6. FLORA AND FAUNA – RIVER LIFFEY

6.1. EXISTING ENVIRONMENT

The area between Caragh Bridge and Alexandra Bridge in Clane was surveyed in detail as part of the Stage II EIS. The survey covered:

- general description of the river along this stretch
- bankside vegetation
- marginal aquatic vegetation
- submerged and floating vegetation
- macroinvertibrates and water quality
- aquatic vegetation
- fish and fisheries including fish stock assessment
- bird communities and habitat

The survey concluded the following:

- The riverbanks are generally well vegetated with many sections containing large overhanging trees.
- The aquatic vegetation in the river changes considerably downstream of the Osberstown discharge with excessive growth in the area of shallow water downstream of Leinster Aquaduct.
- The water quality and invertebrates study concluded that generally satisfactory conditions existed over the entire stretch. The Q-ratings in the area were in the range Q4 to Q4-5 (1995). *(However, as indicated by more recent surveys, the situation has deteriorated downstream of the plant since 1995).*
- The most recent fish-stock survey had been 1986, showing good numbers of salmon, trout, pike, perch, and other course fish species. There were gravel beds suitable for spawning between Caragh Bridge and Castlekeely Ford, but the area downstream of Leinster Aquaduct was unsuitable due to siltation caused by aquatic plant growth.
- The range of bird species observed was typical of a lowland river. There was no evidence of detrimental effects on bird populations due to poor water quality. The population of little grebe and moorhen were considerably lower than normal, possibly due to flooding of nests caused by sudden and large variations in water level.

6.2. LIKELY SIGNIFICANT IMPACTS

It was not considered necessary to re-survey the area for the current EIS for the following reasons:

- Overall, the extension represents a relatively minor change to the existing plant given that it occurs on the same site and no additional works are required that impact on this stretch of the Liffey other than an revised effluent quality (which will be of higher quality than the existing effluent).
- The aspects of aquatic vegetation, invertebrates, fish stocks, and bird species, are all evaluated in the Stage II EIA in regard to the effect of water quality on these aspects. The water quality impacts of the Stage III plant have been evaluated in considerable detail in the "Receiving water study", the majority of which is also reproduced in this EIS.
- Therefore, water quality is the most important consideration regarding the health of the general aquatic flora and fauna in this area. This is addressed in the detailed work carried out in the "Receiving water study, including the biological assessment of invertebrate and general aquatic status, is the.

As discussed in Section 3.2.3, the biological quality of the stations upstream of Osberstown has remained more-or-less stationary over the past 5 years (1995-2000), with unpolluted status apart from one incident of a slightly polluted rating at Victoria Bridge during 1999. The stations downstream of the plant showed a decrease in quality from 1995 to 1999, including a serious pollution rating at Castlekeely Ford during 1998, and an increase in quality during 2000 back to the same slightly polluted rating as assessed in 1995. The main component of the changes in quality is considered to be the overloading of the old Stage 1 plant, followed by the improvements in effluent quality following construction of the Stage II plant.

Given that the detailed survey in 1995 showed a considerable change in aquatic vegetation and suitability for fish spawning downstream of Osberstown, and concluded this to be due to water quality issues, therefore it is most likely that this situation is still prevalent if not accentuated by the poor quality of the river over the past five years (not withstanding recent water quality improvements). This assessment concludes that any significant improvement in this area is provisional on the *Phosphorus Regulations* targets being achieved, which would set an unpolluted target for this stretch of river. Any upgrade of the treatment plant would have to be consistent with this target.

It is therefore concluded that the proposed new extension to the plant will have a positive effect on aquatic flora and fauna in the River Liffey through improved effluent standards resulting in better water quality supporting better ecological status.

6.3. MITIGATION AND RESIDUAL IMPACTS

The mitigation measure recommended to ensure protection and improvement of aquatic flora and fauna in the River Liffey is to ensure that the recommendations under water quality in this section are fulfilled.

Again, the residual impact will arise from the effects on water quality of a relatively constant source of pollutants discharged as effluent from the plant. The impact is predicted to be an improvement over the current (Stage II) plant and is predicted to be consistent with water quality targets for the Liffey, and therefore residual impacts will be minimised.

7. FLORA AND FAUNA - LAND

7.1. EXISTING ENVIRONMENT

A Phase 1 Habitat Survey using the Nature Conservancy Council (1990) standard methodology was carried out as part of the Stage II EIS. The survey covered:

- Field boundary survey and hedges evaluation.
- Birds and mammals recorded at the site.
- Assessment of the proposed National Heritage Area (NHA) downstream of the old Osberstown outfall pipe.

The survey concluded the following:

- The site was already largely developed for the purposes of wastewater treatment.
- The grassland is typical of abandoned pasture and is not of special ecological interest.
- The hedgerows are of low to moderate ecological value.
- The most significant features are small groups of mature trees on the western and northern perimeter hedges.
- The proposed NHA was first surveyed in 1976 and designated an Area of Scientific Interest, mainly due to the presence of the dark-leaved willow (*Salix myrsinifolia* stn. *Salix nigricans*), a nationally rare plant that had not been recorded in this century. A subsequent site survey in 1993 found the site cleared of woody vegetation, and therefore was proposed as a NHA allowing for regeneration. The 1995 survey found some natural regeneration including mature and semi-mature alders and willows. Some dumping of spoil and a tangle of hedge cuttings were also evident.

The footprint of the Stage II plant retained the majority of the existing hedgerows at the site and included landscaping measures and new trees and shrubs that are expected to create valuable new habitats. The proposed NHA site was cleared of spoil and fenced during outfall works and would now be expected to support sustainable regeneration. The pNHA is outside the boundary of the present project.

7.2. LIKELY SIGNIFICANT IMPACTS

The proposed new extension is entirely contained within the existing site and therefore no additional impacts are predicted. The Stage II plant retained the majority of the existing hedgerows at the site and included landscaping measures and new trees and shrubs that are expected to create valuable new habitats. The proposed NHA site in the vicinity of the site will not be impacted by the current project. The pNHA site was cleared of spoil and fenced during Stage II plant outfall works and would now be expected to support sustainable regeneration.

7.3. MITIGATION AND RESIDUAL IMPACTS

The retaining of existing hedgerows at the site, planting of new trees and shrubs, and the clearing of spoil and fencing at the old outfall will ensure protection and development of flora and fauna in the area. No additional mitigation is required, and residual impacts are predicted to be insignificant..

8. AIR QUALITY

8.1. EXISTING ENVIRONMENT

8.1.1. Air Quality

As part of the evaluation of the environmental impact of the extended plant, an assessment of the potential impact on air quality was undertaken by sub-consultants Envirocon Ltd. in September 2001.

The Osberstown wastewater treatment plant site is located approximately 4km to the SW of Naas. There are a small number of detached private dwellings along the public road, within 500m, to the north and south of the entrance into the plant. There are no significant industrial emission sources within a radius of about 3km, with the nearest industrial premises located on the outskirts of Naas. The N7 Motorway runs along the south-eastern site boundary and this road is a significant local source of atmospheric emissions, due to the high volume of traffic that travels along this National primary route.

Overall, the air quality in the locality is good with levels of smoke and sulphur dioxide at Osberstown well below the National Air Quality Standards (NAQS) (SI No 244 of 1987). Daily levels would be less than 25 $\mu g/m^3$, which is below 5% of the limit values. Concentrations would be also well below the values specified in the 1999 European Union Air Quality Directive (1999/30/EEC), which gives limit values for hourly, daily and annual periods. In the case of daily levels, the limit value is 125 $\mu g/m^3$, expressed as a 99.2 percentile (4^{th} highest daily value of the year), to be met by 2005. The limit values specified in the 1999 E.U. Directive will be shortly incorporated into revised NAQS legislation, which will replace the existing NAQS values.

Slightly elevated levels of nitrogen dioxide may be experienced alongside the south-eastern site boundary, due to exhaust emissions from traffic travelling along the N7. However, within a few tens of metres from the roadside the observed levels would be less than 20 $\mu g/m^3$ and well below the future NAQS annual limit value of 40 $\mu g/m^3$. Similarly, carbon monoxide and benzene levels, which are important components of motor vehicle exhausts, would be very low in the area and typically less than 10% of the future NAQS.

Dust and airborne particulates, in particular those referred to, as PM_{10} (particulate material with a mean aerodynamic diameter of less than 10 µm) would be below the future National Air Quality Standards. Annual levels would be typically in the region of 15-20 $\mu g/m^3$ with the vehicle exhaust emissions and roadside dust being the principal sources, compared to the future NAQS of 40 $\mu g/m^3$.

During the site visit carried out in September 2001, no malodours could be detected near the site boundary of the wastewater treatment plant. However, in the past complaints of odours have been reported by local residents to Kildare County Council.

8.1.2. Local Climatology

The meteorological station at Casement Aerodrome (15 km to the NE) will tend to be indicative of conditions experienced in this part of Co. Kildare. Long-term wind observations for the period 1984-93 indicate that the prevailing wind direction is from a SW direction with an annual frequency of about 55% (Fig 1). The wind direction pattern reflects the dominance of westerly low-pressure systems over the Leinster region. The lowest frequency is for winds from a north-easterly direction, which only occur for about 8% of the time. The wind speed is below 5 m/s for about 50% of the time, with winds over 9 m/s for approximately 25% of the year. The highest wind speeds are recorded during the passage of Atlantic storm systems and these are most prevalent during the winter months.

The incidence of slack or calm wind conditions is low with about 3% of hourly observations recording wind speeds below 1m/s and 14% below 2m/s. At higher wind speeds, the rapid rate of dilution of any odorous emissions from sources within the wastewater treatment plant will tend to be sufficient to prevent detection of odours from beyond a few metres from the edge of the open tanks. It should be noted that these hours would not be consecutive and would tend to occur mainly during the summer period.

The greatest potential for odorous emissions is during the summer months when warm dry weather conditions can increase the rate of evaporation from exposed treatment tank surfaces. During the winter months with damp cool windy conditions prevailing, the potential for odours being detected more than a few tens of metres from the plant components would be much lower.

The annual mean air temperature for the Naas area is about 9.3C, with a range in daily averages of 4.7-14.9C. During warm dry spells, air temperatures in this part of Ireland may rise to over 20C. The potential for malodours to be generated will be greatest during this type of weather. Such weather conditions will also be associated with low-flow sewage conditions from the surrounding area.

8.2. THE PROPOSED DEVELOPMENT

8.2.1. Odours from wastewater treatment plants

Fresh wastewater arriving at a wastewater treatment plant via a properly constructed sewer system has a slight smell, normally described as musty in character. As long as a certain level of dissolved oxygen is maintained in the sewage anaerobic conditions will not take place. However, if the oxygen content of the sewage is used up then gases such as hydrogen sulphide, nitrogen and sulphur based organic compounds (mercaptans, ketones, amines, indoles and skatoles) are quickly produced and a general septic condition occurs with typical pungent odours being emitted. These conditions may arise where the incoming sewage becomes septic as it is pumped along the rising main.

The rate of emissions of malodorous compounds from within a wastewater treatment plant depend on the freshness of the incoming sewage, exposed surface areas of treatment tanks, sludge handling procedures and extent of odour control measures. The majority of odour nuisance problems associated with wastewater treatment plants are due to the age of the plant or overloading conditions. With modern technology, treatment plants can exist relatively close to residential areas without causing any problems of odours in the surrounding area.

Sulphide compounds, especially hydrogen sulphide and mercaptans, have very low levels of odour detection and these gases are a major component of the malodours generated from treatment of sewage. The most common component is hydrogen sulphide, which has an odour detection limit in the order of about 0.2-2 μg/m^3. Its characteristic smell of rotten eggs occurs at concentrations of about 3-4 times higher with odour nuisance complaints likely at higher levels.

The perception of odour at some point downwind of an emission source depends on the type of odour compound and the air concentrations of the odorous gas. The measure used to quantify odour nuisance potential is the odour concentration (odour unit per cubic metre, o.u./m^3). An odour concentration of 1 o.u./m^3 is the level at which there is a 50% probability that, under laboratory conditions using a panel of qualified observers, an odour may be detected. At levels below 1 o.u./m^3 the concentration of the gaseous compound causing the odour in the air will be less than the detection level and so although the odorous gas is still present in the air no odour will occur.

The intensity of an odour ranges from 1 o.u./m^3 = odour detection, 2= slight odour up to 5 o.u./m^3 where the odour is easily identifiable, with higher levels of 5-10 o.u./m^3 likely to result in nuisance complaints by the local community. The length of time the odour can be detected is an important factor in the likelihood of the odour causing a nuisance. If the odour is recognisable but very infrequent over the year, then again complaints are unlikely. This is especially the case in rural environments where the community has a higher tolerance of odours associated with agricultural activities than those living in an urban area.

An odour concentration measured in the air of greater than 5 o.u./m^3 is widely used in the U.K. and Ireland as a criteria for predicting the potential for community nuisance near an odour emission source. In planning procedures for a new development such as a wastewater treatment plant, an odour modelling study is undertaken. A criteria of 5 o.u./m^3 not to be exceeded for more than 2% of the year or 175 hours, based on odour dispersion modelling, has been accepted in Ireland and the U.K. as an acceptable approach for planning requirements to demonstrate that no community nuisance from odours is likely to arise at nearby dwellings.

8.2.2. Extended plant design

The Osberstown WWTP has recently been upgraded, including the construction of a new inlet works, secondary treatment in cyclic activated sludge system (CASS) basins, sludge digestion and a new sludge de-watering plant. The proposed extension of the WWTP is designed to increase the capacity of the wastewater treatment plant to 130,000 p.e and this will require additional tanks for primary and secondary treatment.

The area where the new tanks will be located is on ground between the internal road and the north-eastern site boundary. The options for design include both standard activated sludge aeration with secondary clarifiers as well as the use of CASS basins for secondary treatment. The options to be considered for the plant extension are

- Option 1 – 1 primary clarifier and 2 CASS basins
- Option 2 - 1 primary clarifier, activated sludge tanks and secondary clarifiers
- Option 3 - 1 primary clarifier and biotower

The primary and surplus secondary sludge will be treated by thermal digestion to stabilise the sludge and reduce the potential for malodours. The options available involve either an additional mesophilic tank or high temperature (thermophilic) digestion in the existing digester.

Sludge dewatering will be carried out using the existing belt presses or the construction of an additional building with centrifuges or plate filter presses. The procedure will take into account the proposal for a sludge treatment installation at Osberstown.

8.2.3. Existing plant design

The recently upgraded wastewater treatment plant at Osberstown is designed to operate to a high level of efficiency and to control malodorous emissions from the various stages of the sewage treatment process. The inlet works building houses the coarse and fine screens, with two grit removal units located outside of this building. All plant equipment are completely enclosed, along with the inlet pumping station chamber, with the foul air exhausted to atmosphere via a biofilter odour control unit situated adjacent to the inlet works building. Screenings and grit are washed and classified into covered skips and these are housed on the ground floor of the inlet works building.

There are two primary settlement tanks, with a diameter of 24m and surface areas of about 452 m^2 in the current plant arrangement. The main source of emissions from primary settlement tanks tends to be from the peripheral overflow weir where turbulence occurs as the liquor flows out over a drop to the peripheral discharge effluent channel, which can result in the release of high levels of odours. The peripheral overflow weirs of both of the tanks are covered and the foul air exhausted to the main odour control unit, adjacent to the sludge treatment building.

Secondary treatment at Osberstown is provided by four circular CASS tanks, each with a diameter of 40m and a surface area of about 1250m^2. These tanks operate as sequencing batch reactors, with a self-contained secondary treatment of equalisation, aeration and clarification in one basin. The influent from the primary clarifier is mixed in an additional zone with the recirculation sludge stream. This process helps to improve the sludge characteristics and also biological phosphorus removal. The treatment process within the CASS tank removes the need for separate secondary clarifier tanks.

The batch reaction process within the CASS tank involves both periods of aeration and no aeration (anoxic) and so the aeration equipment supplies air into the tank over a shorter period compared to conventional activated secondary treatment tanks. Oxygenated air is supplied to the CASS basin by sub-surface cyclonic aeration which reduces the release of large quantities of aerosols and malodours into the air compared to emissions from surface shaft propeller systems observed from secondary treatment plants in older sewage treatment plants around the country.

Thickened primary sludge and surplus secondary sludge is removed from the primary and secondary treatment tanks to an anaerobic mesophilic sludge digester, where the sludge is stabilised over 15 days at approx. 35C. This stabilisation process reduces the risk of odours from the sludge, as well as providing off-gases that can be used for heating and /or electricity requirements. The sludge is then held in a tank before being thickened and dewatered within the dewatering building. The digesters, holding and thickening tanks are enclosed and the sludge dewatering belt presses are also covered within the dewatering building.

The odour control units installed at Osberstown have a very high removal efficiency rate, with values in excess of 95%. There are two units installed at ground level, one to treat foul air from the inlet works and the other to treat the sludge process stream. Both odour control units use biological filter beds (shells) through which the air is passed before being exhausted to the atmosphere via a vertical stack. The inlet works odour control unit treats air from the inlet pumping station, screens and grit chambers, skip and classifier. All the potentially odorous sources from the sludge handling process, including the sludge thickener tank, digester sludge storage, belt presses, skips and the primary tank peripheral weir head-space air is exhausted to atmosphere via the sludge stream odour control unit.

8.3. ODOUR IMPACT OF WWTP EXTENSION

8.3.1. Introduction

Short-term odour ground level concentrations downwind of the treatment plant boundary were computed using the ADMS3 advanced air quality dispersion model developed in the U.K. by CERC (Cambridge Environmental Research Consultants). This model is used by Regulatory Authorities and the Environment Agency in the United Kingdom and has been approved by the Environmental Protection Agency for modelling studies supporting IPCL applications. The ADMS3 model takes account of the substantially improved understanding of the plume dispersion within the atmospheric boundary layer by the use of more complex parameterisation, than used in previous generation models. It uses boundary layer theory based on the Monin-Obukhov length and boundary layer height instead of the categories of atmospheric stability used in the older U.S. EPA dispersion models including the ISC3. In addition, the treatment of the effect of building wake in the ADMS3 is significantly more advanced than is available in the older U.S. air quality models.

The ADMS3 model has been widely used for modelling the air quality impact of different types of emission sources, including odours from wastewater treatment plants. An advantage of this model that it enables short time periods of 15 minutes or less to be modelled so it provides improved prediction of the impact of odours compared to the U.S. EPA ISC3 model.

Hourly climatological data from Casement meteorological station, for the years 1999 and 2000 were used to predict the 98 percentile short-term odour concentration values. These computations give the odour concentration at each receptor location that is predicted to be exceeded for 2% of the year or 175 hours. This type of interpretation of the pattern of odour concentration around the plant reflects the annual incidence of certain wind speeds and directions coupled with the different types of atmospheric instability close to the ground.

The odour dispersion modelling study was only undertaken for the Option 1 scenario which utilises an additional primary settlement tank and 2 CASS tanks to be installed in the designated footprint area, near the north eastern site boundary. In terms of assessing the odour impact of the emissions occurring from the installation of plant under Option 2 and 3, the volume of emissions from the tanks are likely to be comparable to those modelled under Option 1. The emission rate from a secondary activated sludge tank, coupled with a secondary clarifier, as proposed under Option 2, would be similar to that from the CASS tanks. Therefore, in interpreting the modelled results a similar pattern of predicted odour concentrations downwind of the boundary to the plant can be assumed for each option.

8.3.2. Odour emission survey

To provide an estimate of the emission rate of odours from the existing and proposed extension plant components an odour survey was undertaken in December 2001 by Bord Na Mona, Environmental Consultancy Services, Newbridge. Odour samples were obtained from the surface of the primary settlement tank, CASS tanks as well as the odour control unit exhaust stack and sludge de-watering building. Weather conditions during the odour survey at Osberstown were relatively calm, with light southerly winds and an air temperature of about 10 C.

Samples of odorous gas of approximately 80-100 l were collected via teflon tubing into Tedlar gas sampling bags by means of the "lung principle" method. The sample collection bag was housed in a sealed carbuoy container that was evacuated using a small air pump. The volume of air removed from the carbuoy is replaced by sample gas entering the bag, thus avoiding contamination of the odour sample. The emissions from the liquor surface in the tank were collected by using a sampling box, known as a Lindvall box. Controlled odour-free air (filtered through an activated carbon device) flows through the Lindvall box, which is suspended over the liquor surface, absorbing any odours, released from the tank. The sampling method used was in accordance with German Standard Method VDI 3881 (1987). The odorous air samples were subsequently analysed in the odour panel facility at Bord Na Mona, Newbridge, using dynamic olfactometry, undertaken in accordance with CEN Standard TC264 (1999), using an odour panel of eight assessors. The concentration in each of the samples collected was expressed in terms of odour units per m^3.

The odour emission rates obtained from the odour survey, which were used in the dispersion model, are given in Table 8.1.

The emission rates used in the odour dispersion model were expressed in terms of odour release per second. For point sources, such as emissions from the exhaust stacks of the odour control units the odour emission rate was calculated in terms of o.u/s based on the exhaust airflow (m^3/s). In the case of the primary and the secondary treatment tanks, the emission rates were expressed in terms of the odour emission rate per unit area per second (o.u./m^2.s), as measured by the 'Lindvall box' method.

Table 8.1
Results of odour survey at Osberstown WWTP.

Sampling Location	Odour Concentration (o.u./m^3)	Odour Emission Rate (o.u./m^2.s)
Primary settlement Tank	6	0.29
CASS Tank No 4 – Aeration Mode	6	0.29
CASS Tank No 2 – Aeration Mode	8	0.39
CASS Tank No 1 - Filling	8	0.39
Sludge Dewatering Building	46	
Sludge Treatment Odour Control Exhaust	260	442 o.u./s

8.3.3. Primary and secondary treatment tanks

A tank surface height of 3m and 1.5m for the primary tanks and CASS tanks respectively, with an emission temperature of 15C was used in the odour dispersion model. The vertical exit velocities from the surface of the tanks are very low with rates typically below 0.01 m/s reported in the literature and so emission rates from tanks are due primarily to the rate of evaporation from the water surfaces.

The surface area of each of the existing and proposed additional primary settlement tanks is approximately 452 m^2, resulting in an emission rate per tank of 135 o.u./s, based on an emission rate per m^2 of 0.3 o.u./s. In the case of each of the four existing and the proposed two new CASS tanks (Option1) the surface area is 1256m^2, which based on an emission rate per m^2 of 0.4 o.u./s gives an odour emission rate from each tank of 500 o.u./s.

8.3.4. Odour Control Units

It is proposed that the existing odour control units for the inlet works and sludge treatment plant will handle the additional loading projected from the plant extension.
The emissions from the two existing odour control systems were set at an odour emission concentration of 260 o.u./m^3, obtained from the odour survey. The odour control unit for the inlet works has an exhaust airflow rate of 740 m^3/hr or 0.21 m^3/s, with an equivalent exit velocity of 6.6 m/s. The treated air is discharged to atmosphere from a 3.8m high stack. The larger sludge stream odour control unit has an exhaust airflow rate of 6283 m^3/hr (1.74 m^3/s), with a corresponding exit velocity of 6.2 m/s. The height of the discharge stack for this odour control unit is 5.6m. Recent measurements indicate H_2S emissions were below detection limit from each of the exhaust stacks. The corresponding odour emission rates for the inlet and sludge treatment odour control units was calculated to be 52 o.u./s and 442 o.u./s respectively, based on a measured odour concentration of 260 o.u./m^3.

8.4. RESULTS OF ODOUR DISPERSION MODEL

The results of the odour modelling study based on the predicted 98 percentile ground level concentration over the two years at each of the receptor locations, within a 30x30 grid around the site are presented as odour concentration contours in Figs 8.2-8.3. These diagrams show the predicted odour contours for a 15-minute period of the impact of the existing plant and the combined impact of both the existing and proposed extended plant components.

The intensity of an odour observed will depend on the strength of the initial odour concentration from the surfaces of the various tank or odour control exhaust vent and the distance downwind at which the prediction is made. Where the odour emission plumes from several of these sources combine downwind, the predicted odour concentration can be significantly higher than that predicted for an individual source. An odour concentration of 1 o.u./m^3 is defined as the level at which there is a 50% probability that, under laboratory conditions using a panel of qualified observers, an odour may be detected. At levels below 1 o.u./m^3 the concentration of the gaseous compound causing the odour in the air will be less than the detection level and so although the gas is still present in the air no odour will occur.

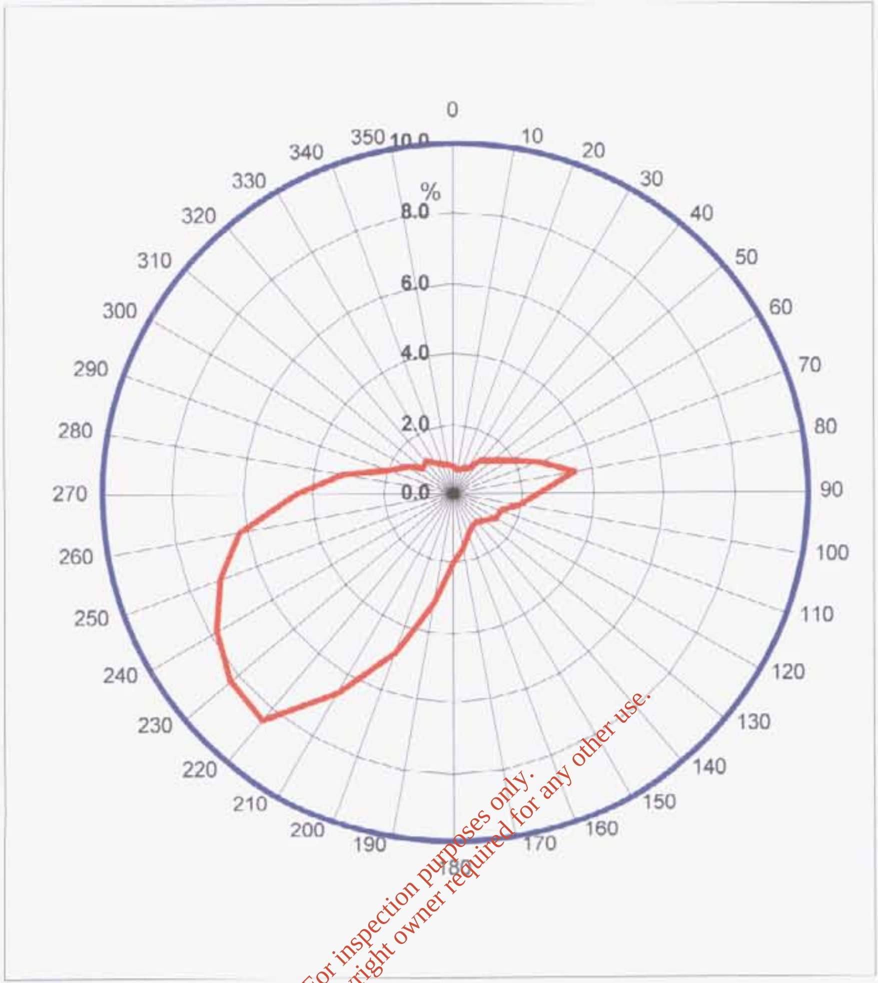
An odour concentration of greater than 5 o.u./m^3 is widely used as a criteria for predicting the potential for nuisance complaints over a short-term period, typically of around 15 minutes. This predicted odour concentration, expressed as a 98 percentile value, has been used as an acceptable approach in Ireland and the U.K. to demonstrate that no community nuisance would arise.

The odour concentrations that are predicted to be exceeded for 2% of the year, or 175 hours during the year, are shown in Fig 8.2 for the existing plant operation. The predicted odour contour pattern downwind of the wastewater treatment plant indicates that the 98 percentile short-term odour levels beyond the plant boundary are less than about 1 o.u./m^3. The predicted 98 percentile odour concentration is less than 0.5 o.u/m^3 beyond about 100m downwind of the north-eastern plant boundary. This predicted odour concentration is less than 20% of the odour exposure criteria of 5 o.u./m^3 for wastewater treatment plants.

When the combined impact of both the existing plant and the proposed extension are modelled the predicted 98 percentile odour concentrations indicate an approximate doubling in levels close to the NE site boundary (Fig 8.3). This is due to the close proximity of the footprint area for the additional primary and secondary tanks for the plant extension. Along the site boundary, bordering the county road to Sallins the predicted 98 percentile odour concentration are between 0.5 and 1 o.u./m^3. At the south-western boundary, the predicted 98 percentile concentrations are similar to those shown in Fig 8.2, with no significant increase in predicted levels. The odour contour plot for the combined impact of odour emissions indicate that at the boundary the maximum 98 percentile concentration is predicted to be about 40-50% of the odour exposure criteria of 5 o.u./m^3. It is evident from the analysis of the predicted odour impact from the proposed plant extension that the potential for significant malodours to occur beyond the site boundary is low.

8.5. CONCLUSION

The design and operation of the wastewater treatment plant at Osberstown minimises the potential for malodours to be detected beyond the site boundary. The proposed plant extension results in a small increase in the predicted odour concentration level downwind of the north-eastern site boundary, compared to the predicted levels based on the current plant layout. The predicted short-term odour concentrations are below 1 o.u/m^3, beyond a distance of about 100m from the site boundary. An odour concentration, of 1o.u./m^3, typically over a 15-minute period, not to be exceeded for more than 2% of the year will ensure that odours from the site are unlikely to be detected at the nearest housing. Based on the results of the odour dispersion modelling study carried out, no adverse impact on the ambient air quality of the area is predicted due to emissions from the wastewater treatment plant at Osberstown.



HOURLY WIND DIRECTION FREQUENCY - ALL WIND SPEEDS

Direction	Percentage Occurrence of Wind Speeds (m/s)						
	<2	2-3	3-5	6-8	9-11	>11	All
350-10	0.5	0.6	0.7	0.4	0.1	<0.1	2.28
20-40	0.7	0.6	0.7	0.5	0.2	<0.1	2.76
50-70	1.1	1.2	1.8	1.4	0.4	0.1	5.97
80-100	1.3	1.6	2.5	1.9	0.4	0.1	7.90
110-130	0.9	0.8	1.0	1.1	0.2	<0.1	4.06
140-160	0.7	0.6	0.7	0.9	0.3	0.2	3.33
170-190	0.6	0.9	1.4	1.6	0.9	1.2	6.74
200-220	1.1	1.2	2.6	5.9	4.5	4.5	19.84
230-250	1.3	2.0	4.6	7.5	4.5	3.0	23.02
260-280	1.4	1.7	3.3	4.2	1.8	1.3	13.75
290-310	0.8	0.9	1.3	1.2	0.2	0.1	4.60
320-340	0.6	0.7	1.0	0.7	0.1	<0.1	3.15
Calms	2.6						2.59
Total	13.6	12.7	21.8	27.5	13.6	10.7	100.00

FIG 8.1: FREQUENCY OF WIND DIRECTION AND WIND SPEED FOR HOURLY OBSERVATIONS AT CASEMENT AERODROME (1984-93)

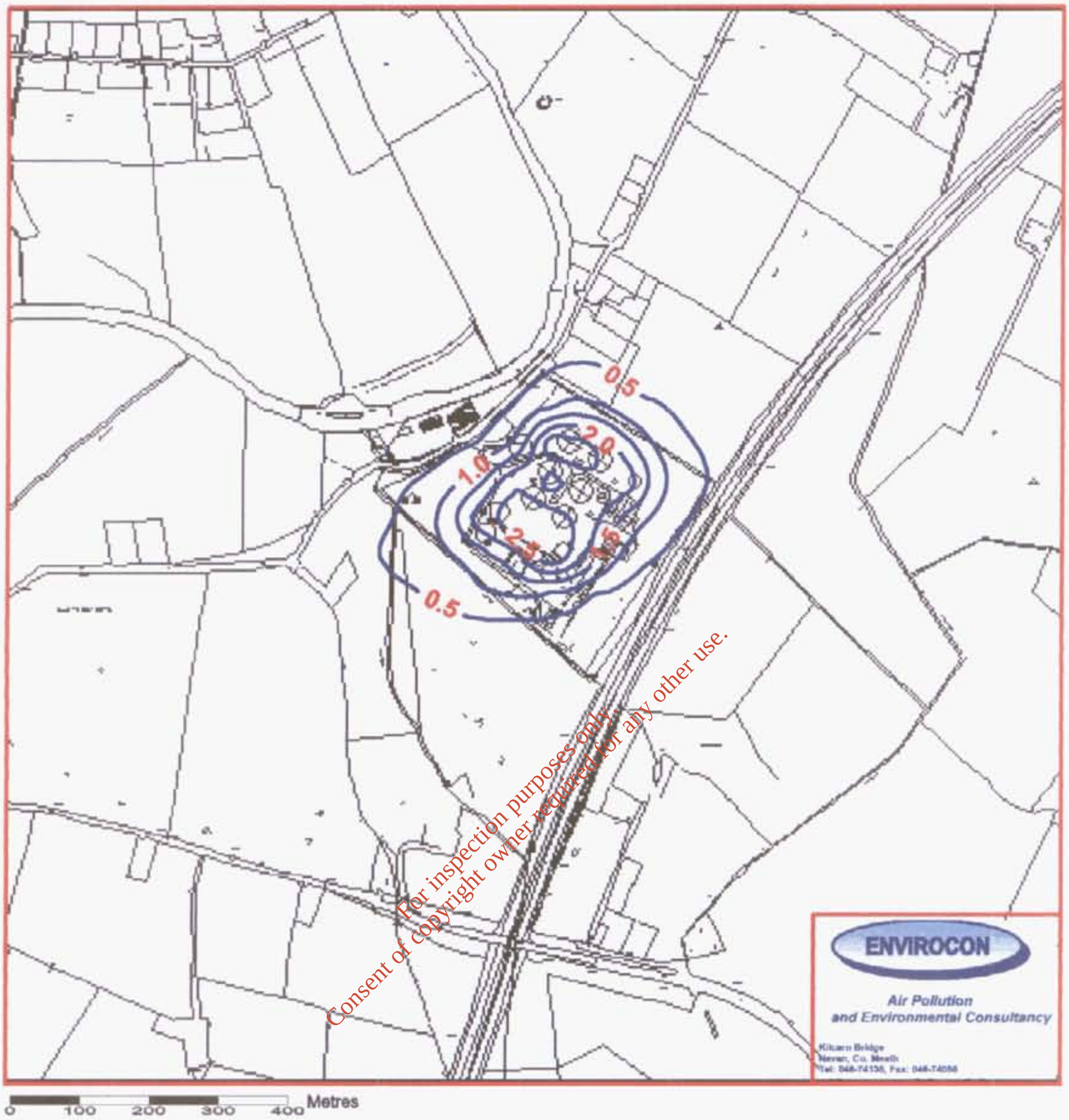


Fig 8.2 – PREDICTED 98 PERCENTILE OF SHORT-TERM ODOUR CONCENTRATIONS OVER A YEAR DUE TO EMISSIONS FROM EXISTING PLANT (O.U./M3)

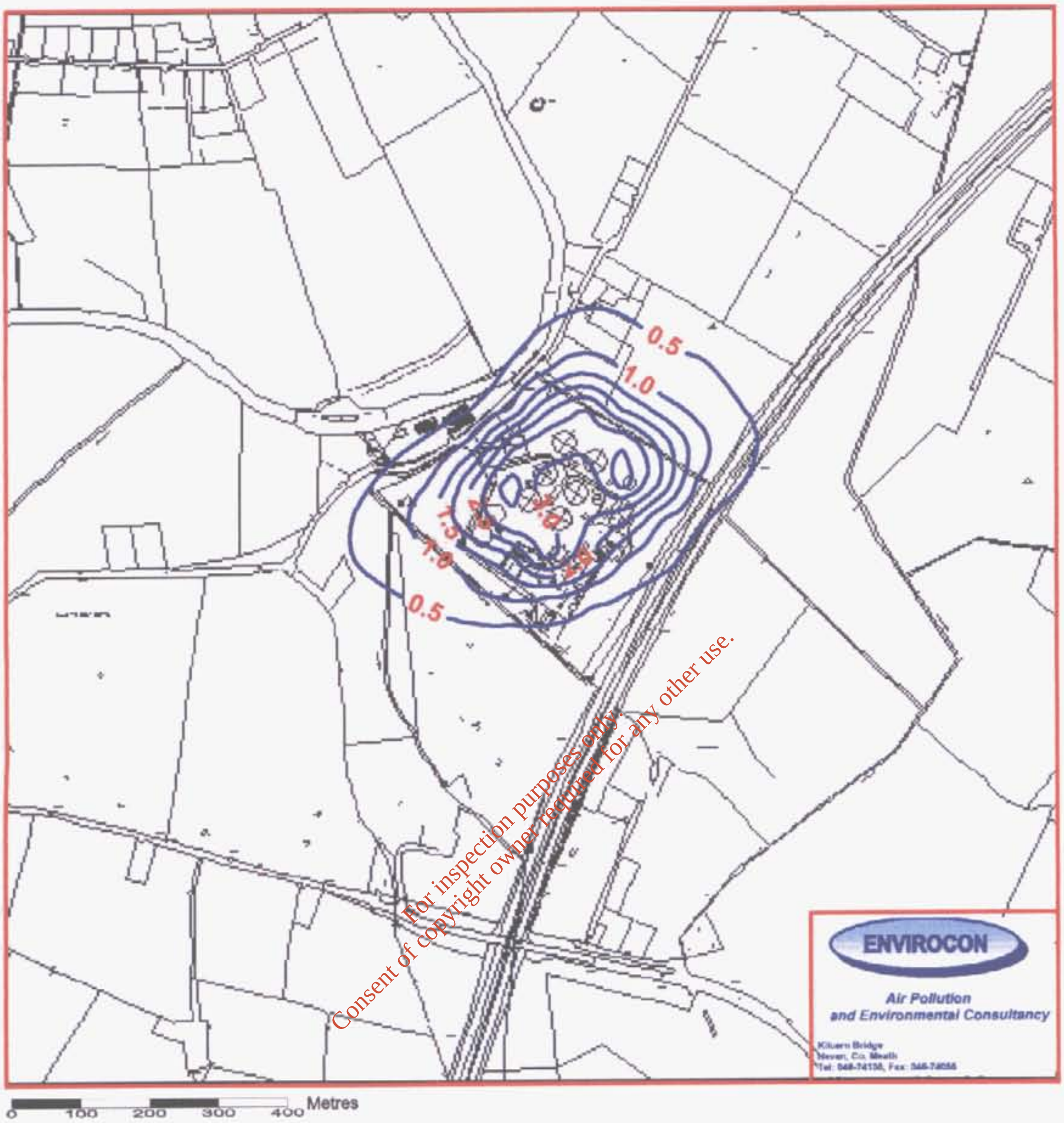


FIG 8.3 – PREDICTED 98 PERCENTILE OF SHORT-TERM ODOUR CONCENTRATIONS OVER A YEAR DUE TO EMISSIONS FROM EXISTING PLANT AND PROPOSED EXTENSION (O.U./M3)

8.6. MITIGATION AND RESIDUAL IMPACTS

The recommended mitigation measures in regard to air quality are similar to those at the current (Stage II) plant. Specifically the following aspects should be continued and capacities upgraded as necessary:

- The inlet works are completely enclosed and utilises odour control units with an emission concentration of 260 o.u./m^3
- Screenings and grit are stored in covered containers.
- The peripheral overflow weirs on the primary tanks are covered and exhaust air directed to the main odour control unit. This should apply to any additional primary treatment units(s).
- All the potentially odorous sources from the sludge handling process, including the sludge thickener tank, digester sludge storage, belt presses, skips and the primary tank peripheral weir head-space air is exhausted to atmosphere via the sludge stream odour control unit operating at an emission concentration of 260 o.u./m^3. Any additional facilities should utilise similar odour control and the same emission rates.

The proposed extended plant will be required to comply with the general odour concentrations predicted in this study. The residual impact on air quality if these measures are implemented is predicted to be insignificant.

9. TRAFFIC

9.1. EXISTING ENVIRONMENT

The main routes surrounding the site include the local access route, running NW from Halverstown Cross-roads towards the Sallins-Naas Road (R407) near Grand Canal 1st Lock, the R409 from Naas to Caragh, and the M7 motorway at the SE boundary of the site. Essentially, east and southbound traffic (including to/from Siliot Hill landfill) to and from the site would generally use the M7 motorway via Halverstown Cross and the R409, whilst north and westbound traffic would generally use the R409 or R407.

The local access road is of typical country road standard, with a 5.0 to 5.5m wide carriageway and a variable soft shoulder width, good vertical alignment, poor horizontal alignment, and a reasonable road surface standard. The section from Halverstown Cross to the plant entrance was resurfaced during 2000, together with a road re-alignment for some 300m from the entrance to improve sight distances and soften the existing double bend. This improved the line-of-sight to the south-east from the existing 30m to 300m plus, with a sight distance of 100m to the north-west. The existing deep-set entrance was essentially retained. The rumble strips installed on the approach to Halverstown were also retained.

The impact of traffic was assessed in the 1995 EIS for the existing plant in regard to potential impacts on humans, the existing road system, existing traffic, and the landscape. An inventory of traffic generated by the new WWTP included; staff cars, maintenance trucks/vans, chemical deliveries, sludge deliveries, screenings removals, dewatered sludge removal, and construction traffic. The main findings were:

- The traffic volumes in the vicinity of the site are very low and the capacities of the existing roads in the area are well above existing and projected traffic volumes.
- The main traffic increase will be due to increased truck movements, and particularly as a consequence of dewatered sludge removal, resulting in 4.5 to 6.5 movements per hour during working hours, at the full capacity of the existing plant. The majority of these trucks would initially use a route destined for Siliot Hill landfill.
- No significant effect was predicted under the headings of; traffic noise, vibration, air pollution, dust-litter-odour, pedestrian stress and delay, pedestrian amenity, driver severance and delay, visual effects, physical environmental impacts, and perception of traffic impact.
- It was recommended that the existing double bend on the county road to the south-west of the site be removed to increase sight distances and for general safety, that all liquid sludge's be transported in sealed containers and washed down before leaving the site to minimise odours, and that damp screenings or dewatered sludge's should be transported in covered trucks to eliminate loss of material en-route.

A new traffic survey was carried out on the local access road in September 2001and found weekday twelve-hour (07:00 to 21:00) vehicle numbers at 153 units/hr and a peak in the 200-230 units/hr range.

The estimated average annual hourly total is 84 units/hr. The capacity of this road is 500 pcu/hr. Truck movements are estimated at below 7% (6 per hour).

The R409 was monitored in January 2001 at Mondello (NW of Caragh) and found weekday twelve-hour (07:00 to 21:00) vehicle numbers at 185 pcu/hr and a peak in the 270-310 pcu/hr range. The estimated average annual hourly total is 147 pcu/hr. The capacity of this road is 900 pcu/hr. Truck movements are estimated at below 19% (27 per hour).

The following vehicle movements to and from the WWTP were assessed for the plant operating at the current 60,000 PE (approximately):

1. Staff cars at 8 per day during normal working hours (mornings between 7.45 and 9.00 am, and evenings between 5.00and 6.00 pm).
2. Maintenance and visitor traffic of 1 cars and one truck/van per day (estimated).
3. Chemical deliveries of one truck per month (estimated).
4. Sludge deliveries of nine tankers per week.
5. Screenings removal once per week (wheelie bins).
6. Grit removal once per month (skip).
7. Digested sludge removals of 10 sludge skips (enclosed) per week in sealed tankers bound for Siliot Hill Landfill.

The plant working at full capacity (80,000 PE) would see an approximately pro-rata increase in traffic items 1, 2, 3, 5, 6, and 7. The most significant movements are therefore the sludge deliveries and removals. This situation is subject to a forthcoming change and is discussed in the impact assessment.

9.2. LIKELY SIGNIFICANT IMPACTS

The following vehicle movements to and from the WWTP were assessed for the plant operating at an extended capacity of 130,000 PE:

- Staff cars at 10 per day during normal working hours (mornings between 7.45 and 9.00 am, and evenings between 5.00and 6.00 pm).
- Maintenance and visitor traffic of 2 cars and one truck/van per day.
- Chemical deliveries of one trucks per month.
- Screenings removal once per week (wheelie bins).
- Grit removal twice per month (skip).

These traffic movements represent an insignificant increase in traffic volumes in the area, with the capacity of the local access road and R409 currently at a fraction of their capacities.

The main traffic impact identified in the 1995 EIS concerned the transport of sludge's to and from the plant. There is a new sludge handling plant currently subject to design and a separate EIS that will assess the overall impact of sludge movements. The sludge transport aspect of the extension is thus excluded from traffic impact on this basis.

There will be a significant amount of construction traffic during the estimated 12-month construction period. This traffic will arise from construction staff personal vehicles, sub-contractor vans, bulk supply trucks and bulk earthmoving trucks. This traffic will impact on the local access road and the R409. The earthmoving truck traffic will have the most significant adverse impact on the local residents due to noise, frequency, dust and personal safety risk.

The actual frequency of truck trips will depend on the type of process selected, the truck payload and the construction sequence. The traffic volume will not be uniform throughout the construction period and much of the traffic will occur early during the construction period. Most of the construction traffic will be associated with deliveries of concrete to site and to a lesser extent by removal of excavated material from site. From these operations between 20 - 30 truck movements per day are anticipated.

In conclusion, traffic impacts arising from the operation of the extended plant under the headings; noise, vibration, air pollution, dust-litter-odour, accidents, pedestrian stress and delay, visual effect, physical impacts, time and location of traffic movements, are thus all considered insignificant. It is therefore concluded that the operation of the proposed extension to the plant will have an insignificant impact on traffic movements in the area.

The main two likely potential impact concerns sludge movements (by truck) and construction traffic. The sludge treatment aspect is subject to a separate EIS for the proposed new sludge handling facility. The impact predicted from construction traffic movements is not predicted to be significant within the context of road capacity, but will potentially impact under noise, vibration, time and location of traffic movements, road damage, and potential road mud problems. Impacts under the heading noise and vibration during the construction phase are also considered under the next section.

9.3. MITIGATION AND RESIDUAL IMPACTS

Regarding the operation of the extended plant, there are no additional mitigation measures required other than those in operation at the current plant. In the interim before the (likely) construction of the sludge handling plant, the 1995 EIS stipulation should be continued whereby all liquid sludge's be transported in sealed containers and washed down before leaving the site to minimise odours, and that damp screenings or dewatered sludge's should be transported in covered trucks to eliminate loss of material en-route.

9.3.1. Traffic management

Regarding the construction of the extended plant, the Contractor will be required to implement detailed traffic management systems in consultation with the Gardai and Kildare County Council Roads Department before construction activities commences. Advance notification, extensive signage and widespread public relations in the area will be used to advise the public and particularly the residents of the area of impending disruption due to particular construction activities.

9.3.2. Working hours

When overtime and shift working is permitted, the hauling of spoil and delivery of materials outside normal working hours is prohibited. No work may be carried out on Sundays or public holidays outside of 0900 & 1600 hours, except in the case of emergencies.

9.3.3. Road damage

The movement of heavy goods vehicles transporting plant and materials along the existing local roads may cause damage to the road structure. The contractor will be required to take all necessary precautions to avoid damage to existing roads.

Vehicles will be required to comply with the gross vehicle weights prescribed in the Road Traffic (Construction, Equipment and Use of Vehicles)(Amendment) Regulations, 1990.

Tracked plant will not be permitted on road surfaces outside the site boundaries unless adequate protective measures have been taken to safeguard the integrity of the road surface and the prior approval of Laois County Council has been obtained.

9.3.4. Road mud

Road mud is regarded as one of the main environmental nuisance problems arising from construction sites with large quantities of spoil to be removed. Although the quantities of spoil to be removed are predicted to be reasonably minor, the contractor will nonetheless be required take strict measures to minimize this problem.

These will include, but not necessarily be limited to:

- The provision of easily cleaned hardstandings for vehicles entering, parking and leaving the site.

- The provision of wheel washing facilities including, where practicable, mechanical wheel spinners.
- The use of an approved mechanical road sweeper to clean the site hardstanding or any mud or debris deposited by site vehicles on roads or footpaths in the vicinity of the site. The road sweeper is to be readily available whenever the need for cleaning arises and will be properly used and maintained.
- The adequate sheeting of each lorry load of spoil removed to prevent spoil falling off during its journey to the tip concerned.

10. NOISE AND VIBRATION

10.1. EXISTING ENVIRONMENT

Project sub-consultants AWN Consulting Limited were appointed to assess the noise and vibration impact from the proposed new extension.

The principal sources of sources of noise in the area emanate from the plant itself, the surrounding roads – the M7 and R409, and traffic movements to and from the plant. Plant noise includes the blower building and the feeder pipes from the blowers to the CASS basins. On a cursory assessment, traffic noise is the dominant noise source in the area, with some plant noise evident during lulls in traffic. The existing plant blower setup includes cladded blower units inside a dedicated building, with insulation of the output pipes over the first 5 metres from the building. There is noise emanating from these pipes away from the insulated section, and particularly at the 90 degree bends into the CASS tanks. There are no known sources of vibration in the area.

The impacts of the extension to the plant, including operational vehicular movements and construction traffic/activities are considered in this section.

10.2. LIKELY SIGNIFICANT IMPACTS

The potential sources of impact associated with the proposed extension are construction noise and, once developed, noise from the new plant and additional vehicular traffic on public roads. As the proposed new extension is likely to be developed as a design-build or design-build-operate contract, the report and assessment is designed to be as generic as possible, whilst still including specific details where considered relevant. In particular, aeration equipment, a main source of noise at a typical plant, is used for most appropriate designs, and is considered in some detail.

Early public consultation with local residents indicated that plant noise is considered a problem after approximately 8pm at night, coinciding with a decrease in motorway traffic at this time. Two noise measurement surveys were performed in order to quantify the situation, as described in the following sections. The initial survey described the existing noise environment, and was followed by a further survey to quantify the impact of the current plant, arising from the local concerns. The second survey quantified the impact of the current plant by measuring at night-time with and without the plant running.

10.2.1. Environmental Noise Survey

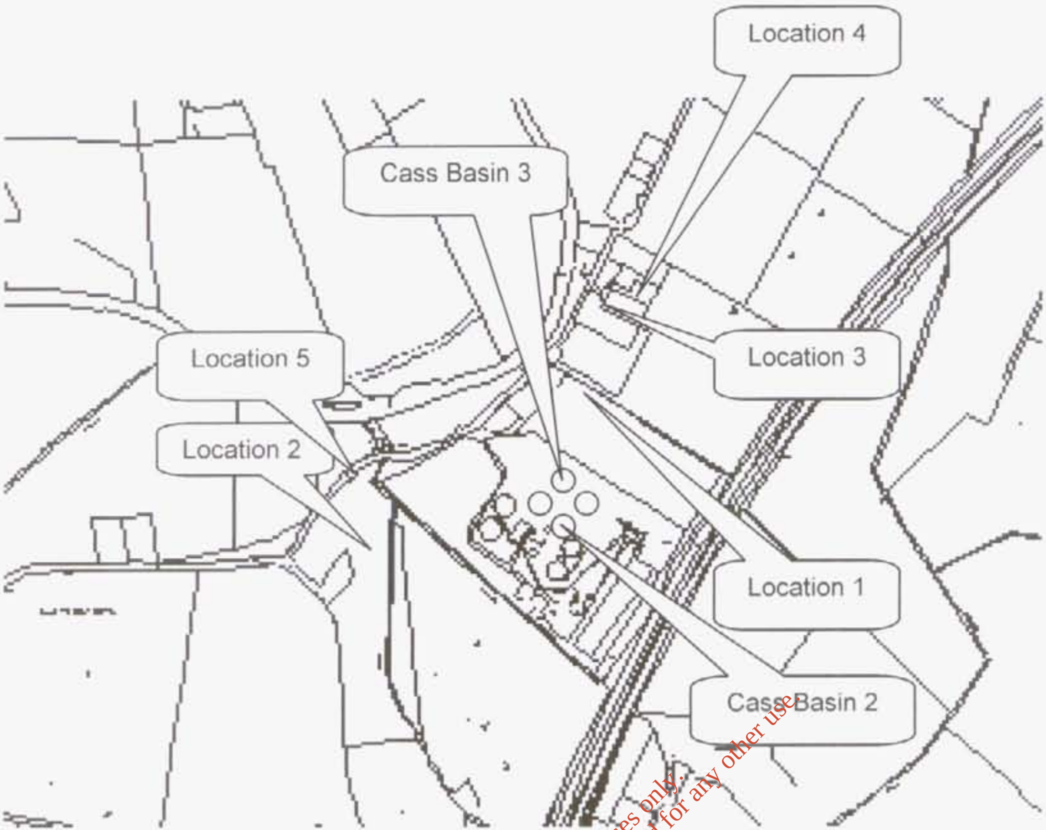
The environmental noise surveys were conducted in order to quantify the existing noise environment. The survey was conducted generally in accordance with ISO 1996: 1982: *Acoustics – Description and measurement of environmental noise*. Specific details are set out below.

Choice of Measurement Locations:
Three measurement locations (1-3) were selected for the initial survey, and the second survey monitored at sites [1, 3, 4, 5]; each is described in turn below and shown on the figure.

Location 1 was on the top of the bund on the north-eastern boundary of the site. This location is between the main plant on site and the new dwelling being constructed just outside the north-east site boundary.

Location 2 was in the centre of the field to the west of the site in the direction of the large house to the west of the site.

Location 3 was in the turning area in front of the three dwellings to the north-west of the site.



Location 4 was at the rear garden of the residence at the location shown.

Location 5 was on the road outside the dwellings to the north-west of the site.

Survey Periods
The initial noise measurements (locations 1-3) were conducted over the course of two survey periods as follows:

- Daytime – 15:40hrs to 18:55hrs on 10/09/2001;
- Night-time – 22: 07hrs to 00:59hrs on 10-11/09/2001.

The daytime measurements cover a typical daytime period. This measurement period was selected in order to provide a typical snapshot of the noise climate, with the primary purpose being to ensure that the proposed development noise criteria are commensurate with the prevailing environment.

The night-time period provides a measure of the existing background noise levels. It is likely that there will be little vehicle or pedestrian activity within the proposed development during the night-time, although there will be some plant noise.

The weather throughout both survey periods was a light westerly wind, dry and with temperatures in the range 10 to 15°C.

The second survey at sites [1, 3, 4, 5] was carried out between 22.30pm and 0.15am on the night of 19/20th November. The weather conditions were similar to the initial survey.

Personnel and Instrumentation
Martin Lester (AWN) 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 Analyser. Before and after the survey the measurement apparatus was check calibrated using a Brüel & Kjær Type 4231 Sound Level Calibrator.

Procedure
Measurements were conducted for the initial survey at the three locations on a cyclical basis. The cycle during the night-time was performed with two samples at each position, and also the noise levels at Location 1 (within the site) were performed first as special access to the site was required.

Sample periods for the noise measurements were 15 minutes during both the daytime and night-time. 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 necessary. Survey personnel noted the primary noise sources contributing to noise build-up.

The second survey was carried out with and without the plant running. Noise levels were taken with and without six blowers operating (the maximum that normally occurs) for Cass Basin's 2 and 3 (see figure). The potential worst case is that the two Cass Basins closest to any neighbour are operating with six blowers and therefore the noise levels at that time could be slightly higher than measured. Vehicular traffic on the M7 motorway was also monitored for the period.

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.

L_{Amax} is the instantaneous maximum sound level measured during the sample period.

L_{Amin} is the instantaneous minimum sound level measured during the sample period.

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 expressed in terms of decibels (dB) relative to $2x10^{-5}$ Pa.

10.2.2. Initial survey results and discussion

Location 1
The results for Location 1 (inside site on north-west boundary) are summarised in Table 10.1 below.

Time		Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
		L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
Daytime	15:40 – 15:55	47	57	43	49	44
	15:56 – 16:11	48	64	43	49	45
Night-time	22:07 – 22:22	46	54	42	48	45
	22:22 – 22:37	48	60	43	50	45

Table 10.1 Summary of results for Location 1

During the daytime, the main sources of noise were site plant (blowers and pipes) and road traffic on the M7 and the regional road (R409). Both daytime and night-time noise levels were relatively steady due to the fact that the main sources of noise (site plant and the M7) produced relatively constant levels of noise during both daytime and night-time periods. Noise levels were in the range 46 to 48dB L_{Aeq} and 44 to 45dB L_{A90}.

No significant sources of vibration were observed.

Location 2
The results for Location 2 (centre of field to west of site) are summarised in Table 10.2 below.

Time		Measured Noise Levels (dB re. 2x10^{-5} Pa)				
		L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
Daytime	16:50 – 17:05	49	61	39	52	42
	17:26 – 17:41	48	57	40	50	42
	18:05 – 18:20	51	66	41	54	43
	18:40 – 18:55	48	60	40	51	42
Night-time	22:40 – 22:55	40	49	36	42	38
	22:56 – 23:11	44	52	36	47	39
	23:52 – 00:07	46	54	38	49	42
	00:08 – 00:23	46	54	37	49	41

Table 10.2 Summary of results for Location 2

During the daytime, the dominant source of noise was traffic on the regional road (R409) and the M7, with the existing plant being barely audible. Noise levels were in the range 48 to 51dB L_{Aeq} and 50 to 54dB L_{A10}, which is typical for the close proximity to a fairly busy road.

During the night-time there was less traffic, particularly during the first period, and the existing plant noise became more audible. Noise levels were in the range 40 to 46dB L_{Aeq}, with background noise levels as low as 38dB L_{A90}.

No significant sources of vibration were observed.

Location 3
The results for Location 3 (car turning area in front of three dwellings to north-west of the site) are summarised in Table 10.3 below.

Time		Measured Noise Levels (dB re. 2x10^{-5} Pa)				
		L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
Daytime	17:08 – 17:23	55	71	38	58	40
	17:46 – 18:01	55	78	38	58	41
	18:23 – 18:38	56	76	38	59	41
Night-time	23:16 – 23:31	45	65	34	46	38
	23:32 – 23:47	45	65	35	46	39
	00:28 – 00:43	48	67	36	50	40
	00:44 – 00:59	48	67	37	51	40

Table 10.3 Summary of results for Location 3

During the daytime, the dominant source of noise was road traffic on the regional road (R409), with the existing site being just audible during lulls in traffic. Noise levels were 55 to 56dB L_{Aeq} and 58 to 59dB L_{A10}.

During the night-time the amount of traffic on the regional road was less and noise from the existing plant and the M7 were more audible. Noise levels were in the range 45 to 48dB L_{Aeq}, with a background noise level of 38dB L_{A90}.

No significant sources of vibration were observed.

Existing Plant Noise Survey
In addition to the environmental noise survey, a noise survey of some the existing plant was performed in order to quantify the potential impact of the proposed extension. The most audible sources of site plant noise at Location 1 were noise break-out from the Blower House and noise from the large pipes feeding from the blower house to the Cass Basins.

At 10 metres from the door end of the blower house noise levels were as high as 69dB L_{Aeq}, whilst at the "back" end the levels were lower at 60dB L_{Aeq}. The difference is mainly due to holes / gaps around the doors.

The noise level close to the pipes from the blower building to each Cass Basin was measured as 72dB L_{Aeq} at 2 metres from the pipe. As the pipes radiate noise from along their length, the predicted noise level at the boundary of the site is as high as 48dB L_{Aeq}. This is comparable to the noise level noted at the boundary when the blower was operating for the Cass Basin closest to Location 1 (Cass Basin 3).

Characteristics of the proposed development
When considering a development of this nature, the potential noise & vibration impact on the surroundings must be considered for each of two distinct stages: the short term impact of the construction phase and the longer term impact of the operational phase.

The construction phase will involve clearing the site and erecting new buildings.

There are two primary sources of noise in the operational context as follows:

- wastewater treatment plant;
- additional vehicular traffic on public roads.

10.2.3. Second survey results and discussion

Based upon the measured noise levels with and without the blowers operating, the calculated contribution of noise associated with the WWTP at the four measurement locations are provided in Table 10.4 below, along with the total noise level with the plant running.

Measurement Location	Total Noise Level	Contributory Noise Level
1	51dB L_{Aeq}	46dB L_{Aeq}
3	40dB L_{Aeq}	26dB L_{Aeq}
4	44dB L_{Aeq}	35dB L_{Aeq}
5	38dB L_{Aeq}	36dB L_{Aeq}

Table 10.4 Calculated Contributory Noise Levels

Due to slight variations in the road traffic noise in the vicinity of the site, the above calculated noise levels are only indicative of the true contribution. They are, however, considered to be within 3dB of the true value.

The 1995 EIS for the current plant set a night-time limit of 40dB L_{Aeq} at noise sensitive locations and this appears to be being achieved (as only Locations [3,4,5] had dwellings at the stage of the previous EIS). This is notwithstanding the concerns of the local residents that these levels of noise constitute a nuisance, as discussed further in the next section.

As there will be more plant added to the site as part of the extension, and there is now a new dwelling in very close proximity to the north-east boundary of the site, it will be necessary to assess the situation to ensure that the total noise associated with the present situation and the proposed extension combined will not cause whatever night-time criterion is adopted to be exceeded at any noise sensitive location.

If mitigation measures are implemented that ensure that the night-time criterion is not exceeded at the boundary of the site, is it expected that the criterion will also be achieved at all other locations.

10.2.4. PREDICTED IMPACT OF THE PROPOSAL

Noise Criteria

Due consideration must be given to the nature of the primary noise sources when setting criteria. In this instance, there are two primary sources of noise associated with the development once operational. Criteria for noise associated with the wastewater treatment plant (a constant "industrial" source of noise) are typically set in terms of the $L_{Aeq,T}$ (equivalent continuous sound level) parameter, whilst vehicle movements on public roads are typically assessed using the L_{A10} (ten percentile noise level) parameter.

There are no Irish Standards containing guidance in relation to noise from wastewater treatment plants that are applicable in this instance. In the absence of such standards, best practice dictates that the potential noise impact of the proposed development is assessed against appropriate British and/or International Standards. The 1995 EIS for the current plant used the criteria:

"The noise emanating from the proposed plant should not exceed 45dBA by day and 40dBA at night outside either of these houses."

Given that this standard has resulted in noise levels that are not acceptable to the local residents, it is recommended that a stricter standard should be adopted for the entire site incorporating the existing plant and the proposed new extension. In the previous EIS submission it was found that the night-time background noise level at O'Keefes (Location 4) was as low as 35dB L_{A90}. It is considered that if the contribution of noise associated with the development is no greater than 30dB L_{Aeq} at the north, west and south boundaries of the site, then it is unlikely that there will be a noise disturbance at any neighbouring dwelling. This can be written as:

The contribution of noise emanating from the existing and proposed plant together should not exceed 30dB $L_{Aeq,\ 15min}$ at the north, west and south boundaries of the site.

In relation to noise associated with vehicular traffic on public roads, Table 10.5 offers guidance as to the likely impact associated with any particular change in traffic noise level.

Change in Sound Level (dB L_{A10})	Subjective Reaction	Impact
< 3	Imperceptible	Negligible
3 – 5	Perceptible	Slight/Marginal
6 – 10	Up to a doubling of loudness	Significant
11 – 15	Over a doubling of loudness	Substantial
> 15	-	Severe

Table 10.5 Likely impact associated with change in traffic noise level

Vibration Guidelines

Vibration standards come in two varieties: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. In both instances, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV).

It is acknowledged that humans are particularly sensitive to vibration stimuli and that any perception of vibration may lead to concern. In the case of traffic, vibration is perceptible at around 0.5mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events of short duration. For example, blasting and piling (two of the primary sources of vibration during construction) are typically tolerated at vibration levels up to 12mm/s and 2.5mm/s respectively. This guidance is applicable to the daytime only; it is unreasonable to expect people to be tolerant of such activities during the night-time.
Guidance relevant to acceptable vibration at the foundation of buildings is contained within:

- Building Research Establishment (BRE) Digest 353 (July 1990): *Damage to structures from ground-borne vibration*, and;
- British Standard BS 7385 (1993): *Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from groundborne vibration.*

The BRE digest refers to the German Standard DIN 4150, which provides limits below which there is very unlikely to be any cosmetic damage to buildings. For structures that are of great intrinsic value and are particularly sensitivity to vibration, transient vibration should not exceed 3mm/s at low frequencies. Allowable levels increase to 8mm/s at 50Hz and 10mm/s at 100Hz and above.

BS 7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

Forecasting Methods
Prediction calculations for building services plant and deliveries to the development have been conducted generally in accordance with ISO 9613: *Acoustics – Attenuation of sound outdoors, Part 2: General method of calculation, 1996.*

Prediction calculations for vehicles on public roads and car parking on site have been conducted in accordance with *Calculation of Road Traffic Noise,* Department of Transport Welsh Office, HMSO, 1988 (hereafter referred to as CRTN).

Construction Phase
A variety of items of plant will be in use, such as excavators, lifting equipment, dumper trucks, compressors and generators. It is also possible that piling may be required on occasions and there will be vehicular movements to and from the site that will make use of existing roads.

Due to the nature of the activities undertaken on a construction site, there is potential for generation of significant levels of noise. The flow of vehicular traffic to and from a construction site is also a potential source of relatively high noise levels. The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works, piling operations and lorry movements on uneven road surfaces. The more significant of these is the vibration from excavation and piling operations; the method of which will need to be selected and controlled to ensure there is no likelihood of structural or even cosmetic damage to existing neighbouring dwellings.

Due to the fact that the construction programme has been established in tentative form only because the project is to be run as either a Design Build or Design Build Operate contract, it is not possible to calculate the actual magnitude of noise emissions to the local environment. However, it should be remembered that the impact due to construction activities will be transient in nature and therefore greater levels of noise are normally tolerated than during the longer term operational phase of the development.

Operational Phase
There are two primary sources of noise in the operational context.

- wastewater treatment plant;
- additional vehicular traffic on public roads.

Each of these primary noise sources is addressed in turn.

Note that it is anticipated that there are no significant sources of vibration associated with the operational phase of the proposed development.

Wastewater Treatment Plant
As noted previously, the final design layout of this project is not fixed at this stage as the development may proceed on either a Design Build or Design Build Operate basis. Therefore, there are a number of possibilities as to what will actually be built. However, what we can assess is an example of the option of repeating the current process (i.e. the construction of two further Cass Basins and an associated Blower House). The predicted level of noise will then be compared with the proposed criteria in order to assess the degree of potential impact.

10.3. MITIGATION AND RESIDUAL IMPACTS

In order to sufficiently ameliorate the likely noise impacts, an outline schedule of noise control measures has been formulated for both construction and operational phases.

10.3.1. Construction Phase

With regard to construction activities, reference will be made to BS5228: *Noise control on construction and open sites*, which offers detailed guidance on the control of noise & vibration from demolition and construction activities. In particular, it is proposed that various practices be adopted during construction, including:

- limiting the hours during which site activities likely to create high levels of noise or vibration are permitted;
- establishing channels of communication between the contractor/developer, Local Authority and residents;
- appointing a site representative responsible for matters relating to noise and vibration;
- monitoring typical levels of noise and vibration during critical periods and at sensitive locations;
- all site access roads will be kept even so as to mitigate the potential for vibration from lorries.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These may include:

- selection of plant with low inherent potential for generation of noise and/ or vibration;
- erection of barriers as necessary around items such as generators or high duty compressors;
- siting of noisy / vibratory plant as far away from sensitive properties as permitted by site constraints and the use of vibration isolated support structures where necessary.

It would be recommended that vibration from construction activities be limited to the values set out in Table 10.6 below.

Allowable vibration (in terms of peak particle velocity) at the closest part of any sensitive property to the source of vibration, at a frequency of		
Less than 10Hz	10 to 50Hz	50 to 100Hz (and above)
3 mm/s	3 to 8 mm/s	8 to 10 mm/s

Table 10.6 Allowable Vibration During Construction Phase

Normal working hours will be 0700-1900 hours Monday to Friday and 0800-1630 hours on Saturday. The Safety, Health and Welfare at Work Act, 1989 will apply. Works other than the pumping out of excavations, security and emergency works will not be undertaken outside these working hours without the written permission of Kildare County Council. This permission, if granted, can be withdrawn at any time should the working regulations be breached.

The same provision applies to night and Sunday working. Night is defined as 1900-0700 hours. When overtime and shift working is permitted, the hauling of spoil and delivery of materials outside normal working hours is prohibited and the noise limits mentioned above will apply. No work may be carried out on Sundays or public holidays outside of 0900 & 1600 hours, except in the case of emergencies.

Emergency work includes the replacement of warning lights, signs and other safety items on public roads, the repair of damaged fences and repair of water supplies and other services which have been interrupted.

10.3.2. Operational Phase

Wastewater Treatment Plant

It has been shown above that there is the potential for the existing and proposed future wastewater treatment plant to have a contributory noise level at the nearest noise sensitive location that is in excess of the proposed criteria.

Whatever option is followed during the design stage (whether it be the example option or any other), it will be necessary to consider noise control measures that will reduce the potential contribution of noise to below the proposed criteria. Such measures could include the lagging or boxing around of the pipes that feed from the blower house to the Cass Basins.

The blower pipes and the blowers themselves dominate noise from the existing plant. It is considered that the noise from the pipes is the greater of the two. As discussed, it is suggested that the pipework for one of the Cass Basins be lagged (as per the ductwork close to the blower house) and further noise measurements to confirm the benefit of the lagging performed. Reducing noise from the blowers themselves requires initially speaking the to suppliers to find out if more substantial inlet and outlet attenuators are available, and then looking at the possibility of improving the sound insulation of the blower house.

Additional Vehicular Traffic on Public Roads

The noise impact assessment outlined above has demonstrated that mitigation measures are not required.

10.3.3. Predicted residual impact of the proposal including mitigation measures

This section summarises the likely noise impact associated with the proposed development, taking into account the mitigation measures.

Construction Phase

During the construction phase of the project there will be some small impact on nearby residential properties due to noise emissions from site traffic and other activities. However, given that the development site is in an urban area next to several busy roads, it is considered that the various noise sources will not be excessively intrusive. Furthermore, the application of binding noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum.

Operational Phase

Wastewater Treatment Plant

During the detailed design stage of the project, noise and vibration control measures will need to be employed in order to ensure that noise emissions from the proposed works (which could be a Blower House and the pipework between the Blower House and each CASS Basin) will not cause the recommended criteria to be exceeded. If the proposed criteria are achieved, the resultant noise impact will be acceptable.

Additional Vehicular Traffic on Public Roads.

The change in the level of road traffic noise adjacent to existing roads is anticipated to be a very small reduction. The resultant noise impact is negligible.

10.4. NOISE SUMMARY

A noise survey was carried out at both the site boundary and the nearest noise sensitive locations, during day and night-time. The survey found day-time overall noise levels of *47-56 dB* L_{Aeq}, and night-time noise levels of *40-51 dB* L_{Aeq}, emanating from background noise, the M7, and the plant. The plant contribution of noise was assessed at night-time by operating and shutting-down the plant, and the results indicate a plant noise contribution of approximately 36 *dB* L_{Aeq} at one of the noise sensitive locations, and 46 *dB* L_{Aeq} at the boundary of the site. The contributory noise level is within the 40 *dB* L_{Aeq} criteria specified in the 1995 EIS for the current plant (at a noise sensitive location).

The noise standard criteria adopted for the current plant is considered to result in a nuisance according to the local residents. Both local concerns and evidence gathered during the surveys indicate that whilst the motorway noise is dominant during busy periods, with the plant barely audible, periods of a lull in traffic or lower traffic periods (e.g. between 8pm and 6am) result in a clearly audible noise emanating from the plant.

It is thus considered that the noise standard criteria adopted in the 1995 EIS be improved for the proposed new extension. The overall impact of the existing and proposed new extension should be restricted to 30*dB* L_{Aeq} at the site boundary. This will ensure that the noise contribution from the plant is unlikely to cause a disturbance at any noise sensitive location.

11. ARCHAEOLOGY AND CULTURAL HERITAGE

11.1. EXISTING ENVIRONMENT

The archaeology of the area was assessed in the 1995 EIS and is summarised as follows:

- There are no archaeological sites on or near the facility and the topography of the site does not suggest the presence of any such.
- A burial site lies quite close to the development located on rising ground to the east of the site past the M7 motorway. The site would not extend as far as the development nor are any other burial sites expected in the location of the development.
- The site of the development is comprehensively disturbed by the existing plant and is considered very unlikely to have any archaeological potential. Therefore, inspection during development was not considered necessary or desirable.

In the proposed new extension it is therefore considered unnecessary to re-examine the archaeology of the area.

11.2. LIKELY SIGNIFICANT IMPACTS

There is no extension of the bounds of the site and therefore no change to the 1995 EIS status whereby no impact was assessed in terms of archaeology.

11.3. MITIGATION AND RESIDUAL IMPACTS

No mitigation measures are required for archaeological protection, nor are any residual impacts predicted.

12. INTERACTION OF IMPACTS

12.1. LIKELY SIGNIFICANT IMPACTS

There are particular interactions of impacts within the groups:

- water quality and aquatic flora and fauna
- landscape and visual impact, flora and fauna of the site, air quality, noise, and traffic
- construction – traffic, noise and vibration, dust and mud

As discussed, the impact of the proposed extension on water quality is predicted to be positive, due to better quality effluent, and this is predicted to have a follow-on benefit to aquatic flora and fauna.

The hedgerows and trees on the existing site create a valuable habitat for flora and fauna, and this is further protected by the acceptable impacts predicted for air quality, noise, and traffic.

The construction phase has the potential to create a significant impact and must be considered from many aspects in the mitigation recommendations.

Overall, the interaction of impacts is not predicted to be negative as all impacts were generally predicted to be either positive, neutral, or slight.

12.2. MITIGATION AND RESIDUAL IMPACTS

The particular interactions groups considered were:

- water quality and aquatic flora and fauna
- landscape and visual impact, flora and fauna of the site, air quality, noise, and traffic
- construction – traffic, noise and vibration, dust and mud

The mitigation measures under water quality will need to be achieved to ensure a benefit to aquatic flora and fauna.

The protection and enhancement of habitats for flora and fauna is reliant on the proposed landscape planting, and the recommended air quality, noise, and traffic mitigation measures.

The construction phase involves successful mitigation of noise, vibration, and traffic issues, as recommended under these separate headings.

Overall, the residual impacts are not predicted to be significant under each individual heading or under interaction of impacts.

Appendix A

Water Quality Standards

TABLE A1 STANDARDS FOR QUALITY OF RAW WATER FOR ABSTRACTION

Parameter	Unit	Standards for Categories		
I		A1	A2	A3
pH	pH Unit	5.5-8.5	5.5-9.0	5.5-9.0
Colouration	mg/l Pt scale	20(o)	100 (o)	150(o)
Total Suspended Solids	mg/l SS	50		
Temperature	°C	25 (o)	25 (o)	25 (o)
Conductivity	µs/cm-1 at 20°C	1000	1000	1000
Odour	Dilution factor at 25oC	5	10	20
Nitrates	mg/l NO3	50(o)	50(o)	50(o)
Chlorides	mg/l Cl	250	250	250
Phosphates	mg/l P2 O5	0.5	0.7	0.7
COD	mg/l O2			40
DO	% O2	>60%	>50%	>30%
BOD	mg/l O2	5	5	7
Ammonium	mg/l NH4	0.2	1.5	4 (o)
II				
Total Coliforms	No/100 ml	5,000	25,000	100,000
Faecal Coliforms	No/100 ml	1,000	5,000	40,000
Kjeldahl Nitrogen	mg/l N	200	2,000	10,000
Dissolved iron	mg/l Fe	0.2	2	2
Manganese	mg/l Mn	0.05	0.3	1
Copper	mg/l Cu	0.50(o)	0.1(o)	1(o)
Zinc	mg/l Zn	3	5	5
Sulphates	mg/l SO4	250	200(o)	200(o)
Phenols	mg/l C6H5OH	0.0005	0.005	0.1
Surfactants (reacting with Methylene blue)	mg/l laurysulphate	0.2	0.2	0.2
III				
Fluorides	mg/l F	1	1.7	1.7
Boron	mg/l B	2	2	2
Arsenic	mg/l As	0.05	0.05	0.1
Cadmium	mg/l Cd	0.005	0.005	0.005
Total chromium	mg/l Cr	0.05	0.05	0.05
Lead	mg/l Pb	0.05	0.05	0.05
Selenium	mg/l Se	0.01	0.01	0.01
Mercury	mg/l Hg	0.001	0.001	0.001
Barium	mg/l Ba	0.1	1	1
Cyanide	mg/lCN	0.05	0.05	0.05
Dissolved or emulsified hydrocarbons	mg/l	0.01	0.2	1
PAH	mg/l	0.0002	0.0002	0.001
Total Pesticides	mg/l	0.0005	0.0025	0.005
Substances extracted with chloroform	mg/l SEC	0.2	0.4	1
Faecal Streptococci	No/100 ml	200	2,000	10,000
Salmonella		Not present in 500ml	Not present in 100ml	

O = exceptional climatic or geographical conditions

TABLE A2 STANDARDS FOR SALMONID WATERS

S.I. No. 293 of 1988

Parameter	Units	Standard	Sampling Frequency	Conformance to Standard
Temperature	°C	Downstream of thermal discharge Discharge > 1.5°C temperature of receiving water > 21.5°C May-Oct > 10°C Nov-April	Weekly upstream and downstream	98% of time
Dissolved Oxygen (D.O.)	mg/l O_2	> 9 Danger at 6, L.A. to prove no harm to fish population E.U. Directive – guidance limits > 7	Monthly representative of low O_2 conditions	50% of time 100% of time
pH		≥ 6 ≤9 not exceed ± 0.5 change in receiving water	Monthly	95% of monthly samples 100% when less frequent monitoring
Suspended solids (SS)	mg/l	≤ 25 does not apply to SS with harmful chemical properties	Monthly	Average over 12 months
BOD_5	mg/l O_2	≤ 5 E.U. directive guidance limit < 3	Monthly	95% of monthly samples 100% when less frequently monitored
Nitrites	mg/l	≤ 0.05 E.U. Directive guidance limit < 0.01	Monthly	95% of monthly samples 100% when less frequently monitored
Non-Ionised Ammonia	mg/l NH_3	≤ 0.02	Monthly	95% of monthly samples 100% when less frequently monitored

Parameter	Units	Standard	Sampling Frequency	Conformance to Standard
Total Ammonium	Mg/l NH_4	≤ 1 subject to conforming with non-ionised ammonia standard	Monthly	95% of monthly samples 100% when less frequently monitored
Total Residual Chloride	mg/l HOC1	≤ 0.005	Monthly	95% of monthly samples 100% when less frequently monitored
Total Zinc	mg/l zinc	≤ 0.03 to ≤ 0.5 Dependant on water hardness	Monthly	95% of monthly samples 100% when less frequently monitored
Dissolved Copper	mg/l cu	≤ 0.005 to ≤ 0.112 Dependent on water hardness	Monthly	95% of monthly samples 100% when less frequently monitored
Phenolic Compounds		Not adversely affect fish flavour	Monthly when presence of phenolic compounds are suspended	
Petroleum Hydrocarbons		Not form visible film on water surface or benthic surfaces not be detectable in fish flavour not produce harmful effects in fish	Monthly	

Table A3 Threshold limits used by the EPA in assessing impaired water quality in Irish rivers

Determinand	*Min*	*Med*	*Max*
pH	<6.6 or >9.5	<6.6 or >9.5	<6.6 or >9.5
Conductivity (µS cm^{-1})	none	none	none
Temperature (°C)	>21.5	>21.5	>21.5
Dissolved Oxygen (%)	<70 or >130	<70 or >130	<70 or >130
Dissolved Oxygen (mg O_2 l^{-1})	<7	<9	<9
BOD (mg O_2 l^{-1})	>3	>3	>5
Cl (mg l^{-1})	>50	>999 (saline)	>999 (saline)
Total ammonia (mg N l^{-1})	>0.1	>0.1	>0.3
Un-Ionised ammonia (mg NH_3 l^{-1})	>0.01	>0.01	>0.02
Oxidised N (mg N l^{-1})	>5.65	>5.65	>5.65
ortho-Phosphate (mg P l^{-1})	>0.02	>0.03	>0.15
Colour (Hazen)	>50	>50	>100