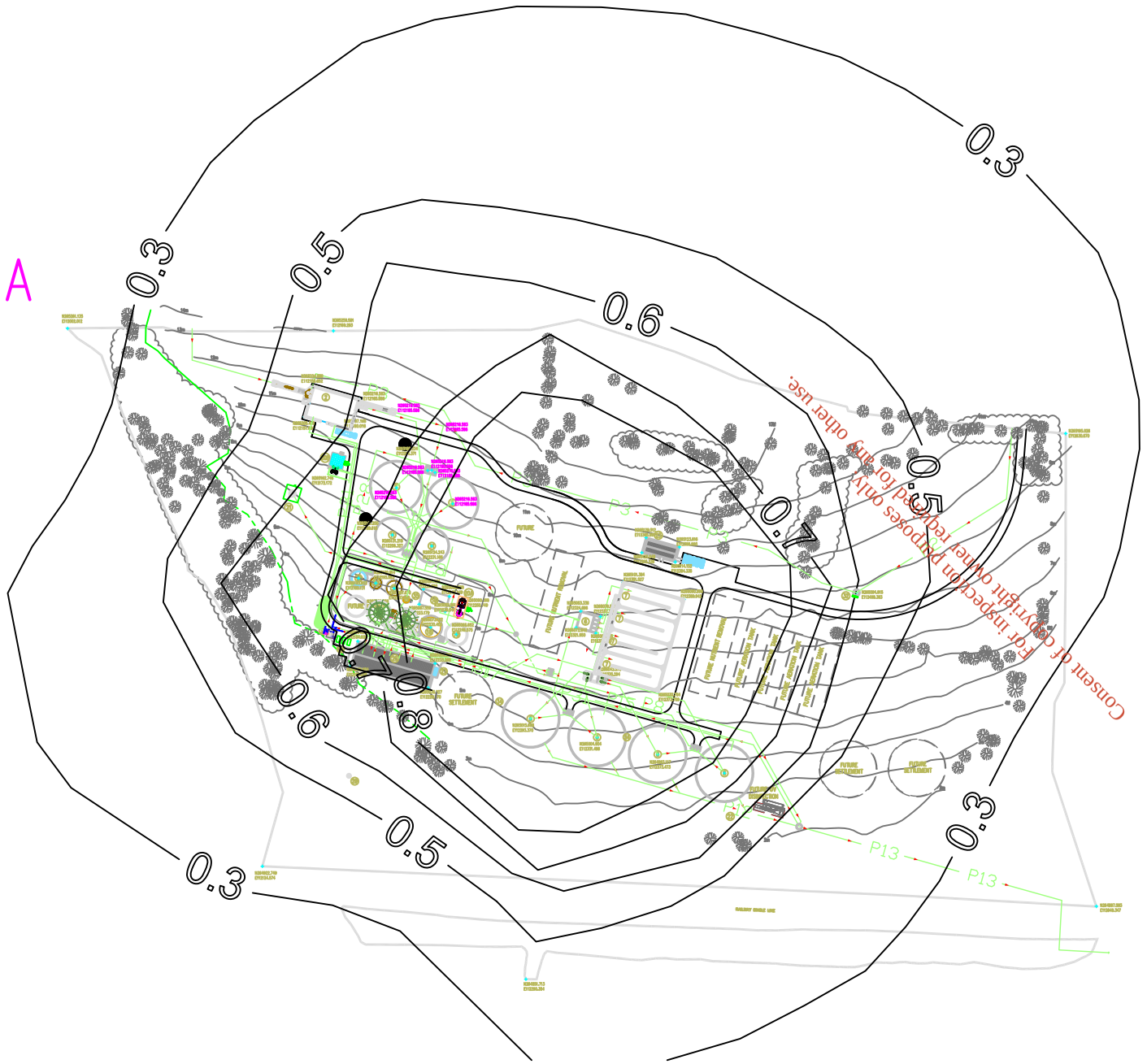
DO NOT SCALE - IF IN DOUBT ASK

Rev. B

Drg. No. C1197-3008

RECEPTOR A

RECEPTOR B



See Previous Issues For Past Revision Details

Rev.	Date	Description	Drawn
B		ITEM 20A ODOUR CONTROL UNIT INDICATED, ITEM 32 BELVIEW PS RELOCATED.	

UNDER REVISION

A.W.I. CONTRACT No 1002

..\03 Title Blocks\Coffey Logo.JPG enpure

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Customer
WATERFORD CITY COUNCIL

Title
ODOUR DISPERSION
CONTOUR MAP 95%ILE
WATERFORD WWTW

Drawn	Checked	Approved	Original Sheet Size
DDFudger			A1
Date	Date	Date	Original Scale
08/08/2007			1:2000
Drg. No. C1197-3008			Rev. B

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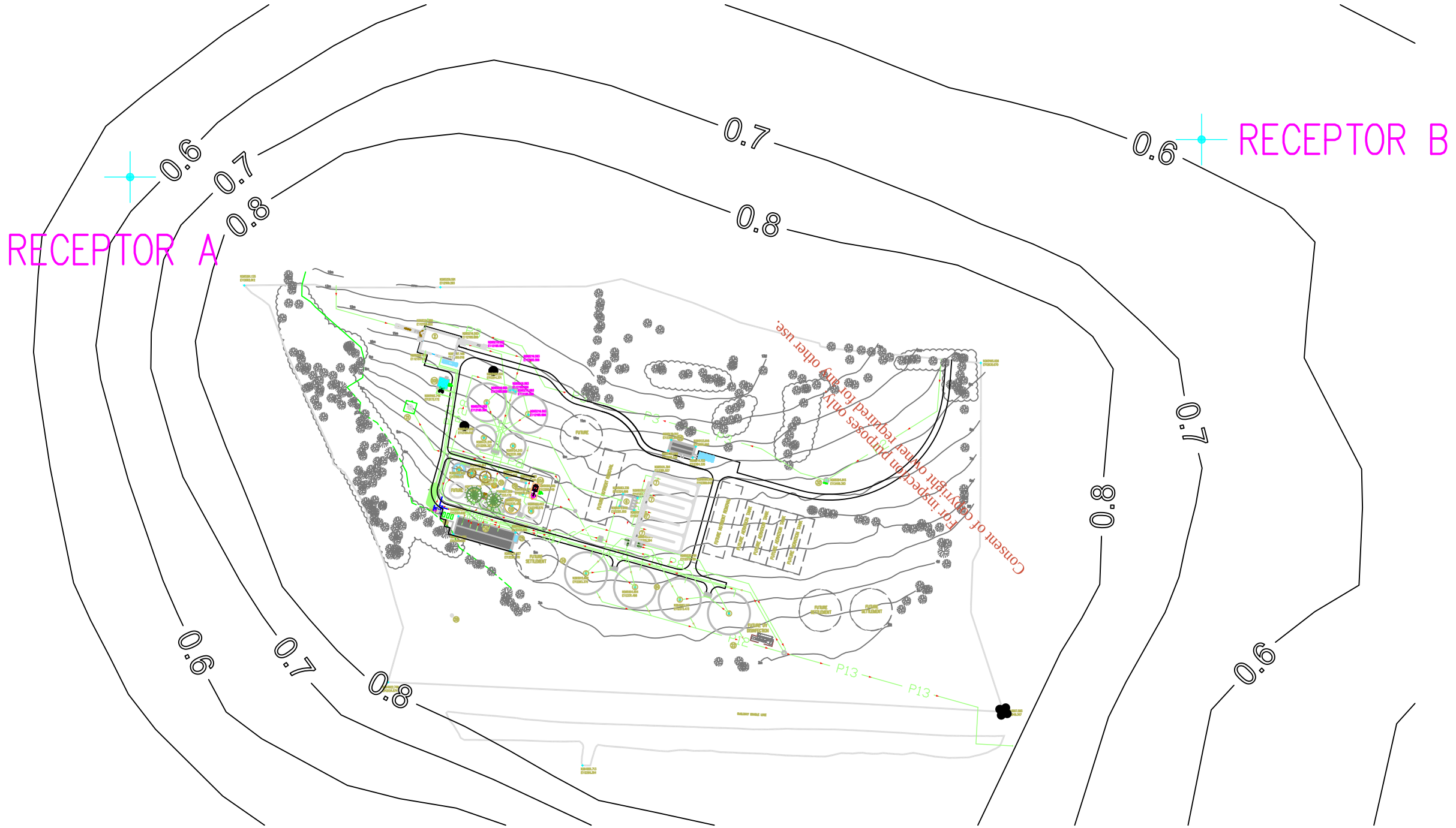
Rev. B

Drg. No. C1197-3009



See Previous Issues For Past Revision Details

Rev.	Date	Description	Drawn
B		ITEM 20A ODOUR CONTROL UNIT INDICATED, ITEM 32 BELVIEW PS RELOCATED.	

UNDER REVISION

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Customer: WATERFORD CITY COUNCIL

Title: ODOUR DISPERSION
CONTOUR MAP 99.5%ILE
WATERFORD WWTW

Drawn	Checked	Approved	Original Sheet Size
DDFudger			A1
Date	Date	Date	Original Scale
08/08/2007			1:2000
Drg. No. C1197-3009			Rev. B

A Baseline Odour Survey at the proposed Waterford City WwTP on behalf of EPS Ireland

For the Attention of:
Mr Michael O'Sullivan
EPS Ireland Ltd
Quarterstown Ind Est
Mallow
Co Cork

Prepared by:
Mr. Sean Creedon
Senior Environmental Consultant

Reviewed by:
Ms. Lisa Blyth
Technical Manager

Ref: ECS2363 – April 2007

EXECUTIVE SUMMARY

Bord na Móna Technical Services was commissioned by Mr. Michael O'Sullivan, of EPS Ireland to carry out a baseline odour assessment of the proposed location for Waterford City WwTP The odour assessment involved ambient hydrogen sulphide measurements and meteorological observations at the boundary and the stipulated sensitive receptors.

Hydrogen Sulphide and meteorological measurements were made over a two day period in the vicinity of the proposed WwTW and also at selected sensitive receptors. The sampling was carried out under specified meteorological conditions. Monitoring was carried out at over 75 different locations each day.

Meteorological conditions were recorded at each monitoring location and comparison is made with the corresponding met data from Rosslare met station. This comparison indicates that the met data at both locations correlates well. The significant difference between the two sets of data is with respect to the recorded wind speed. On both monitoring days the wind speed at the inland proposed facility location is significantly lower that these levels recorded at the Rosslare met station. This indicates that potential dispersion of odours from the proposed site location would not be as good as dispersion at the Rosslare site.

The Hydrogen Sulphide levels recorded on the 05/03/07 ranged from 2.33ppb to 4.00ppb. These ambient measurements were complied and are presented in the form of a contour plot of the area around the proposed facility. These indicate that higher levels of H_2S were recorded at the eastern boundary of the site.

The Hydrogen Sulphide levels recorded on the 06/03/07 ranged from 5.00ppb to 9.00ppb. These ambient measurements were complied and are presented in the form of a contour plot of the area around the proposed facility. These also indicate that higher levels of H_2S were recorded at the eastern boundary of the site.

Under the scope of work it is required that a baseline concentration of Hydrogen Sulphide be proposed for the target area and used in future dispersion modelling. Using the raw data the lowest mean value was recorded for each of the monitoring days. The average figure for both days is 4.62ppb. It is important to note that this figure is dependent on the levels of hydrogen sulphide recorded over the two days under the specific meteorological conditions of those days. It is also important to note that not all odour originating for the operation of WwTW's originates from Hydrogen sulphide emissions.

Respectively Submitted

Mr. Sean Creedon
Senior Environmental Consultant

Ms. Lisa Blyth
Technical Manager

CONTENTS

1.0 INTRODUCTION

Bord na Móna Technical services were contacted by Mr. Michael O'Sullivan, of EPS to carry out a baseline odour survey at the proposed location of the Waterford City Waste water treatment plant.

The scope of the assessment was outlined on page 22 of the Construction Document for Review of the Waterford Main Drainage Scheme Phase 2 – Contract 5 – Waterford City WwTP – volume 2 and also in further detail in Appendix B of the same document. The scope consists of the following:

The baseline odour monitoring will take place across the proposed site, at the boundary of the site, at designated receptor positions and over an area of at least 1km from the site boundary. The survey will take place over at least two days and will correspond to a time when there is no activity on the site. The odour survey will be carried out **only** under the following conditions:

- Two separate days
- Wind speed has to be below 10/m/s (22miles per hour) during the survey
- There must be no precipitation at least 2 hours before the survey commences and also no precipitation during the survey
- Hydrogen Sulphide monitoring must be carried out using a Jerome 631-X gold film analyser (see Section 3.0 for methodology)
- Wind speed and wind direction must be recorded at each monitoring point, cloud cover, ambient temperature and vertical stability must be recorded for each assessment day
- A minimum of 75 monitoring points must be achieved throughout a 2km radius from the site boundary
- Each monitoring location must be assigned a grid reference number recorded using a GPS system
- Triplicate measurement of H_2S shall be taken at each monitoring location
- The wind speed shall be recorded at a height of 1.5m from ground level in m/s.
- The wind direction shall be recorded in degrees and measured to within $\pm$ 5º

There were a number of additional requirements for the data handling and reporting of the baseline odour survey. These include:

- Anomalous readings will be excluded from the data used to calculate the mean calculation (includes the contribution of temporary odour sources)
- Data collected on separate days shall be treated separately
- The lowest mean value, the highest mean value and the average of all mean values will be presented (including standard deviation)
- The prevailing weather conditions will be presented with a statistical summary of the data collected
- The mean concentrations will be plotted on a map and isopleths formed to create Hydrogen Sulphide contours
- The lowest mean value will be adopted as the baseline concentration for the target area

Based on the above scope the following comments were made:

1. The baseline odour mapping of the area where the proposed WwTP is to be located will reflect the odour levels during the meteorological conditions of the day of sampling only. This may not reflect the worst case baseline odour levels at that location.

2. At present there are no ambient Hydrogen Sulphide limit or guideline values for the prevention of Odour nuisance. Comparison can be made to odour impact guidelines using the odour threshold of H_2S, however this is not recommended as odour impact guidelines are determined irrespective of background odour.

3. Finally, although Hydrogen Sulphide is used as a marker odour compound for the operation of WwTPs, not all odour produced from this type of facility is made up of this compound.

This report presents the results of that sampling programme, assessment of the recorded figures and comment on the proposed baseline hydrogen sulphide concentration.

2.0 SAMPLING METHODOLOGY

Ambient Hydrogen Sulphide measurement and Analysis

H_2S monitoring was monitored using a hand held Jerome 631-X H_2S analyser. This instrument utilizes a patented gold film sensor to make accurate determinations of hydrogen sulphide at levels well below the conventional odour nuisance threshold of 8-12 ppb (parts per billion), in comparison to the colorimetric qualitative indicator tubes (Drager). When sampling, an internal pump draws air into the instrument and any hydrogen sulphide present is absorbed onto the gold film sensor. The sensor is selective to hydrogen sulphide which causes a change in electrical resistance properties directly proportional to the gas concentration. The gold film sensors' selectivity to H_2S eliminates interference from SO_2, CO_2, CO and water vapour. Sensor calibration can be verified in the filed using the Jerome H_2S functional test kit. The analysis range of the Jerome 631-X is from 0.001ppm to 50ppm (parts per million).

Figures 2.1 and 2.2 below and overleaf outline the odour sampling locations chosen at the site during the 05/03/07 and the 06/03/07.

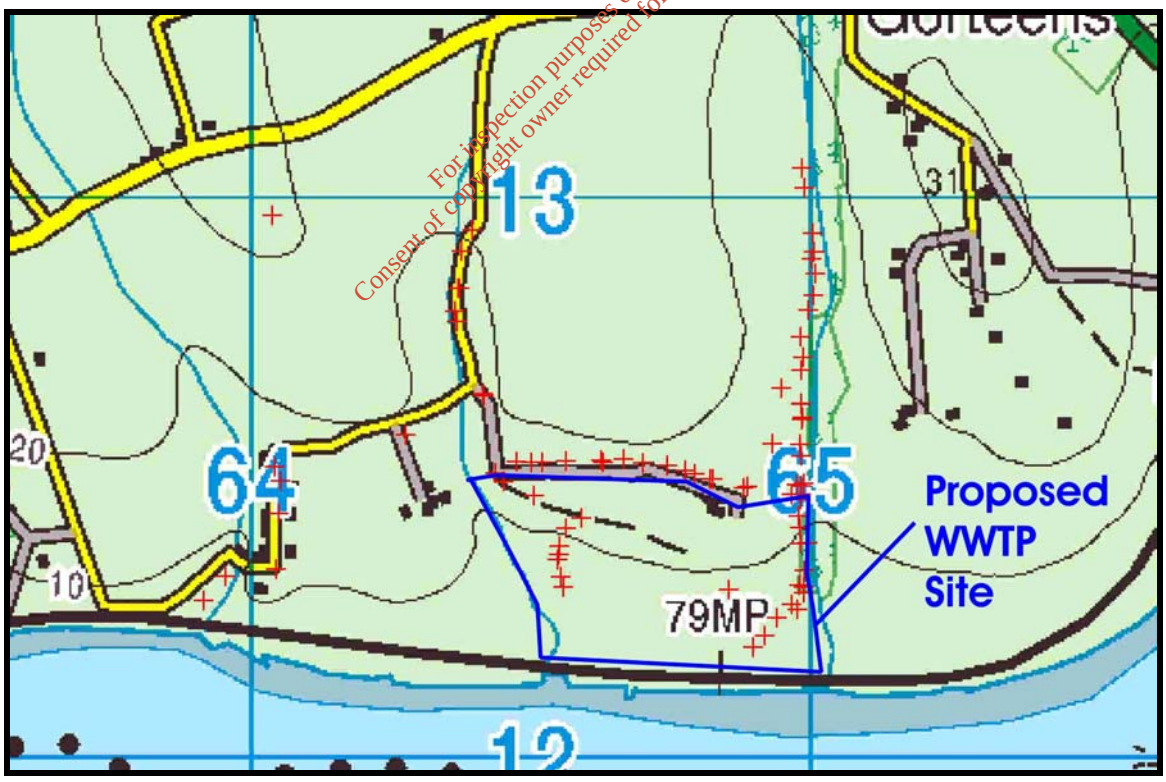


Figure 2.1 Location of Odour monitoring locations on the 05/03/07

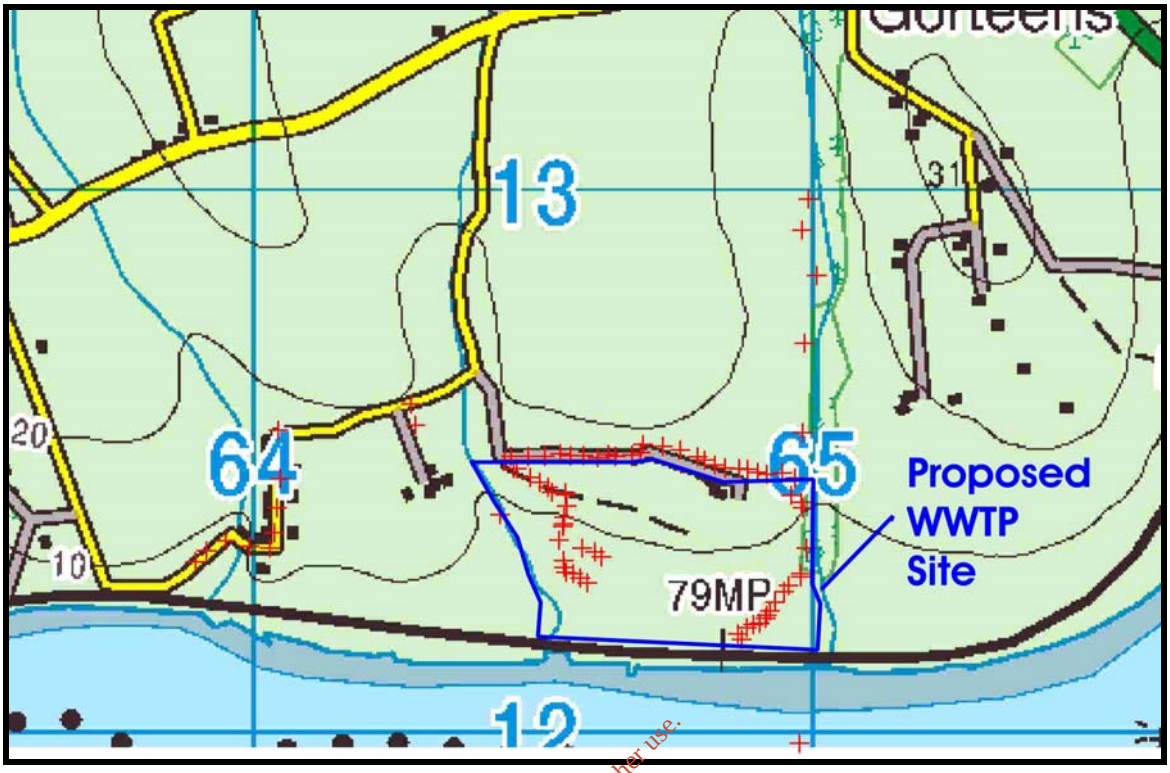


Figure 2.2 Location of Odour monitoring locations on the 06/03/07

Table 2.1 below outlines the general classification of the odour monitoring locations.

TABLE 2.1 ODOUR MONITORING LOCATIONS	
Sampling Locations	**Description**
Northern Boundary	A large number of measurements along the Northern Boundary of the proposed site
Eastern Boundary	A series of measurements along an existing stream
Western Boundary	A series of measurements along an existing contour
South Eastern Boundary	A number of measurements within the site
Entrance Road	A large number of measurements along the new entrance road
Western Sensitive Receptors	A number of measurements beside existing dwellings to the west of the proposed site
Northern Sensitive Receptors	A number of measurements along an existing roadway to the north of the site

3.0 RESULTS

3.1 Meteorological Data

Meteorological Sampling Conditions on the 5/03/07 and 06/03/07

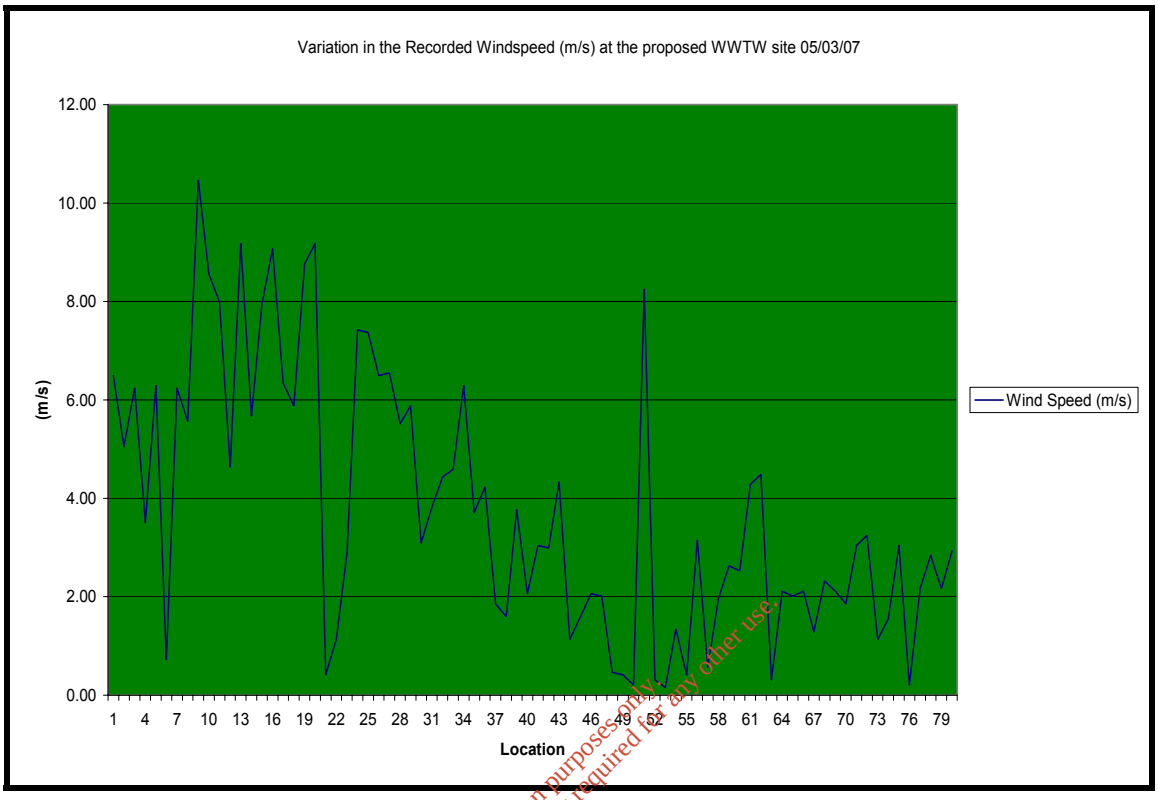
Weather conditions during ambient H_2S sampling are outlined in Table 4.1 below. The cloud cover was constant (8/8 coverage) and the ground conditions were damp throughout the survey.

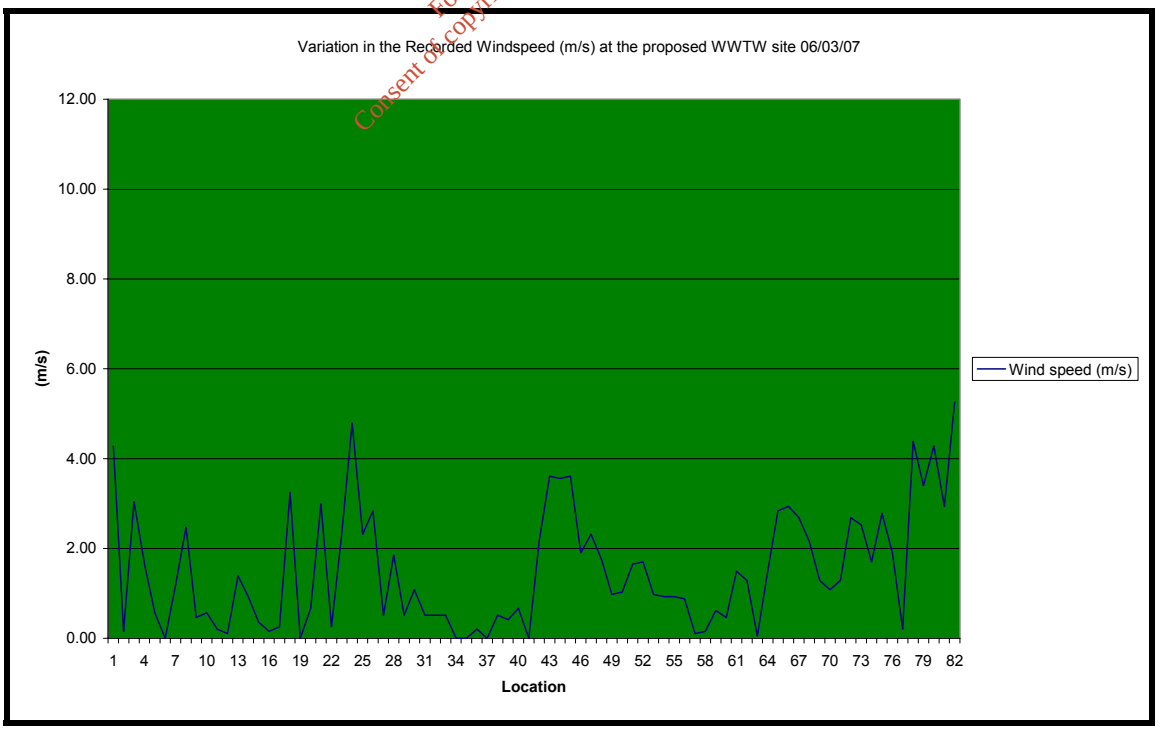
TABLE 3.1: SUMMARY OF ON-SITE METEOROLOGICAL CONDITIONS DURING THE 05/03/07	
Parameter	**Range of recorded values**
Wind Direction (Degrees)	190 to 240
Maximum Wind Velocity (m/s)	10.46 Note 1
Average Wind Velocity(m/s)	3.77
Temperature (^oC)	8.2
Barometric Pressure (mbar)	995.6

Note 1: This was the only recorded exceedence of the 10m/s limit value during the survey

TABLE 3.2: SUMMARY OF ON-SITE METEOROLOGICAL CONDITIONS DURING THE 06/03/07	
Parameter	**Range of recorded values**
Wind Direction (Degrees)	200 to 275
Maximum Wind Velocity (m/s)	5.26
Average Wind Velocity(m/s)	1.52
Temperature (^oC)	10.0
Barometric Pressure (mbar)	992.6

Figures 3.1 and 3.2 below illustrate the variation in windspeed recorded during the 5th and 6th of March at the proposed WwTW location.





Meteorological data is also taken from the nearest Met Eireann meteorological Station for the 5/03/07.

TABLE 3.3: RECORDED METEOROLOGICAL DATA AT ROSSLARE – 05/03/07					
Date	**Hour**	**Wind Direction (Degrees from North)**	**Wind Speed (m/s)**	**Temperature (Degrees Celsius)**	**Mean Sea Level Pressure (hPa)**
05/03/07	1	220	8.2	6.5	995.3
05/03/07	2	230	8.2	6.7	996
05/03/07	3	240	8.8	6.9	997
05/03/07	4	240	9.3	6.6	997.8
05/03/07	5	240	7.7	6	998.7
05/03/07	6	240	7.7	6	1000
05/03/07	7	240	7.2	6.4	1000.7
05/03/07	8	230	6.2	6.2	1001.5
05/03/07	9	230	7.2	7.4	1001.8
05/03/07	10	220	8.8	7.8	1002
05/03/07	11	220	9.3	7.1	1002
05/03/07	12	210	9.8	9.4	1001.3
05/03/07	13	210	11.9	9.3	1000.6
05/03/07	14	200	11.9	9.4	998.5
05/03/07	15	200	12.9	9.2	996.5
05/03/07	16	200	13.9	9.5	995
05/03/07	17	200	14.4	9.8	993.1
05/03/07	18	200	14.4	9.6	991.2
05/03/07	19	200	14.9	9.6	989.5
05/03/07	20	200	14.9	9.5	988
05/03/07	21	200	14.9	9.9	986
05/03/07	22	200	15.5	10	984.3
05/03/07	23	210	13.4	10.3	984.1
05/03/07	24	210	12.9	10.3	983.2
Minimum	**N/A**	**200.0**	**6.2**	**6.0**	**983.2**
Average	**N/A**	**216.3**	**11.0**	**8.3**	**995.2**
Maximum	**N/A**	**240.0**	**15.5**	**10.3**	**1002.0**

TABLE 3.4: RECORDED METEOROLOGICAL DATA AT ROSSLARE – 06/03/07					
Date	**Hour**	**Wind Direction (Degrees from North)**	**Wind Speed (m/s)**	**Temperature (Degrees Celsius)**	**Mean Sea Level Pressure (hPa)**
06/03/07	1	210	12.9	10.4	981.9
06/03/07	2	230	9.8	9.3	983.5
06/03/07	3	250	7.7	9	985.7
06/03/07	4	280	4.6	7.8	988
06/03/07	5	260	5.7	7	989.3
06/03/07	6	240	5.2	7	991
06/03/07	7	240	5.2	6.8	992
06/03/07	8	230	4.1	6.7	992.5
06/03/07	9	230	5.2	7.6	993
06/03/07	10	230	5.7	8.6	993.4
06/03/07	11	230	7.2	10	993.7
06/03/07	12	220	8.2	10.7	993.8
06/03/07	13	220	8.2	10.1	993.9
06/03/07	14	220	7.7	10.5	994.1
06/03/07	15	220	7.2	9.3	993.4
06/03/07	16	220	7.7	9	993.3
06/03/07	17	220	6.7	9.1	993
06/03/07	18	230	6.7	9.1	993.6
06/03/07	19	250	4.1	7.7	994.4
06/03/07	20	250	3.6	6.9	994.9
06/03/07	21	240	3.1	6.7	995.4
06/03/07	22	250	5.2	6.9	995.8
06/03/07	23	250	4.1	6.2	996.2
06/03/07	24	240	4.1	6.3	996.5
Minimum	**N/A**	**210.0**	**3.1**	**6.2**	**981.9**
Average	**N/A**	**235.8**	**6.3**	**8.3**	**992.2**
Maximum	**N/A**	**280.0**	**12.9**	**10.7**	**996.5**

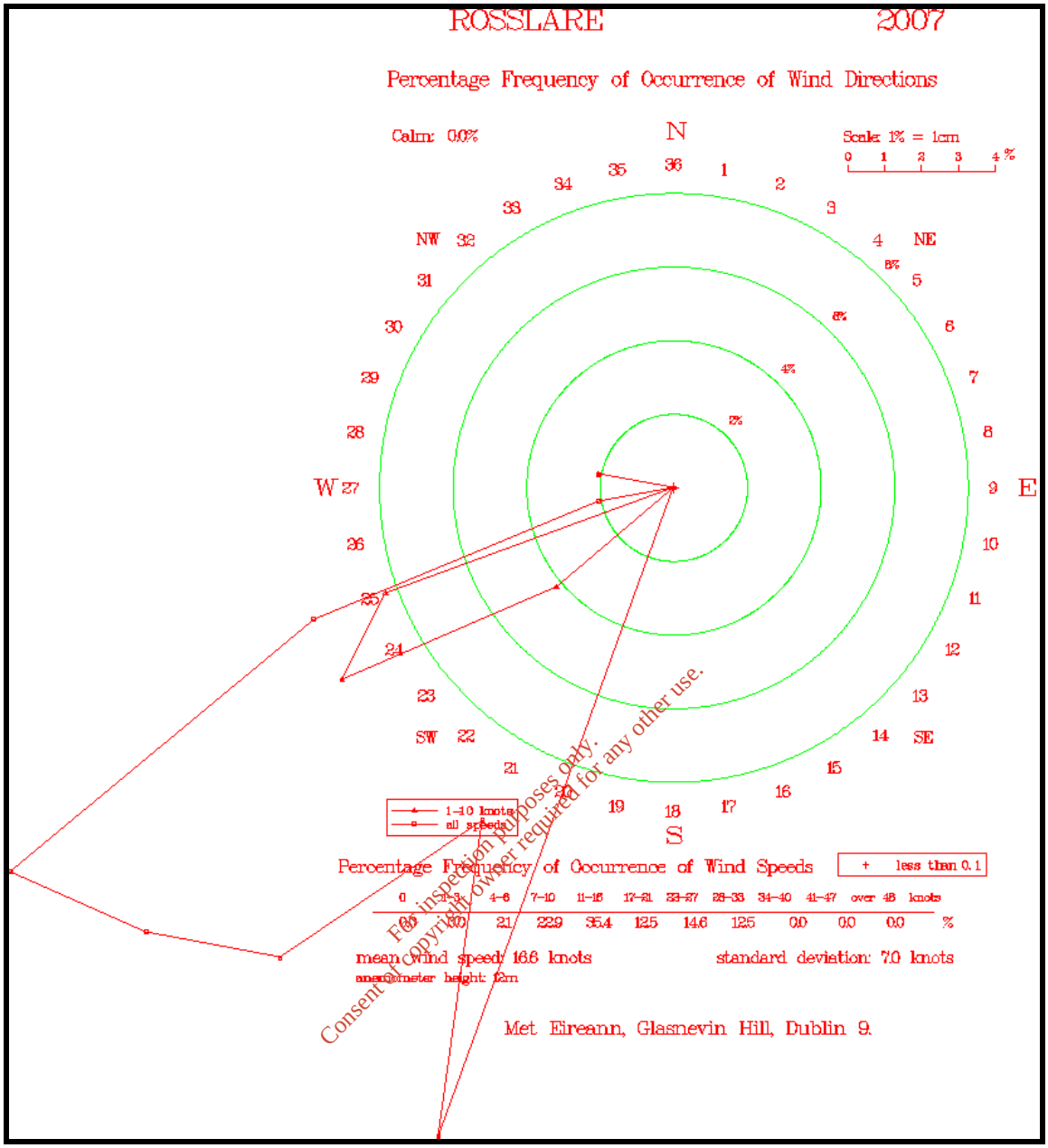


Figure 3.1 Windrose illustrating wind speed and wind direction at Rosslare Met station during the 5th and 6th of March 2007

The degree of atmospheric turbulence is easily described using the Pasquill Stability Indices which range from extremely unstable (A) to extremely stable (F). This simple system takes into account the influence of solar radiation during the day and night time cloud cover. Unstable conditions promote the rapid dispersion of atmospheric contaminants and result in lower air concentrations compared with stable conditions.

TABLE 3.5 PASQUILL STABILITY INDEX

Pasquill Stability Index	Definition	Comment
A	Very unstable	Most turbulent, excellent mixing
B	Unstable	
C	Slightly unstable	Some mixing
D	Neutral	
E	Slightly stable	
F	Stable	Inversion conditions, ground layer trapped, little dispersion

TABLE 3.6 PASQUILL STABILITY INDICES DURING THE MONITOIRNG PERIOD (5TH TO THE 6TH OF MARCH 2007)

Pasquill Stability Index	Percentage occurrence (%)
A	3.6
B	12.7
C	9.0
D	72.7
E	1.8
F	0.0

Examination of the stability indices indicates that the turbulence conditions during the monitoring period were mainly neutral with some unstable conditions. These unstable conditions would result in enhanced dispersion and lowered H_2S ambient air levels.

Table 4.1 Average Hydrogen Sulphide Concentrations on the 5/03/07 Note 1	
Measurement No.	**Concentration (ppb)**
1	2.67
2	3.00
3	3.00
4	3.00
5	3.00
6	2.67
7	3.00
8	2.67
9	3.00
10	3.00
11	3.00
12	3.00
13	3.00
14	3.00
15	3.00
16	3.00
17	3.00
18	3.00
19	3.00
20	3.00
21	3.00
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23	3.00
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25	3.00
26	2.67
27	3.00
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29	3.00
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42	3.00
43	3.00
44	3.00
45	3.00
46	3.00
47	3.00
48	3.00
49	3.67

50	4.00
51	4.00
52	3.33
53	3.33
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69	3.00
70	3.00
71	3.00
72	3.00
73	3.00
74	3.00
75	3.00
76	3.00
77	3.00
78	3.00
79	3.00
80	3.00
Average Concentration	**3.01**
Maximum Concentration	**4.00**
Minimum Concentration	**2.33**

Note 1 Each concentration is an average of 3 measurements taken at each location.

TABLE 4.2 AVERAGE AND STANDARD DEVIATION OF LOWEST, MEDIAN AND HIGHEST RECORDED LEVELS AT EACH LOCATION			
	Lowest Mean Value	**Average Mean Value**	**Highest Mean Value**
	Concentration (ppb)	**Concentration (ppb)**	**Concentration (ppb)**
Average	2.86	3.01	3.14
Standard Deviation	0.44	0.25	0.44

Table 4.3 Average Hydrogen Sulphide Concentrations on the 6/03/07 Note 1	
Measurement No.	**Concentration (ppb)**
1	5.67
2	6.00
3	6.00
4	6.33
5	6.00
6	6.00
7	7.00
8	6.00
9	6.00
10	5.67
11	6.00
12	7.00
13	7.00
14	7.00
15	6.67
16	6.33
17	5.33
18	5.00
19	5.67
20	7.00
21	6.33
22	6.00
23	6.00
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25	6.33
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47	6.00
48	7.00
49	7.00

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51	6.00
52	9.00
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64	6.00
65	6.00
66	6.33
67	6.00
68	6.00
69	7.00
70	6.00
71	6.00
72	5.67
73	6.00
74	7.00
75	7.00
76	7.00
77	6.67
78	6.33
79	5.33
80	5.00
Average Concentration	**6.55**
Maximum Concentration	**9.00**
Minimum Concentration	**5.00**

Note 1 Each concentration is an average of 3 measurements taken at each location.

TABLE 4.4 AVERAGE AND STANDARD DEVIATION OF LOWEST, MEDIAN AND HIGHEST RECORDED LEVELS AT EACH LOCATION			
	Lowest Mean Value	**Average Mean Value**	**Highest Mean Value**
	Concentration (ppb)	**Concentration (ppb)**	**Concentration (ppb)**
Average	6.38	6.73	6.55
Standard Deviation	0.68	0.75	0.63

.

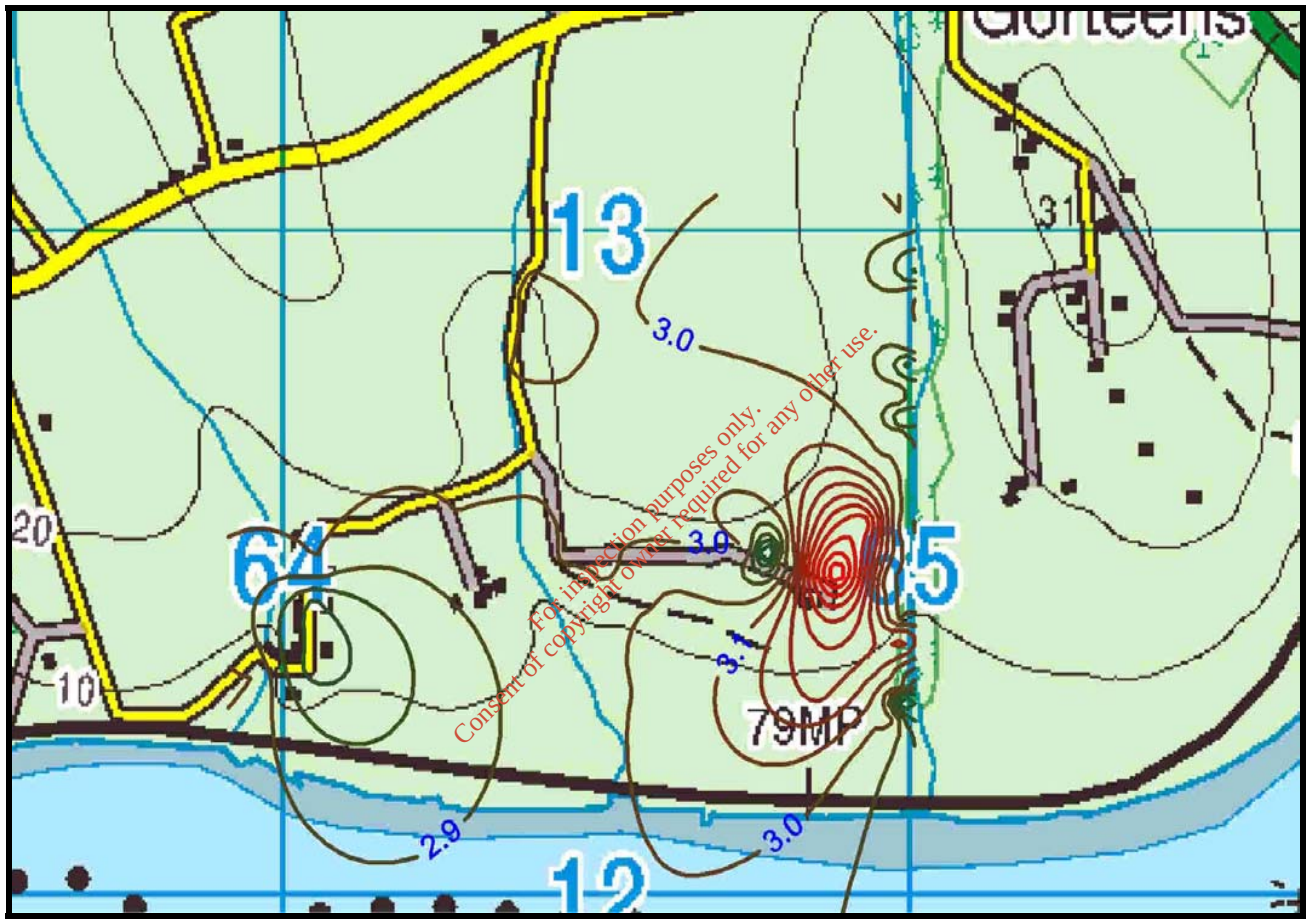

Figure 4.1 Hydrogen Sulphide Contour plot of data recorded on the 5/03/06

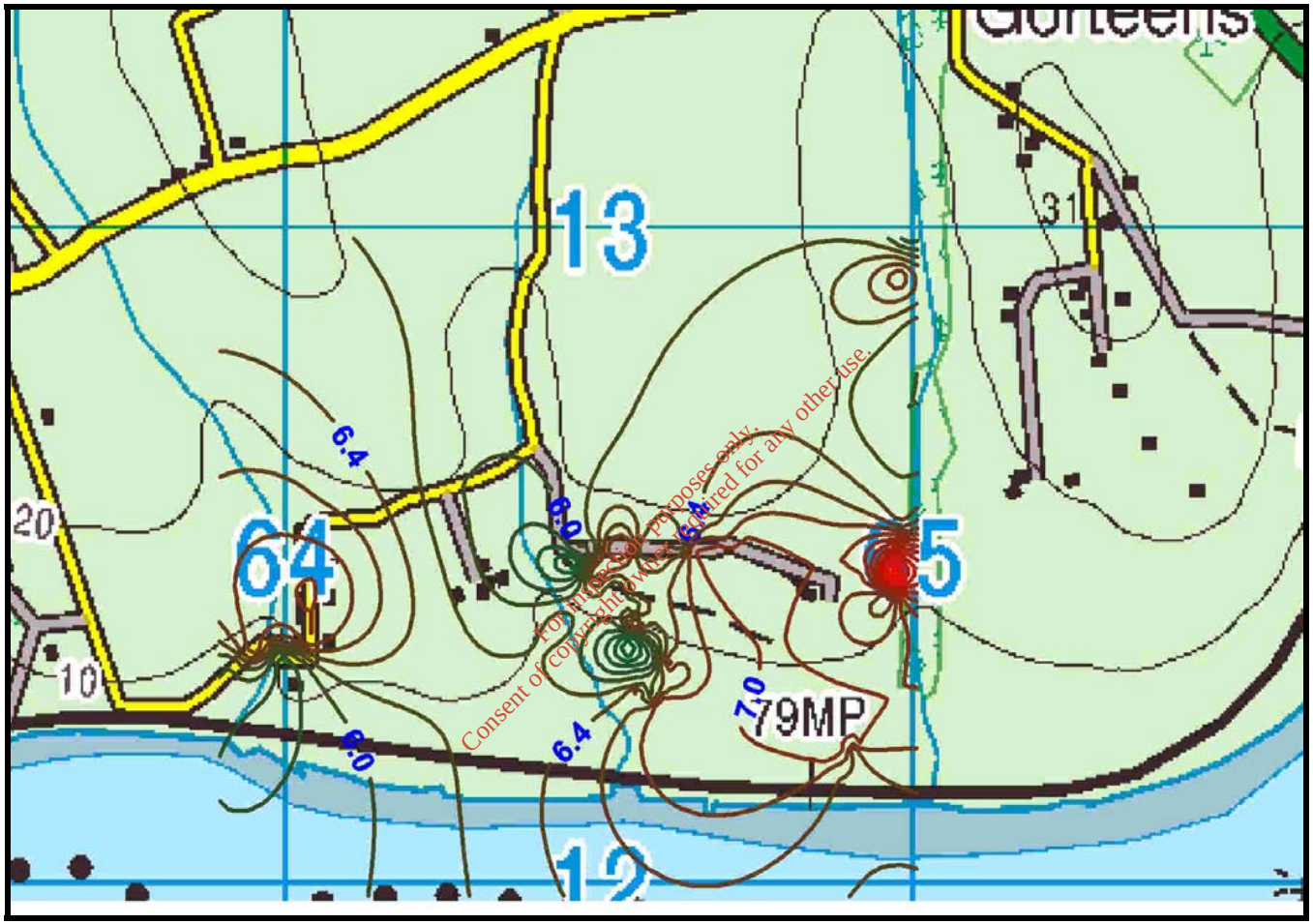

Figure 4.2 Hydrogen Sulphide Contour plot of data recorded on the 6/03/06

4.0 DISCUSSION

The discussion of the assessment is split into two sections. The first section discusses the odour measurements and meteorological observations made during the monitoring period and the second section deals with the proposed Hydrogen sulphide baseline concentration and any relevant hydrogen sulphide limit values.

Assessment Results

An odour is defined as a sensation resulting from the reception of a stimulus by the olfactory sensory system. The way the human response to an odour is evaluated depends on the particular sensory property that is being measured, including the intensity, detectability, character, and hedonic tone (acceptability) of the odour. The combined effect of these properties is related to the annoyance that may be caused by the odour. Odorous air pollutants are often judged important, primarily for their nuisance value and the number of complaints they generate.

Weather conditions were recorded during both days of the monitoring programme. These recordings are compared to the nearest met eireann meteorological station which in this case was Rosslare. Table 5.1 below outlines the site specific and Rosslare meteorological recordings.

TABLE 4.1 SUMMARY OF MET DATA FOR THE 5/03/07		
Parameter	**Range of on site recorded values**	**Range of Rosslare recorded values**
Wind Direction (Degrees)	190 to 240	200 to 240
Maximum Wind Velocity (m/s)	10.46	15.5
Average Wind Velocity(m/s)	3.77	8.3
Temperature (^{o}C)	8.2	8.3
Barometric Pressure (mbar)	995.6	995.2

The on-site measurements correlate very well with those measurements taken at the Rosslare met station. There is a significant difference in both the maximum windspeed and average wind speed parameters. Both parameters are significantly

higher at the Rosslare location. This reflects the exposed location of the met station in comparison to the relatively sheltered inland location of the proposed WwtW.

TABLE 4.2 SUMMARY OF MET DATA FOR THE 6/03/07		
Parameter	**Range of on site recorded values**	**Range of Rosslare recorded values**
Wind Direction (Degrees)	200 to 275	210 to 280
Maximum Wind Velocity (m/s)	5.26	12.9
Average Wind Velocity(m/s)	1.52	6.3
Temperature (^{o}C)	10.0	8.3
Barometric Pressure (mbar)	992.6	992.2

As on the 5th, the on-site met data recorded on the 6th correlates well with the Rosslare data. Also the recorded wind speeds at the Rosslare site are again significantly higher that at the proposed WwTW. This would indicate that in general the windspeed at the proposed WwTW are in general lower than those recorded at the nearest costal met station. Pollutant or odour dispersion is generally poorer in lower wind conditions.

The ambient temperature over the two days ranged from 6.0^{o}C to 10.7^{o}C. The maximum wind velocity recorded during the sampling period was 10.47 m/s (Fresh Breeze). The maximum barometric pressure was recorded on the 05/04/07 (1002.0mbar).

Inspection of the levels of Hydrogen Sulphide recorded during the assessment at the site boundary and at the stipulated sensitive receptors indicates that there was little variation in the H_2S concentrations between locations. The measurements recorded on the 05/03/07 ranged from 2.33ppb to 4.0ppb and from 5.0ppb to 9.0ppb on the 06/03/07. The reported odour threshold for Hydrogen sulphide ranges from 2.5ppb [1] to 0.5ppb [2]. During the site assessment no discernable odour of Hydrogen Sulphide was detected at the majority of the sampling locations. An ambient sampling programme was carried out by the Environment Agency in the vicinity of a landfill site in Wales in 2004 [3]. In this study ambient concentrations of H_2S up to 1.5ppb were recorded. A similar study was carried out in 2003 which also reported Hydrogen sulphide values in the same range. [4]. Although these activities are not directly related to the proposed

WwTWs, they are useful for comparative purposes. Comparison of the reported ambient H_2S levels and the odour threshold values for this compound indicate that the recorded levels during the assessment are comparable to background concentrations.

The measured hydrogen sulphide concentrations are presented in Figures 4.1 and 4.2 as isopleth contour plots. These plots indicate that the most significant concentrations are located on the eastern boundary of the proposed facility. The plots indicate that there were localised increases in hydrogen sulphide detected in this area.

Significantly higher H_2S concentrations were determined on the 6th of March in comparison to those on the 5th of March. This may reflect the influence of the decreased wind speeds that were recorded during the second monitoring period.

Proposed Hydrogen Sulphide Baseline

As required under the terms of the assessment scope, a proposed hydrogen sulphide baseline level is required to be determined. This was determined by assessing the H_2S concentrations recorded at each location and determining the lowest mean of these results. The lowest mean recorded on the 05/03/07 was 2.86ppb and 6.38ppb on the 06/03/07.The average lowest mean over the two days is **4.62ppb**. Therefore this is proposed as the baseline concentration. It is important to note the following comments with regard to the above baseline concentration.

- The Hydrogen Sulphide levels were recorded under the specific meteorological conditions on the 5th and 6th of March. These met conditions may not reflect the worst case baseline levels of Hydrogen sulphide.
- Hydrogen sulphide is a constituent of odour from the operation of WwTW's but is not the only odorous compound generated by this process.

5.0 REFERENCES

[1] Devos, M. 'Standardized Human Olfactory Thresholds' Oxford University Press 1990

[2] IPPC H4 Horizontal Guidance for Odour. Environment Agency 2002

[3] 'Study of Ambient Air Quality at Clydach Vale 29 October 2003 to 3 February 2004' Environment Agency – Monitoring and Assessment April 2004

[4] 'Study of Ambient Air Quality at Llanidloes 30 June 2003 to 28 October 2003' Environment Agency – Monitoring and Assessment February 2004

Appendix 4.1

SERBD Water Quality Monitoring Data

Station No.	Location	DO	BOD	pH	Ammo	o-	Nitrate	Total	Faecal
		% Sat	mg/l O2		mg/l N	mg/l P	mg/l N	Count	Count
		Surface						/100ml	/100ml
	Suir Estuary - Middle								
50	R. Suir at Waterford Br.	91.00	1.10	8.30	0.10	0.04	3.30	4100	520
50	R. Suir at Waterford Br.	91.00	1.20	8.20	0.22	0.04	3.00	6500	620
50	R. Suir at Waterford Br.	97.00	2.10	8.00	0.11	0.02	2.00	24200	5800
50	R. Suir at Waterford Br.	96.00	0.90	8.10	0.10	0.01	2.10	4494	406
50	R. Suir at Waterford Br.	97.00	0.90	8.20	0.04	0.01		4620	456
50	R. Suir at Waterford Br.	98.00	4.50	8.30	0.06	0.03	2.10	12300	1100
50	R. Suir at Waterford Br.	78.00	2.40	7.90	0.41	0.03	1.10	4960	600
50	R. Suir at Waterford Br.	72.00	2.20	8.00	0.35	0.05	2.30	24190	3450
50	R. Suir at Waterford Br.	81.40	2.20	7.80	0.20	0.03	1.80	5230	700
50	R. Suir at Waterford Br.	83.00	2.30	7.90	0.19	0.04	2.20	48380	12260
50	R. Suir at Waterford Br.	93.00	2.00	7.90	0.14	<0.006	3.60	48384	4494
50	R. Suir at Waterford Br.	89.00	2.70	7.90	0.13	0.03	2.20	15380	1140
50	R. Suir at Waterford Br.	88.87	2.04	8.04	0.17	0.03	2.34	16895	2629
51.2	R. Suir at Abbeylands	91.00	1.10	8.10	0.23	0.04	2.60	31000	3300
51.2	R. Suir at Abbeylands	95.00	2.70	8.10	0.19	0.03	1.70	24200	19900
51.2	R. Suir at Abbeylands	96.00	0.80	8.10	0.11	0.01	2.10	5226	492
51.2	R. Suir at Abbeylands	96.00	1.00	8.10	0.07	0.02	2.10	5818	456
51.2	R. Suir at Abbeylands	79.60	1.50	7.80	0.21	0.03	1.60	4290	760
51.2	R. Suir at Abbeylands	80.00	1.50	7.90	0.21	0.04	2.20	10950	1590
51.2	R. Suir at Abbeylands	95.00	1.50	7.90	0.30	<0.006	3.40	48384	8212
51.2	R. Suir at Abbeylands	89.00	2.30	7.80	0.17	0.03	2.20	17240	1705
51.2	R. Suir at Abbeylands	90.20	1.55	7.98	0.19	0.03	2.24	18389	4552
	Suir Estuary - Lower								
53	Waterford Castle	94.00	1.10	8.10	0.10	0.01	1.90	10344	844
53	Waterford Castle	96.00	1.21	8.10	0.11	0.01	1.20	7308	748
53	Waterford Castle	82.00	3.60	8.00	0.26	0.03	0.56	3255	330
53	Waterford Castle	67.00	2.80	7.90	0.46	0.05	2.10	17330	1330
53	Waterford Castle	82.80	1.00	7.90	0.17	0.03	1.30	8160	960

53	Waterford Castle	79.00	1.20	7.90	0.24	0.04	1.60	8700	940
53	Waterford Castle	83.47	1.82	7.98	0.22	0.03	1.44	9183	859
58	R. Suir at King's Channel	95.00	1.10	8.10	0.10	0.00		14136	2909
58	R. Suir at King's Channel	95.00	1.10	8.10	0.12	0.01		6867	670
58	R. Suir at King's Channel	82.50	2.40	8.00	0.24	0.03	0.42	1960	265
58	R. Suir at King's Channel	70.00	3.70	7.90	0.46	0.05	1.50	10460	1410
58	R. Suir at King's Channel	81.00	1.80	7.90	0.18	0.03	1.30	9210	1160
58	R. Suir at King's Channel	82.00	1.10	7.90	0.21	0.04	1.70	7270	1010
58	R. Suir at King's Channel	84.25	1.87	7.98	0.22	0.03	1.23	8317	1237
59	R. Suir at Belview Port	96.00	2.10	8.20	0.34	0.04	2.40	8660	1483
59	R. Suir at Belview Port	100.00	1.50	8.20	0.19	0.03	2.40	2480	320
59	R. Suir at Belview Port	95.00	1.90	8.00	0.08	<0.006	2.40	31061	1454
59	R. Suir at Belview Port	90.00	2.00	7.80	0.16	0.04	2.00	28272	3130
59	R. Suir at Belview Port	95.25	1.88	8.05	0.19	0.04	2.30	17618	1597
	Suir/Barrow/Nore Estuary								
61	Estuary - Cheekpoint	93.00	2.90	8.20	0.23	0.03	1.30	6900	990
61	Estuary - Cheekpoint	98.00	1.10	8.20	0.16	0.03	1.60	1180	207
61	Estuary - Cheekpoint	103.00	1.50	8.20	0.02	<0.006		996	155
61	Estuary - Cheekpoint	102.00	1.20	8.10	0.05	<0.006		1462	92
61	Estuary - Cheekpoint	91.00	2.60	8.20	0.03		1.20	5800	540
61	Estuary - Cheekpoint	85.00	3.00	8.00	0.18	0.02	0.35	1630	150
61	Estuary - Cheekpoint	79.60	3.90	7.90	0.44	0.04	1.70	3920	260
61	Estuary - Cheekpoint	87.00	1.40	8.00	0.13	0.03	1.30	3850	510
61	Estuary - Cheekpoint	87.00	1.30	8.00	0.16	0.03	1.70	2595	270
61	Estuary - Cheekpoint	97.00	1.80	8.10	0.11	0.01	3.20	24192	1401
61	Estuary - Cheekpoint	92.00	1.80	7.90	0.14	0.04	1.50	18416	1814
61	Estuary - Cheekpoint	92.24	2.05	8.07	0.15	0.03	1.54	6449	581

Station No.	Location	DO	BOD	pH	Ammonia	Ortho-Phosphate	Nitrate	Total Coliforms	Faecal Coliforms
		% Sat	mg/l O2	pH Units	mg/l N	mg/l P	mg/l N	Count	Count
		Surface						/100ml	/100ml
50	R. Suir at Waterford Br.	88.87	2.04	8.04	0.17	0.03	2.34	16895	2629
51.2	R. Suir at Abbeylands	90.20	1.55	7.98	0.19	0.03	2.24	18389	4552
53	Waterford Castle	83.47	1.82	7.98	0.22	0.03	1.44	9183	859
58	R. Suir at King's Channel	84.25	1.87	7.98	0.22	0.03	1.23	8317	1237
59	R. Suir at Belview Port	95.25	1.88	8.05	0.19	0.04	2.30	17618	1597
61	Estuary - Cheekpoint	92.24	2.05	8.07	0.15	0.03	1.54	6449	581

Appendix 4.2

WCC Wastewater Discharge Monitoring Results

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus,
Mahon Industrial Park,
Blackrock,
CorkTel: 021-4536141
Fax: 021-4536149

Analysis Report

Attention:
Derek White/Ray Mannix
Waterford City Council (Waterpark)
Waterpark Pumping Station
Park Road,
Waterford
Fax No:
Tel No: 087-2690213/
086 8304644
PO Number:
Sample Type Wastewater

Condition on receipt Satisfactory

Report No: 09006

Date of receipt: 29/11/2007
Date Started: 29/11/2007

Issue Date: 14/12/2007
Page 1 **of** 3

Delivery Mode Courier
No. of Samples 3

Client Ref: See Attached

Parameter	Method
pH	EW132 Electrometric Measurement
Conductivity	EW042 Conductivity Measurement
Suspended Solids	EW013 Suspended Solids by Gravimetric Analysis
COD	EW094 Chemical Oxygen Demand by Closed Reflux Colorimetry
BOD	Std Method 5210 B: 5 day test, DO meter
Total Nitrogen	EW022 Total Nitrogen by Persulphate Digestion
Total Phosphorus	EW002 Total Phosphorus by Acid Persulphate Digestion
Cyanide	EW050 Autoanalyser Spectrophotometry
Ammonium	EW003 -Ammonia by Autoanalyser Spectrophotometry
Nitrate	EW034 -Nitrate by Autoanalyser Spectrophotometry
Nitrite	EW035 Nitrite by Autoanalyser Spectrophotometry
Phosphate	EW007 Autoanalyser Spectrophotometry
Sulphate	EW016 Autoanalyser Spectrophotometry
Flouride	H 8029,SPADNS Method,colorimetric.
Metals	EM130 ICP-MS
Volatile Organic Compounds	Purge & Trap GC-MS (USEPA 5035)
Triazines	EO129 Pesticides/PAHs by Solid Phase Extraction, GC/MS Detection
Phenols	APHA5530C, chloroform extraction
VOCs, THMs	EO 025 Purge and Trap/GC/MS
Tributyl Tin	Subcontract

Technical Manager (or Deputy)

Donal Morrissey

14/12/2007

ELS LTD INAB ACCREDITATION SCHEDULE SUMMARY SHEET

Miscellaneous (P,G,W,S)
Ammonia/Ammonium 0.007-1mg/l N EW003
Chloride 2.6-250 mg/l EW015
COD 8-1500 mg/l TM00010
Nitrate 0.12-50 mg/l N EW034
Nitrite 0.013-1 mg/l N EW035
PH 4 – 10 PH Units EW019
Phosphate 0.009-1 mg/l P EW007
Total Phosphorus 0.03-1 mg/l P EW002
Total Nitrogen 1.0 - 150mg/l N EW022

Miscellaneous (P,G,S)
Bromate 1 to 50ug/l BRO3 (EW137)
Colour 2.5-50mg/l PtCCo (EW021)
Conductivity 5.0-5000us/cm (EW042)
Dissolved Oxygen 1 to 10 mg/l (EW043)
Sulphate 1-250mg/l SO4(EW015)
Suspended Solids 1-1000mg/l (EW013)
Total Dissolved Solids 1-1000mg/l (EW046)
Total Hardness 3-330mg/l CaCO3 (EM099)
Total Oxidised Nitrogen 0.138-51mg/l N (EW051)

Metals EM130 (P,G,S)
Aluminium 5.0 – 500 µg/l
Antimony 0.1 – 10µg/l
Arsenic 0.2 - 20µg/l
Barium 1.0 - 100µg/l
Boron 0.02 – 2mg/l
Cadmium 0.1 – 10µg/l
Calcium 1.0 – 100mg/l
Chromium 1.0 - 100µg/l
Cobalt 1.0 - 100µg/l
Copper 3 - 4000µg/l
Iron 5.0 - 500µg/l
Lead 0.3 - 30µg/l
Magnesium 0.3 – 20mg/l
Manganese 1.0 - 100µg/l
Mercury 0.02 - 2µg/l
Molybdenum 1.0 - 100µg/l
Nickel 0.5 - 50µg/l
Potassium 0.2 – 20mg/l
Selenium 0.2 - 20µg/l
Sodium 0.5 – 50mg/l
Strontium 1.0 - 100µg/l
Tin 1.0 - 100µg/l
Vanadium 1.0 - 100µg/l
Zinc 1.0 - 100µg/l

SI439 Potable Water VOCs & THM EO025 (P,G,S)
Benzene 0.1-35 µg/l
1.2-Dichloroethane 0.1-35 µg/l
Tetrachloroethene 0.1-35 µg/l
Trichloroethene 0.1-35 µg/l
Chloroform 1.0-35 µg/l
Bromoform 1.0-35 µg/l
Dibromochloromethane 1.0-35 µg/l
Bromodichloromethane 2.0-35 µg/l

Other VOC's EO025 (P,G,S)
Bromomethane 0.5 - 35 µg/l
Ethyl Ether/Diethyl Ether0.5 - 35 µg/l
11 Dichloroethene0.5 - 35 µg/l
Iodomethane/Mehyl Iodide 0.5 - 35 µg/l
Carbon Disulphide 0.5 - 35 µg/l
Allyl Chloride0.5 - 35 µg/l
Methylene Chloride/DCM 5.0 - 35 µg/l
2-Propenenitrile/Acrylonitrile 2.0 - 35 µg/l
Chlormethyl Cyanide 0.5 - 35 µg/l
Hexachlorobutadiene0.5 - 35 µg/l
Trans-1,2 Dichloroethene0.5 - 35 µg/l
MtBE0.5 - 35 µg/l
11 Dichloroethane0.5 - 35 µg/l
22 Dichloropropane0.5 - 35 µg/l
Cis-12 Dichloroethene0.5 - 35 µg/l
Methyl Acrylate5.0 - 35 µg/l
Bromochloromethane0.5 - 35 µg/l
Tetrahydrofuran5.0 - 35 µg/l
111 Trichloroethane0.5 - 35 µg/l
1-Chlorobutane0.5 - 35 µg/l
Carbon Tetrachloride0.5 - 35 µg/l
11 Dichloropropene0.5 - 35 µg/l
12 Dichloropropane0.5 - 35 µg/l
Dibromomethane0.5 - 35 µg/l
Methyl Methacrylate0.5 - 35 µg/l
13 Dichloropropene, cis0.5 - 35 µg/l
MIBK/4 Methyl 2 Pentanone 2.0 - 35 µg/l
Toluene0.5 - 35 µg/l
13 Dichloropropene,trans2.0 - 35 µg/l
Ethyl Methacrylate2.0 - 35 µg/l
112 Trichloroethane0.5 - 35 µg/l
13 Dichloropropane0.5 - 35 µg/l
2 Hexanone1.0 - 35 µg/l
12 Dibromoethane0.5 - 35 µg/l
Chlorobenzene0.5 - 35 µg/l
1112 Tetrachloroethane2.0 - 35 µg/l
Ethyl Benzene0.5 - 35 µg/l
m & p Xylene0.5 - 35 µg/l
O Xylene0.5 - 35 µg/l
Stryene2.0 - 35 µg/l
Isopropyl Benzene0.5 - 35 µg/l
Bromobenzene0.5 - 35 µg/l
1122 Tetrachloroethane0.5 - 35 µg/l
123 Trichloropropane2.0 - 35 µg/l
Propyl Benzene0.5 - 35 µg/l
2-Chlorotoluene0.5 - 35 µg/l
4 Chlorotoluene0.5 - 35 µg/l
135 Trimenthylbenzene0.5 - 35 µg/l
Tert Butyl Benzene0.5 - 35 µg/l
124 Trimethlbenzene0.5 - 35 µg/l
Sec Butyl Benzene0.5 - 35 µg/l
13 Dichlorobenzene0.5 - 35 µg/l
P Isopropyltoluene0.5 - 35 µg/l
14 Dichlorobenzene0.5 - 35 µg/l
12 Dichlorobenzene0.5 - 35 µg/l
N Butyl Benzene0.5 - 35 µg/l
Hexachloroethane5.0 - 35 µg/l
12 Dibromo 3Chloropropane 2.0 - 35 µg/l
124 Trichlorobenzene0.5 - 35 µg/l
123 Trichlorobenzene0.5 - 35 µg/l

PAH EO129 (P,G,S)
Range 0.01 - 0.2 µg/l
Acenaphthene
Benzo (a) Anthracene
Benzo (a) Pyrene
Benzo (b) Fluoranthene
Benzo (ghi) Perylene
Benzo (k) Fluoranthene
Chrysene
Dibenzo (ah) Anthracene
Fluoranthene
Fluorene
Indeno (123-cd) Pyrene
Phenanthrene
Pyrene

Acid Herbicides (P,G,S)
Range 0.01 - 0.2 µg/l
2,4,5-T H
2,4-D H
2,4-DB H
MCPA H
Picloram H

Organophosphorus Pesticides(P,G,S)
Range 0.01 - 0.2 µg/l
Famphur OP
Methyl Parathion OP
Parathion OP
Thionazin OP

Organochlorine Pesticides (P,G,S)
Range 0.01 - 0.2 µg/l
Aldrin
BHC Alpha isomer OC
BHC Beta isomer OC
BHC Delta isomer OC
Dieldrin OC
Endosulphan Alpha isomer OC
Endosulphan Beta isomer OC
Endosulphan Sulphate OC
Endrin OC
Heptachlor Epoxide OC
Heptachlor OC
Lindane OC
P,P' DDE OC
P,P'-DDD OC
P,P'-DDT OC

Notes
1.Sample Matrix:P=Potable Water (Drinking) , G=Ground Water , S=Surface Water, W=Waste Water

		Atrazine	Simazine	Methylene Chloride	Toluene	Benzene	Xylenes	B	Cd	Hg	Se	As	Cr	Cu	Pb	Ni	Zn	Ba	Total Nitrogen	Total Phosphorou	Suspended solids	BOD	COD	Conductivity	pH	CN	Ammonium	Nitrate	Nitrite	Phosphate	Sulphate	Phenol	F	Tributyl tin*
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l N	mg/l P	mg/l	mg/l	mg/l	uS/cm	mg/l	ug/l	mg/l N	mg/l N	mg/l N	mg/l P	mg/l S	ug/l	ug/l	ug/l
Limit of Detection		0.01	0.01	5.0	0.1	0.1	0.1	0.02	0.1	0.02	0.2	0.2	1.0	3.0	0.3	0.5	1.0	1.0	1.0	0.0	1.0	3.0	8.0	5.0	0.3	5	0.007	0.12	0.013	0.009	1.0	0.5	10	0.02
Date Testing Initiated		28/11	28/11	10/12	10/12	10/12	10/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	05/12	05/12	05/12	30/11	12/12	29/11	29/11	12/12	13/12	05/12	05/12	07/12	07/12	28/11	11/12	30/11
ELS Ref	Client Ref																																	
9006-1	SW1 14.3	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.23	<0.1	0.12	0.6	0.7	13.4	120.5	339.7	10.9	260.7	32.3	50	4.7	204	<3	542	1754	6.3	21	14.532	<0.12	0.047	2.481	182.2	Pg3	310	<0.10
9006-2	SW9 14.4	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	<0.02	<0.1	<0.02	6.0	1.0	5.5	189.1	5.1	3.1	102.7	55.8	70	9.5	144	<3	399	950	6.8	10	69.845	<0.12	0.071	9.516	42.8	Pg3	650	<0.10
9006-3	SW10 14.7	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.03	<0.1	<0.02	<0.2	<0.2	3.5	<3.0	2.3	1.5	4.0	126.1	41	10.1	185	190	380	4180	6.9	<5	35.746	<0.12	0.073	7.167	262.8	Pg3	290	<0.10

NOTES

1 Sub-contract analysis denoted by
2 ND = Concentration was below the limit of detection
3 LOD raised due to sample volume extracted.

Volatile Organic Compounds and THM's

No.	Analyte	LOD (ug/l)	9006-1	9006-2	9006-3
61	Bromoform	1.0	ND	ND	ND
43	Bromodichloromethane	2.0	ND	ND	ND
31	Trichloromethane/ Chloroform	1.0	ND	ND	ND
53	Dibromochloromethane	1.0	ND	ND	ND
	Total THM's	5.0	<5.0	<5.0	<5.0
37	1-2 Dichloroethane	0.1	ND	ND	ND
50	Tetrachloroethylene/ Tetrachloroethene	0.1	ND	ND	ND
39	Trichloroethylene/ Trichloroethene	0.1	ND	ND	ND
5	Vinyl Chloride/Chloroethene	0.5	ND	ND	ND

1. ND = Concentration was below the limit of detection.

Phenol Breakdown

		9006-1	9006-2	9006-3
	Units			
2- Chlorophenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
2- Nitrophenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
Phenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
2,4- Dimethylphenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
2,4- Dichlorophenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
2,4,6- Trichlorophenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
4- Chloro-3-methylphenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
2,4- Dinitrophenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
2-Methyl-4-6-dinitrophenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
Pentachlorophenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
4-Nitrophenol	ug/l	<2.5[1]	<2.5[1]	<2.5[1]
TOTAL PHENOLS	ug/l	<2.5[1]	<2.5[1]	<2.5[1]

Notes:

1 LOD raised due to sample volume extracted.

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus,
Mahon Industrial Park,
Blackrock,
CorkTel: 021-4536141
Fax: 021-4536149

Analysis Report

Attention:
Derek White/Ray Mannix
Waterford City Council (Waterpark)
Waterpark Pumping Station
Park Road,
Waterford
Fax No:
Tel No: 087-2690213/ 086 8304644
PO Number: 400067900
Sample Type Wastewater

Condition on receipt Satisfactory

Report No: 09031

Date of receipt: 30/11/2007
Date Started: 30/11/2007

Issue Date: 18/12/2007
Page 1 of 1

Delivery Mode Courier
No. of Samples 7

Client Ref: see Attached

Parameter	Method
pH	EW132 Electrometric Measurement
Conductivity	EW042 Conductivity Measurement
Suspended Solids	EW013 Suspended Solids by Gravimetric Analysis
COD	EW094 Chemical Oxygen Demand by Closed Reflux Colorimetry
BOD	Std Method 5210 B: 5 day test, DO meter
Total Nitrogen	EW022 Total Nitrogen by Persulphate Digestion
Total Phosphorus	EW002 Total Phosphorus by Acid Persulphate Digestion
Cyanide	EW050 Autoanalyser Spectrophotometry
Ammonium	EW003 -Ammonia by Autoanalyser Spectrophotometry
Nitrate	EW034 -Nitrate by Autoanalyser Spectrophotometry
Nitrite	EW035 Nitrite by Autoanalyser Spectrophotometry
Phosphate	EW007 Autoanalyser Spectrophotometry
Sulphate	EW016 Autoanalyser Spectrophotometry
Flouride	H 8029,SPADNS Method,colorimetric.
Metals	EM130 ICP-MS
Volatile Organic Compounds	Purge & Trap GC-MS (USEPA 5035)
Triazines	EO129 Pesticides/PAHs by Solid Phase Extraction, GC/MS Detection
Phenols	APHA5530C, chloroform extraction
VOCs, THMs	EO 025 Purge and Trap/GC/MS
Tributyl Tin	Subcontract

Technical Manager (or Deputy) Donal Morrissey 18/12/2007

ENVIRONMENTAL SERVICES
28 DEC 2007

			Atrazine	Simazine	Methylene Chloride	Toluene	Benzene	Xylenes	B	Cd	Hg	Se	As	Cr	Cu	Pb	Ni	Zn	Ba	Total Nitrogen	Total Phosphorous	Suspended solids	BOD	COD	Conductivity	pH	CN	Ammonium	Nitrate	Nitrite	Phosphate	Sulphate	Phenol	F	Tributyl tin[4]
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l N	mg/l P	mg/l	mg/l	mg/l	uS/cm	mg/l	ug/l	mg/l N	mg/l N	mg/l N	mg/l P	mg/l S	ug/l	ug/l	ug/l
Limit of Detection			0.01	0.01	5.0	0.1	0.1	0.1	0.02	0.1	0.02	0.2	0.2	1.0	3.0	0.3	0.5	1.0	1.0	1.0	0.0	1.0	3.0	8.0	5.0	0.3	5	0.007	0.12	0.013	0.009	1	0.5	10	0.02
Date Testing Initiated			07/12	07/12	10/12	10/12	10/12	10/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	05/10	30/11	10/12	30/11	30/11	12/12	13/12	05/12	05/12	07/12	07/12	07/12	11/12	17/12
ELS Ref	Client Ref	Date																																	
9031-1	SW11	29/11/2007	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.45	<0.1	<0.02	6.7	1.0	2.2	82.5	8.5	1.8	164.8	25.8	45	7.7	210	<3	206	784	9	<5	28.229	0.24	0.120	0.786	64	Pg3	420	<0.15
9031-2	SW12	29/11/2007	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.09	<0.1	<0.02	<0.2	<0.2	1.7	63.5	27.5	2.0	236.4	19.5	28	3.3	135	95	225	493	6.6	<5	20.850	<0.12	0.050	2.866	69	Pg3	80	<0.05
9031-3	SW13	29/11/2007	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.21	<0.1	0.10	5.8	0.5	8.0	199.3	9.4	11.2	180.0	205.2	39	4.5	120	53	255	561	6.9	<5	19.956	<0.12	0.030	3.910	64	Pg3	510	<0.05
9031-4	SW16	29/11/2007	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.23	<0.1	<0.02	<0.2	<0.2	8.5	395.0	4.9	14.0	158.3	217.4	81	14	570	332	1444	1214	6.9	<5	37.863	<0.12	0.130	11.485	169	Pg3	<10	<0.1
9031-5	SW17	29/11/2007	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.07	<0.1	<0.02	<0.2	<0.2	7.2	85.3	3.4	3.3	41.0	116.2	51	10.4	215	<3	434	738	6.7	8	45.666	<0.12	0.070	6.546	87	Pg3	380	<0.05
9031-6	SW18	29/11/2007	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.08	<0.1	<0.02	<0.2	<0.2	9.2	89.0	4.8	5.1	32.7	360.9	75	15	390	122	602	1041	6.9	10	71.862	<0.12	0.060	13.190	104	Pg3	450	<0.05
9031-7	SW19	29/11/2007	<0.05[3]	<0.05[3]	<5.0	<0.1	<0.1	<0.1	0.12	<0.1	0.13	3.3	0.9	9.2	21.5	4.7	14.7	48.9	388.0	51	8.4	185	221	615	884	6.7	7	31.513	<0.12	0.058	6.602	102	Pg3	<10	<0.05

NOTES
1 Sub-contract analysis denoted by
2 ND = Concentration was below the limit of detection
3 LOD raised due to sample volume extracted.
4 LOD for TBT raised by sub-contract lab due to sample interference

Volatile Organic Compounds and THM's

No.	Analyte	LOD (ug/l)	9031-1	9031-2	9031-3	9031-4	9031-5	9031-6	9031-7
61	Bromoform	1.0	ND	ND	ND	ND	ND	ND	ND
43	Bromodichloromethane	2.0	ND	ND	ND	ND	ND	ND	ND
31	Trichloromethane/ Chloroform	1.0	ND	ND	ND	ND	ND	5.8	ND
53	Dibromochloromethane	1.0	ND	ND	ND	ND	ND	ND	ND
	Total THM's	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	5.8	<5.0
37	1-2 Dichloroethane	0.1	ND	ND	ND	ND	ND	ND	ND
50	Tetrachloroethylene/ Tetrachloroethene	0.1	ND	ND	ND	ND	ND	ND	ND
39	Trichloroethylene/ Trichloroethene	0.1	ND	ND	ND	ND	ND	ND	ND
5	Vinyl Chloride/Chloroethene	0.5	ND	ND	ND	ND	ND	ND	ND

Phenol Breakdown

		9031-1	9031-2	9031-3	9031-4	9031-5	9031-6	9031-7
	Units							
2- Chlorophenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
2- Nitrophenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
Phenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
2,4- Dimethylphenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
2,4- Dichlorophenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
2,4,6- Trichlorophenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
4- Chloro-3-methylphenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
2,4- Dinitrophenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
2-Methyl-4-6-dinitrophenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
Pentachlorophenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
4-Nitrophenol	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]
TOTAL PHENOLS	ug/l	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]	<2.5[2]

Notes:
1. ND = Concentration was below the limit of detection.
2. LOD raised due to sample volume extracted.

		Atrazine	Simazine	Methylene Chloride	Toluene	Benzene	Xylenes	B	Cd	Hg	Se	As	Cr	Cu	Pb	Ni	Zn	Ba	Total Nitrogen	Total Phosphorou	Suspended solids	BOD	COD	Conductivity	pH	CN	Ammonium	Nitrate	Nitrite	Phosphate	Sulphate	Phenol	F	Tributyl tin*
		ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l N	mg/l P	mg/l	mg/l	mg/l	uS/cm	mg/l	ug/l	mg/l N	mg/l N	mg/l N	mg/l P	mg/l S	ug/l	ug/l	ug/l
Limit of Detection		0.01	0.01	5.0	0.1	0.1	0.1	0.02	0.1	0.02	0.2	0.2	1.0	3.0	0.3	0.5	1.0	1.0	1.0	0.0	1	3.0	8.0	5.0	0.3	5	0.007	0.12	0.013	0.009	1	0.5	10	0.02
Date Testing Initiated		07/12	07/12	10/12	10/12	10/12	10/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	11/12	07/12	05/12	30/11	11/12	05/12	05/12	12/12	13/12	07/12	07/12	07/12	07/12	07/12	11/12	11/12
ELS Ref	Client Ref																																	
9036-1	ML-1	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	<0.02	<0.1	<0.02	0.5	<0.2	<1.0	7.9	0.6	<0.5	21.4	2.3	<1	0.3	73	<3	19	19190	7.4	<5	0.269	<0.12	0.026	0.029	1207	Pg3	1210	<0.02
9036-2	ML-2	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	<0.02	<0.1	<0.02	<0.2	<0.2	<1.0	4.3	1.1	0.7	20.7	4.4	1	0.5	75	<3	40	21300	7.4	<5	0.433	<0.12	0.024	0.019	1260	Pg3	1050	<0.02
9036-3	ML-3	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	<0.02	<0.1	<0.02	<0.2	<0.2	<1.0	10.6	2.0	<0.5	107.3	4.1	<1	0.6	101	<3	38	21700	7.4	<5	0.429	<0.12	0.024	0.041	1441	Pg3	1170	<0.02
9036-4	ML-4	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	<0.02	<0.1	<0.02	<0.2	<0.2	<1.0	6.7	0.3	<0.5	14.9	3.6	<1	0.4	79	<3	34	23700	7.5	<5	0.635	<0.12	0.022	0.077	1728	Pg3	950	<0.02
9036-5	ML-5	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	<0.02	<0.1	<0.02	<0.2	<0.2	<1.0	<3.0	<0.3	<0.5	7.4	2.8	1	0.3	166	<3	45	24500	7.5	<5	0.707	<0.12	0.024	0.023	1355	Pg3	1100	<0.02
9036-6	ML-6	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	<0.02	<0.1	<0.02	<0.2	<0.2	<1.0	<3.0	0.5	<0.5	8.0	8.6	<1	0.6	134	<3	60	26400	7.5	<5	0.822	<0.12	0.022	0.035	1981	Pg3	1260	<0.02

NOTES

1 Sub-contract analysis denoted by *

2 ND = Concentration was below the limit of detection

3 LOD raised due to sample volume extracted.

Volatile Organic Compounds and THM's

No.	Analyte	LOD (ug/l)	9036-1	9036-2	9036-3	9036-4	9036-5	9036-6
61	Bromoform	1.0	ND	ND	ND	ND	ND	ND
43	Bromodichloromethane	2.0	ND	ND	ND	ND	ND	ND
31	Trichloromethane/ Chloroform	1.0	ND	ND	ND	ND	ND	ND
53	Dibromochloromethane	1.0	ND	ND	ND	ND	ND	ND
	Total THM's	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
37	1-2 Dichloroethane	0.1	ND	ND	ND	ND	ND	ND
50	Tetrachloroethylene/ Tetrachloroethene	0.1	ND	ND	ND	ND	ND	ND
39	Trichloroethylene/ Trichloroethene	0.1	ND	ND	ND	ND	ND	ND
5	Vinyl Chloride/Chloroethene	0.5	ND	ND	ND	ND	ND	ND

Phenol Breakdown

		9036-1	9036-2	9036-3	9036-4	9036-5	9036-6
	Units						
2- Chlorophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2- Nitrophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
Phenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2,4- Dimethylphenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2,4- Dichlorophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2,4,6- Trichlorophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
4- Chloro-3-methylphenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2,4- Dinitrophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2-Methyl-4-6-dinitrophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
Pentachlorophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
4-Nitrophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
TOTAL PHENOLS	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]

1. ND = Concentration was below the limit of detection.
2. LOD raised due to sample volume extracted.

ENVIRONMENTAL
LABORATORY SERVICES
Acorn Business Campus,
Mahon Industrial Park,
Blackrock,
CorkTel: 021-4536141
Fax: 021-4536149

Analysis Report

Attention:
Derek White/Ray Mannix
Waterford City Council (Waterpark)
Waterpark Pumping Station
Park Road,
Waterford
Fax No:
Tel No: 087-2690213/
086 8304644
PO Number: 400067900
Sample Type Wastewater

Condition on receipt Satisfactory

Report No: 09050

Date of receipt: 01/12/2007
Date Started: 01/12/2007

Issue Date: 02/01/2008
Page 1 **of** 3

Delivery Mode Pickup
No. of Samples 7

Client Ref: see Attached

Parameter	Method
pH	EW132 Electrometric Measurement
Conductivity	EW042 Conductivity Measurement
Suspended Solids	EW013 Suspended Solids by Gravimetric Analysis
COD	EW094 Chemical Oxygen Demand by Closed Reflux Colorimetry
BOD	Std Method 5210 B: 5 day test, DO meter
Total Nitrogen	EW022 Total Nitrogen by Persulphate Digestion
Total Phosphorus	EW002 Total Phosphorus by Acid Persulphate Digestion
Cyanide	EW050 Autoanalyser Spectrophotometry
Ammonium	EW003 -Ammonia by Autoanalyser Spectrophotometry
Nitrate	EW034 -Nitrate by Autoanalyser Spectrophotometry
Nitrite	EW035 Nitrite by Autoanalyser Spectrophotometry
Phosphate	EW007 Autoanalyser Spectrophotometry
Sulphate	EW016 Autoanalyser Spectrophotometry
Flouride	H 8029,SPADNS Method,colorimetric.
Metals	EM130 ICP-MS
Volatile Organic Compounds	Purge & Trap GC-MS (USEPA 5035)
Triazines	EO129 Pesticides/PAHs by Solid Phase Extraction, GC/MS Detection
Phenols	APHA5530C, chloroform extraction
VOCs, THMs	EO 025 Purge and Trap/GC/MS
Tributyl Tin	Subcontract

Technical Manager (or Deputy) Donal Morrissey 02/01/2008

			Atrazine	Simazine	Methylene Chloride	Toluene	Benzene	Xylenes	B	Cd	Hg	Se	As	Cr	Cu	Pb	Ni	Zn	Ba	Total Nitrogen	Total Phosphorou	Suspended solids	BOD	COD	Conductivity	pH	CN	Ammonium	Nitrate	Nitrite	Phosphate	Sulphate	Phenol	F	Tributyl tin*
			ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	ug/l	mg/l N	mg/l P	mg/l	mg/l	mg/l	uS/cm	mg/l	ug/l	mg/l N	mg/l N	mg/l N	mg/l P	mg/l S	ug/l	ug/l	ug/l
Limit of Detection			0.01	0.01	5.0	0.1	0.1	0.1	0.02	0.1	0.02	0.2	0.2	1.0	3.0	0.3	0.5	1.0	10.0	1.0	0.0	1	3.0	8.0	5.0	0.3	5	0.007	0.12	0.013	0.009	1	0.5	10	0.02
Date Testing Initiated			07/12	07/12	10/12	10/12	10/12	10/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	07/12	11/12	07/12	05/12	03/12	10/12	05/12	05/12	12/12	13/12	07/12	07/12	07/12	07/12	07/12	11/12	11/12
ELS Ref	Client Ref	Date																																	
9050-1	SW4	29/11/2007	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	0.12	<0.1	0.22	<0.2	<0.2	10.7	18.6	4.2	14.2	36.3	373.0	20	6.5	185	<3	249	560	6.6	<5	5.922	<0.12	0.016	1.171	219	Pg3	190	<0.02
9050-2	SW5	29/11/2007	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	0.07	45.2	9.28	97.7	100.1	483.5	14.8	96.7	176.9	549.7	666.0	37	5.4	230	123	346	754	7.1	<5	22.642	<0.12	0.024	2.553	69	Pg3	470	<0.10
9050-3	SW6	29/11/2007	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	0.06	<0.1	0.45	<0.2	<0.2	20.0	99.0	5.8	6.5	48.6	145.4	40	5	115	90	394	754	6.9	<5	22.372	<0.12	0.035	3.822	85	Pg3	<10	<0.10
9050-4	SW7	29/11/2007	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	0.06	<0.1	0.17	0.8	<0.2	15.7	100.3	6.0	6.6	123.7	134.2	65	13	105	363	675	951	6.5	6	71.332	<0.12	0.068	8.806	44	Pg3	100	<0.10
9050-5	SW8	29/11/2007	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	0.09	<0.1	0.36	3.2	<0.2	17.6	67.5	12.8	6.7	65.0	170.3	55	7.8	63	18	280	821	6.9	<5	46.858	<0.12	<0.013	5.678	20	Pg3	90	<0.10
9050-6	SW14	29/11/2007	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	0.09	<0.1	0.18	3.4	<0.2	13.6	141.7	6.1	6.8	59.9	781.3	53	8	270	39	355	5790	6.8	5	43.241	<0.12	0.051	7.619	330	Pg3	600	<0.10
9050-7	SW15	29/11/2007	<0.02[3]	<0.02[3]	<5.0	<0.1	<0.1	<0.1	0.08	<0.1	0.21	28	<0.2	12.3	233.4	10.8	7.9	327.5	107.3	38	5.1	100	183	287	581	6.8	6	27.721	<0.12	0.059	4.205	44	Pg3	160	<0.10

NOTES

1 Sub-contract analysis denoted by *

2 ND = Concentration was below the limit of detection

3 LOD raised due to sample volume extracted.

Volatile Organic Compounds and THM's

No.	Analyte	LOD (ug/l)	9050-1	9050-2	9050-3	9050-4	9050-5	9050-6	9050-7
61	Bromoform	1.0	ND	ND	ND	ND	ND	ND	ND
43	Bromodichloromethane	2.0	ND	ND	ND	ND	ND	ND	ND
31	Trichloromethane/ Chloroform	1.0	ND	ND	ND	ND	ND	ND	ND
53	Dibromochloromethane	1.0	ND	ND	ND	ND	ND	ND	ND
	Total THM's	5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
37	1-2 Dichloroethane	0.1	ND	ND	ND	ND	ND	ND	ND
50	Tetrachloroethylene/ Tetrachloroethene	0.1	ND	ND	ND	ND	ND	ND	ND
39	Trichloroethylene/ Trichloroethene	0.1	ND	ND	ND	ND	ND	ND	ND
5	Vinyl Chloride/Chloroethene	0.5	ND	ND	ND	ND	ND	ND	ND

Phenol Breakdown

		9050-1	9050-2	9050-3	9050-4	9050-5	9050-6	9050-7
	Units							
2- Chlorophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2- Nitrophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
Phenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2,4- Dimethylphenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2,4- Dichlorophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2,4,6- Trichlorophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
4- Chloro-3-methylphenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2,4- Dinitrophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
2-Methyl-4-6-dinitrophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
Pentachlorophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
4-Nitrophenol	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]
TOTAL PHENOLS	ug/l	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]	<1.0[2]

1. ND = Concentration was below the limit of detection.
2. LOD raised due to sample volume extracted.