SECTION 3

ENVIRONMENTAL IMPACT AND REMEDIAL MEASURES

3.1 HUMAN BEINGS

Human beings are one of the most important elements of the 'environment' to be considered. One of the principal concerns in the execution of a development is that the local population experience no diminution in the quality of life as a result of the development on either a temporary or permanent basis. All the effects of a development on the environment impinge upon human beings. Any significant impact on the status of humans that may be potentially caused by a development proposal must, therefore, be comprehensively addressed. Air quality, water quality, noise and landscape impact directly while flora, fauna and road traffic impact more indirectly.

The only change as part of the planning application is the ash from a peat fired power station to the acceptance of ash from a power station with the co-fuelling of peat with biomass (wood material) and/or (treated) Meat and Bone Meal (MBM).

The facility has been operational since 2001 with no significant impact on the surrounding environmental taken place during this period.

3.1.1 HUMAN BEINGS IN THE EXISTING ENVIRONMENT

The proposed development site is located within a rural setting with a low population living in the surrounding area. The nearest dwelling to the site is located at a distance greater than 600 metres to the south of the site. The nearest village is located ca. 1.5 km south east of the site.

The area is characterised by low intensity low intensity agricultural pastureland and cut-away peatlands.

The area is characterized by variable intensity farming and peat production. Peat production, dairying, grassland management, and dry cattle are the main activities in the area. There has been an approximate 18.5% increase in the population of Clonbulloge between 1996 to 2002, from 329 to 390 (CSO 2002 Census data). There are a number of dwellings along the roadways (Daingean – Clonbullogue and Clonbullogue to Edenderry), with the nearest dwelling located at a distance of greater than 500 m to the south of the facility (refer to Drawing No. 2401057-9).

2.5.2 IMPACTS ON HUMAN BEINGS

(1) Noise

Noise is an identified form of air pollution and uncontrolled it can cause nuisance or a deterioration of amenities and the quality of human life. The potential impact of the proposed development on noise levels within the area is described in section 3.7:Noise. In summary, it is concluded that the noise levels from on-site activities associated with the limited construction phase and in particular, the operational phase of the ash repository site does not pose a significantly impact on the ambient noise levels in the area. Noise monitoring at the facility to-date has indicated that there has been no increase in the level of background noise at the nearest sensitive location since operations commenced in 2001. It is concluded that noise levels will remain within the limits as stipulated in the Waste Licence 49-1.

(2) Traffic

Access to the site for ash, fuel and materials will be via rail only. The access road (off the Clonbullogue to Tullamore road) will be used of access to workers and visitors to the site. The use of the rail link is a more environmentally friendlier mode of transport which:

- More economic user of energy;
- Allows for the transportation of larger volumes of ash in less vehicle movements;
- Reduce the indirect impacts on the community through lower accident levels, traffic congestion, less noise and pollution levels.

During the operational phases traffic movement is restricted to workers and visitors. This will typically occur during normal working hours, twice daily from Monday to Saturday. These movements are considered minor and will not pose a problem to other road users. There will be no increase in the existing traffic movements on the road way as a result of the proposed changes to the facility.

(3) Human Health

A variety of air pollutants have known or suspected harmful effects on human health and the environment. The primary potential air pollutants derived from

the ash repository site are detailed in §3.6:Air. These are identified as Dust and Particulate matter (PM_{10}).

- Particular dust emissions.

Particles that are suspended in the atmosphere give rise to health implications. In addition, particles, which are deposited to ground, give rise to problems such as soiling of buildings and other materials and also cause a general nuisance. There is therefore a requirement to minimise and if possible eliminate such emissions.

The incorporation of MBM ash into the waste ash to be deposited at the site may give rise to additional significant health risks which are identified as potential levels of dioxins [within the ash material] and also the possible BSE infectivity.

To determine the nature of the ash and its risk to human health an assessment was carried out by Dr. Kevin McDonnell, University College Dublin, 2002. A copy of Dr. McDonnell's report is included in Attachment 05. In summary this report indicated that any risk from actual exposure from the ash is low and has negligible implications on human health. In addition, it is noted that the IPPC Licence at EPL allows for the co-fuelling using category 3 MBM (i.e. no SRM material) thus reducing the any potential risks of significant BSE infectivity.

Analytical characterisation of the ash produced from the laboratory combustion of a sample of the co-fuel was carried out. These results are included in attachment 05. Overall the results of the analysis concluded that there were no contaminants present in the sample as to present a significant risk to the environment if deposited in a lined landfill.

On-going dust and PM_{10} monitoring at the facility have illustrated that the immediate surrounds of the site are not affected by dust emissions with average levels of dust deposition and PM_{10} levels well within stipulated emission limits. Furthermore, dust mitigation measures (refer to section 3.6.4) associated with the working procedures at the facility ensure that any potential problems associated with fugitive dust emissions from the site will be negligible.

(4) Site Structure / Land Use

Any potential impacts of the proposed development on the existing structural and land usage of the area are considered insignificant. There will be no building

construction undertaken at the facility. The site is located within predominantly rural setting with low intensity agricultural pastureland and cut-away peatlands.

The site will be designed and worked in such a way as to inflict minimum visual intrusion on existing residential dwellings, and road users. (refer to section 3.8: Landscaping & Visual Impacts). Capping of each cell will be undertaken upon completion in line with the restoration plan. A cycle of progressive filling across the site will occur, with one phase being restored while a second phase is being filled and a third being prepared. Currently there is one cell capped (cell I), one under construction (cell II), and one in operation (cell III). The retention and storage of excavated peat and soil will be retained in stockpiles for intermediate and final capping purposes. These will be kept away from the drainage channels (prevent pollution), however may lead to short term visual nuisance.

Following cessation of all activities on the site, site restoration will commence in line with an aftercare management plan specific to the site. The final finishing of the site has been designed so to inflict minimum intrusion on the existing landscape. The site will be finished in a concave mound design, will be contoured, reseeded and revegetated in order to blend with the natural landscape of the area. The site will be revegetated with a mixture of native coniferous and deciduous tree species post decommissioning.

(5) Socio-Economic

Since the commencement of the facility, there has been a number of social and economic benefits. These effects may be categorised as follows:

- Primary Socio-Economic Effects. These effects are directly related to the development itself such as Job Creation.

  The development and construction of the ash repository facility has and will continue to exert demands on resources such as land, labour and raw material. The development benefits both the skilled and unskilled labour force with a knock-on effect to building suppliers and their employees, capital lending firms and professionals thereby having a positive impact on the local economy.

- Secondary Socio-Economic Effects. These include those effects, which arise as a result of services required (e.g. Water Supply, etc.) by the operation of a development.

Electricity Supply
Electricity demands exerted by the proposed development are negligible with use restricted to administration.

Telecommunications
The telecommunications requirement of the proposed development, both during construction and after completion, will be afforded by portable hand-held radios and mobile telephones. This should not place the current telecommunications network under stress.

(6) Nuisances

Given the nature of the activities on the site it is not envisaged that pests (such as birds and vermin) will be attracted to the site, and therefore do not pose a nuisance to the local community. In addition, nuisances caused by odours and litter will not be generated at the site due to activities occurring at the Ash Repository site. To-date there has been no complaints received at the facility as a result of nuisances at the site.

3.2 FLORA AND FAUNA

3.2.1 INTRODUCTION

An ecological survey of the site and its environs was undertaken in 1998 as part of the Environmental Impact Statement for the Waste Licence Application for the proposed ash disposal facility at Cloncreen, Clonbullogue, Co. Offaly. The objective of the ecological survey was to:

- Determine the existing ecology and diversity of the site
- Establish the presence or absence of important species or habitats

A baseline survey (which involved a visual examination of the terrestrial habitats and identification and quantification of the floral species present) was undertaken by a specialist on behalf of Bord na Móna Environmental Consultancy Services in April 1998 prior to the submission of the initial waste license. The site was revisited in 2002 and again in October 2005 to ensure current site activities are not impacting on the surrounding environment.

3.2.2 BASELINE ECOLOGICAL STUDY

The site is located in the Bog of Allen within the townland of Clonbullogue, Co. Offaly ca. 7 km south-west of Edenderry. The site is made up of predominantly exposed cutaway bog, with some colonisation of immature birch trees at the boundaries, and immature stands within the cutaway bog. The surrounding lands are largely used for livestock farming (predominantly sheep and cows) with varying degrees of intensity.

The existing environment is not designated as a Natural Heritage Area (NHA) or a Special Protection Area (SPA) under the Birds Directive (79/409/EEC) and the Wildlife (Amendment) Act 2000 (S.I. No. 38 of 2000) or as a Special Conservation Area in accordance with the Habitats Directive (92/43/EEC). The overall conservation value of the site is considered low.

The site is owned by Bord na Móna Energy Ltd. and is utilised as an area for the disposal of waste ash, from the neighbouring power station. Historically peat was harvested on this site, but ceased approx. 15 years ago, due to the large quantity of woody relics found within the peat which proved unworkable. Ash from the power plant is now transported to the site via an existing railway line that was originally constructed for the transportation of harvested peat to the power

station. The habitats encountered on site are widespread and typical throughout the cutaway bogs of Ireland.

(1) Flora

The ash disposal facility is located in the middle of the Bog of Allen, which is made up predominately of raised bog. However intensive peat cutting has depleted the original floristic and faunal diversity of the bog. Bord na Móna Energy Ltd. initially harvested this area of bog for milled peat. As part of this process, large surface water drains were excavated to provide drainage for the site and these have remained functional. Drainage causes consolidation, shrinkage and contraction of peat and allows access of oxygen into the peat which severely alters the delicate ecological equilibrium of a bog habitat. Due to past peat extraction and drainage works on this section of the Bog of Allen, these will prevent the original raised bog ecology to be restored.

It is estimated that approximately 50 % of the site consists of exposed peat and plant colonization has been severely restricted. Surface water drains have been partially colonized by rushes (*Juncus effusus*) and mosses (*Sphagnum spp*). There are some stands of isolated shrubs present within the site consisting of Willow (*Salix spp*), Scots Pine (*Pinnus silvestris*). Common gorse (*Ulnex europaeus*) is interspersed with Birch.

Colonisation of flora has occurred on exposed peat on the site boundary and the sides of the surface water drains. Species includes Birch (*Betula pubesens*), Ling Heather (*Calluna vulgaris*), Bell Heather (*Erica cinerea*), Cross-leafed heath (*Erica tetralix*), and Bracken (*Pteridium aquilinum*). In some of the drier locations, namely at the boundaries lichens are becoming abundant, especially *Cladonia floerkeanna* and *Cladonia impexa*.

In 2005, the site visit noted one cells that had been completed. This cell had been colonized with invasive floristic species (trifolium spp). This cell illustrated the floral assemblage that will form after the area has stabilized and lies undisturbed. The invasive species have decreased and the restored cell is dominated by grasses. This is following a natural succession which would be expected, i.e. vegetation from the surrounding landscape is colonizing the new habitat.

Plate 3.2/1: Birch *(Betula pubescans)* and Bracken (*Pteridium aquilinum*) habitat

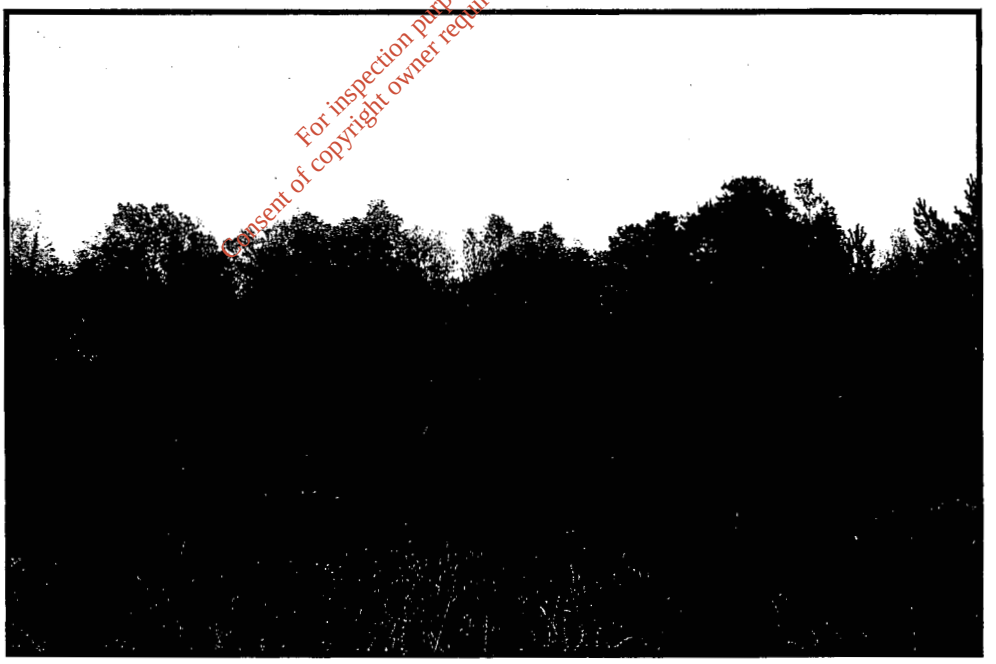


Plate 3.2/2: Willow (Salix spp), Scots pine (Pinnus silvestris) and common gorse (*Ulnex europaeas*) habitat.

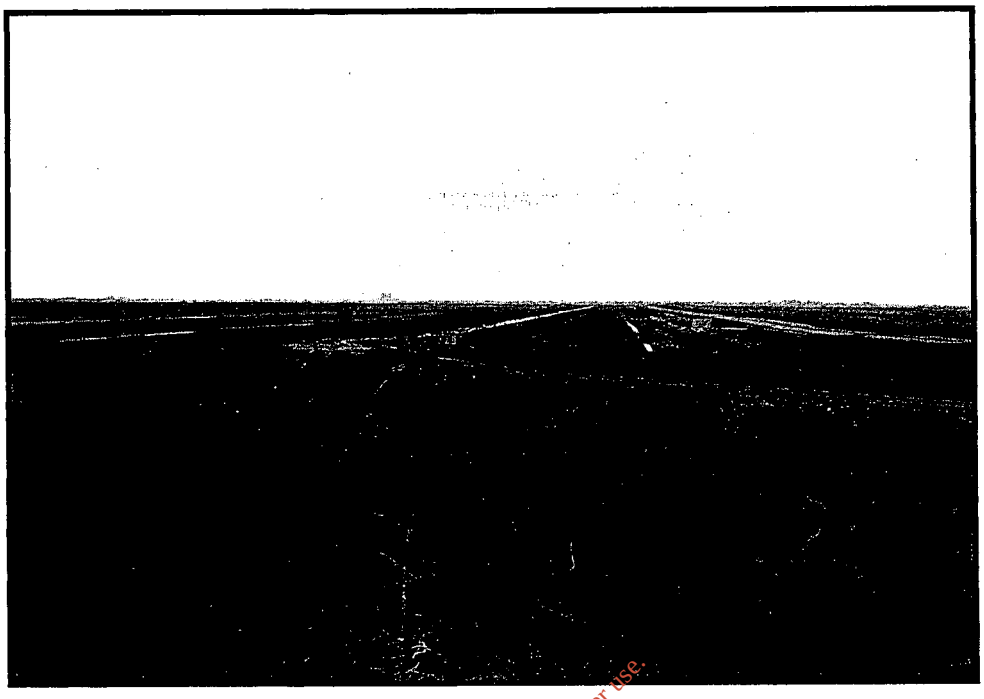


Plate 3.2/3: Exposed cutaway bog with limited colonisation of plant species.

(2) Fauna

Few faunal species are found on bogs due to the restricted nature of food bearing plants and lack of shelter. Birds are common on cutaway raised bogs due to the colonisation of heather and other pioneering species. Species such as meadow pipit (*Anthus pratensis*), skylark (*Alauda arvensis*), carrion crow (*Corvus corone corone*) and woodpigeon (*Columba livia*) have been observed at the site.

3.2.3 ENVIRONMENTAL IMPACTS

As previously stated in the original Waste Licence Application the habitats encountered on the site are widespread and very typical throughout Ireland and none of the habitats or animals recorded are of high conservation value. Therefore the Clonbullogue Ash Repository site was determined not to have a significant impact on the existing habitat. The original waste licence was for the disposal of inert waste products (fly ash and bottom ash) was deemed to have no significant impacts on ecological environment. The change of ash composition

to peat with biomass (wood material) and/or (Treated) Meat and Bone Meal (MBM) and/or a combination of both may have the following impacts on the on the local ecology:

(1) Construction of Cells

Disturbance due to earth-moving activities causing displacement of fauna and flora.

(2) Operational Noise

Noise generated from working vehicles affecting the local fauna.

(3) Decommissioning of Site

Capping material used for decommissioning disposal areas could reduce the natural recolonisation of the area allowing invasive species to become dominant.

(4) Dust Emissions

Increased levels of dust may decrease plant productivity in the environs of the site.

3.2.4 MITIGATION MEASURES

(1) Construction of Cells

The terrestrial habitats affected by the construction of new cells were deemed to have low conservation value due to the absence of mature trees and limited habitat diversity. The terrestrial habitats that have developed are relatively recent in origin, coinciding in age with the creation of the drainage channels and suspension of peat harvesting. In selected areas, namely adjacent to the boundary, good engineering practices are adhered to, ensuring that the impact is minimised and provide a visual screen for the Ash Repository.

(2) Operational noise

Noise is occasional and temporary and is unlikely to have a lasting or significant effect on the surrounding environment.

(3) Decommissioning of site

On completion, the site will be re-vegetated in order to blend in with the surrounding natural landscape. It is envisaged that the facility will be re-vegetated with a mixture of coniferous and deciduous tree post

decommissioning. Plantings will not only complement the existing habitats but will encourage further colonisation by native and local species. Plate 3.2/4 illustrates a cell that has been capped in the last 12 months and illustrates that local flora has colonized the soil used to cap the cell. On viewing a recently capped cell in 2005, it appears that the invasive weed species rapidly colonise the disturbed ground for a short period before becoming colonized with flora that exists in the local area.

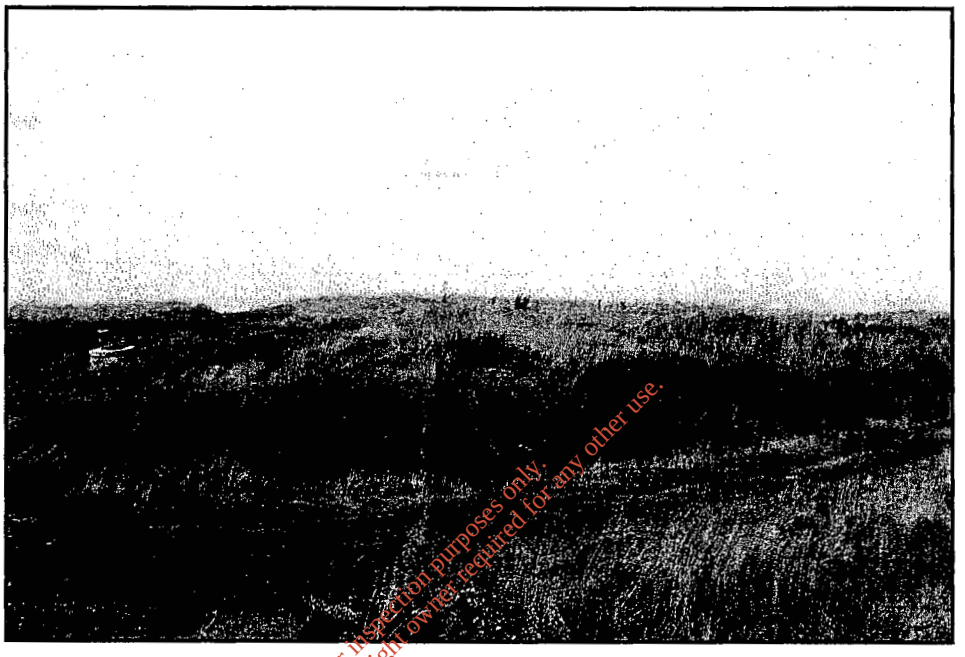


Plate 3.2/4: Decommissioned Capped Cell colonized by local floral species

(4) Dust Emissions

Dust generation has been kept to a minimum while the ash depository has been in operation due to a number of dust prevent measures that are operational on site. These are described in Section 3.6.4 including the dampening of fly ash prior to delivery to the ash repository and further dampening of the deposited ash on site.

The site visit in October 2005 concluded that current dust suppression technique is successful in suppressing dust from current site activities. Flora productivity has not been significantly affected from current site operations. The proposed change in ash type is considered to have insignificant impact on ecological environment.

3.3 SOIL AND GEOLOGY

The proposed development is for a change in the waste ash accepted at the facility from ash generated from a peat fuel power station to ash generated from the co-fuelling with biomass and MBM. There will be no significant changes to the existing infrastructure and operational procedures at the facility.

3.3.1 INTRODUCTION

Desk-based information on the substrata underlying the ash repository site was obtained through the Geological Survey of Ireland and intrusive investigations undertaken at the site as part of the initial EIS (April 1998) and on-going compliances of the waste licence (49-1) as outlined below.

- *March-April 1998*
  Installation of 4 no. shallow groundwater monitoring boreholes (MW 01, MW 02, MW 03, MW 04) and subsequent sampling; Depths of boreholes ranging from 3.50 m – 6.00 m (Quaternary deposits only). Permeability (falling head) test undertaken on MW 04.

- *February 1999*
  Geophysical survey (resistivity and seismic refraction techniques); Permeability (falling head) test undertaken on MW 03.

- *November 2000*
  Installation of 3 no. shallow groundwater monitoring boreholes (MW 05, MW 06, and MW 07); Depths ca. 5m. (Quaternary deposits only).

- *September 2001*
  Installation of 4 no. deep bedrock groundwater monitoring boreholes (MW 08, MW 09, MW 10, MW 11); Depths ranging from 10.0 – 16.8 m.

- *September 2001*
  Permeability testing of quaternary deposits underlying the area of phase 2.

- September 2002
  Permeability testing of the bedrock geology underlying the site.

3.3.2 QUATERNARY GEOLOGY

There is limited published Quaternary overburden information available for the site. A preliminary search identified a gravel pit quarry approximately five kilometres Northeast of the Ash Repository Facility toward Shean, and extraction planning permission exists for an esker ridge approximately 5 km Northwest of the site near Rathvilla. Cloncreen bog peat is currently in production along the site's adjacent tracts of land.

The underlying Quaternary deposits (subsoil) were identified during the intrusive investigations undertaken at the site. Borehole lithology is generally interpreted and presented in borehole logs referred to in attachment 07. Samples recovered during drilling can be stratigraphically identified as follows:

- Surface drained residual raised bog/peat deposits (having a typical moisture content of 90%) - *overlying*

- Blue-grey silty clay (Marl) with variable thickness of light brown clay/silt horizons (a sticky plastic clay was encountered in some of the locations) - *overlying*

- Till - commonly referred to as "boulder clay" - a poorly sorted deposit of stones and limestone boulders within a silty clay matrix (boulder content varies in type, size and volume); Lenses of sands and gravels have been encountered in this strata;

- Glacial boulders have been documented as reaching sizes greater than one metre in diameter, and lower depths of glacial boulder material encountered during intrusive site investigations could resemble weathered bedrock.

Resistivity assessments undertaken at the site in 1999 confirmed that the subsurface beneath the site consists of a variable saturated peat layer ranging from 0.0 to 3.5 m in thickness. The peats are thinnest at the central Southern part of the site where the underlying clay layer can be seen at the surface. A firm clay layer underlies the peat. This layer was present at all locations ranging from 1.2 to 5.0 m in depth (as shown in cross-section of the site in Attachment 07). Notably this layer was significant in the vicinity of the interceptor lagoon.

- Permeability Testing

A falling head test was conducted for a clay horizon at the MW-04 location. Hydraulic conductivity (k) or coefficient of permeability is defined as the capacity of a porous medium to transmit water. Results indicated that the estimated representative hydraulic conductivity approached **1 x 10^{-9} m / s**.

In-situ permeability conditions can vary considerably in a peatland environment as perched water can fluctuate significantly with changes in rainfall, therefore, determining the hydraulic conductivity of a clay unit within in a peatland environment can be problematic as hydraulic conductivity can change with imposed head variations.

In addition to this, a number of permeability tests were undertaken in the clay horizon underlying the proposed area for phase II. These tests gave permeability coefficients ranging from **1 x 10^{-8} m/s to 6.4 x 10^{-9} m/s.**

Similar permeability tests were conducted on the compacted *"concreted"* fly-ash material within the existing phase I cell. Four separated falling head tests were undertaken within this phase I cell and permeability coefficients ranging from **1 x 10^{-8} m/s to 7.7 x 10^{-9} m/s** were obtained.

3.3.3 DEPTH TO BEDROCK

The depth to bedrock was identified during the site investigation undertaken at the site in 2001. This ranged from 4.5 m in MW-08 to 6.4 m in MW-10 (please refer to geological logs and cross-sections in Attachment 07). Prior to 2001, assumed depth to bedrock was when shell and auger refusals where encountered (ranging from 3.50 m in MW-04 to 6.0 m in MW-02). It should be noted that refusal can be encountered when large boulders are present and do not necessarily relate to bedrock.

3.3.4 BEDROCK GEOLOGY

According to GSI publications, bedrock geology underlying the Clonbullogue Ash Repository Site area is described as the Upper Palaeozoic, Lower Carboniferous Allenwood formation (Edenderry Limestone). There were small rock outcrops

noted as evidence of near surface bedrock toward the Southeast area of the Site (refer to bedrock geology map).

Site specific resistivity assessments undertaken at the site in 1999 reported that the limestone bedrock is thick bedded, strong and clean and that permeability, porosity and consequently water yields are likely to be low.

During the drilling and installation of the 4 no. bedrock boreholes at the site in September 2001, the following lithology was encountered:

"Fine to medium grained grey limestone with some cavities and the rock was weathered in places. Fossils (crinoids), calcite veins and patches of darker rock present;"

3.3.5 IMPACTS ON THE RECEIVING ENVIRONMENT

As detailed previously the proposed development does not entail any changes to the infrastructure and operational procedures at the facility, and as such there will be no additional impacts to the subsoil as a result of changes to the existing facility.

- **Lining System**

  Currently the facility accepts inert ash from the Peat burning power plant. This inert ash is placed into the lined cells in compliance with the existing waste licence 49-1. Cells 1 and 2 were constructed in line with the requirements for that of an non-hazardous waste (as detailed in section 2.2.7).

  Following discussions with the EPA, the lining specifications were changed to those applying to landfills for inert wastes. This entails a lining system consisting of *greater than 1 metre of mineral layer which is of ideal impermeability* ($K \leq 1 \times 10^{-7}$ *m/s)* as per Annex 1, 3.2 of the Council Directive 1999/31/EC on the Landfill of waste. This was agreed with the EPA on the 24th August 2005 (refer to attachment 6). Currently preliminary site preparations are being carried out for the construction of cell 3. This will be developed in line with the new specifications (as detailed above), unless the proposed changes in the ash type are developed, in which event the original lining arrangements will be carried out.

With the acceptance of ash from the burning of co-fuelled power plant from MBM and biomass, the ash is classified as non-hazardous and as such the lining arrangement for a non-hazardous waste type will be adopted (as detailed in section 2.2). All construction works will be carried out in approved standard working methods.

- **Geological Protection**

Permeability tests and intrusive investigations carried out on the naturally occurring glacial tills under the landfill have indicated that there is in excess of one metre of the till with a permeability co-efficient ranging between $1x10^{-7}$ - 10^{-9}.m/s (as detailed in section 2.2.7).

Permeability tests undertaken on the fly-ash itself in the existing cell indicated that once the ash is compacted it appears to "concrete" giving low permeability characteristics, ranging from 1×10^{-8} m/s to 7.7×10^{-9} m/s.

The permeability characteristics of the underlying subsurface and the "concreted" ash itself will act as a barrier to prevent the infilration of any leachate generated into the subsurface soils and thus eliminate the potential for groundwater contamination.

Restoration of the site (final capping and landscaping) will entail the usage of excavated material from the development of the cells (in accordance with good engineering practice). Thus the overall impact of backfilling and landscaping of excavated indigenous subsoil on completion of the development is expected to be negligible.

3.3.6 Mitigation Measures

There are no significant impacts on the underlying subsoil and bedrock geology and as such there are no mitigation measures required.

3.4 HYDROLOGY

The proposed development is for a change in the composition and quantities of the waste ash accepted at the facility, from ash generated from a peat fuel power station to ash generated from the co-fuelling power station of peat with biomass and/or MBM. There will be no significant changes to the existing infrastructure and operational procedures at the facility.

Desk-based information on the hydrology conditions was obtained through a review of the Environmental Protection Agency records, assessments carried out as part of the initial EIS (April 1998) and on-going compliance monitoring reports for the waste licence (49-1) as outlined below.

3.4.1 INTRODUCTION

The study area is located within Hydrometric Area No. 14, the River Barrow catchment. The River Figile, a tributary of the River Barrow, flows adjacent to the eastern boundary of the site. A stream which flows adjacent to the southern boundary of the site receives the drainage water from the site and flows into the River Figile at the south-eastern corner of the site.

The River Figile source is within a peatland area and flows through predominantly peatland areas, with some isolated areas of forestry.

3.4.2 EXISTING HYDROLOGY & DRAINAGE PATTERN

There is no major surface water body on the site. Constructed surface water drains are located throughout the site and flow in a south easterly direction, towards the stream that flows adjacent to the southern boundary of the site (see drawing No.2401057-6: Environmental Monitoring & Sampling Locations and figure 3.4/1).

The River Figile is located on the eastern perimeter of the site and flows in a southerly direction. The river and the areas that it drains are part of the hydrometric Area 14, namely the River Barrow catchment. The River Figile flows about 40 km from its source in the peatland of Lullymore to its confluence

with the River Barrow, located north of Monasterevin. Upstream of the site, the River Figile flows in the topographically flat region of the Bog of Allen.

From its source, the river flows in a predominantly westerly direction. Approximately 3-km upstream of the site the river turns and flows in a southerly direction. The land usage upstream of the site is primarily peatland, with some isolated areas of forestry.

Three tributaries, the Black River, Crabtree River and the Cushaling River, contribute to the headwaters of the River Figile. All of these tributaries are sourced within peatland areas.

The River Figile is a tributary of the River Barrow, which is an important salmon and brown trout fishery resource, in addition to being a high amenity area.

3.4.3 SURFACE WATER QUALITY

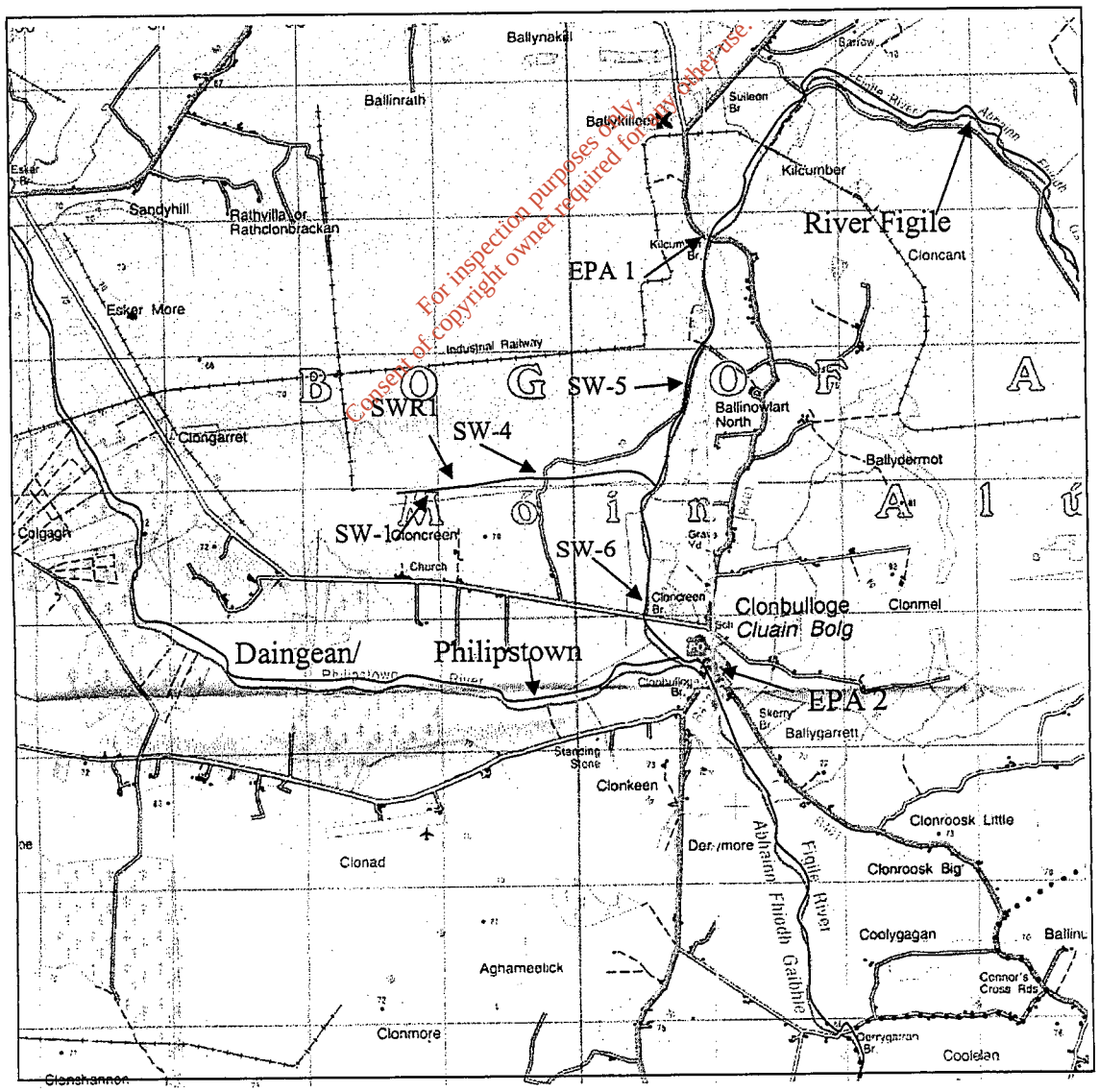
In order to assess the existing nature and quality of surface waters in the vicinity of the site, historical and baseline data was reviewed. As part of Schedule F.3 of the current waste licence (Ref. No. 49-1), Clonbullogue Ash Repository is required to monitor surface waters at six locations (namely SW-1, SW-4, SW-5, SW-6, SWR-1, and SWR-2) In addition data on the water quality upstream, and downstream of the site available from the national river quality survey operated by the Environmental Protection Agency (EPA) was also reviewed. Figure 3.4/1 illustrates the sampling locations.

(1) On-Going Surface Water Monitoring

Surface water were analysed as part of their Waste Licence (Ref. No. 49-1), as per Schedule F, Table F.3.6. A total of four surface water samples and two surface water run-off are analysed (see Table 3.4/1). Surface water samples were collected using International Standard ISO 5667-6 Part 6: Guidance on sampling of rivers and streams and were submitted for laboratory chemical analysis.

TABLE 3.4/1: Location of Surface Water Sampling Points		
Station	**Location**	**Justification**
SW-1	West-East Drain upstream of Ash Disposal Area	To determine the quality of water in West-East Drain prior to discharges from Disposal Area
SW-4	West-East Drain downstream of Leachate Lagoon/Leachate Treatment Plant	To determine the quality of water in West-East Drain post discharges from Disposal Area
SW-5	Figile River upstream of confluence with West-East Drain	To determine the quality of water in River Figile prior to discharges from Ash Repository
SW-6	Figile River Downstream of confluence with West-East Drain	To determine the quality of water in River Figile post discharges from Ash Repository
SWR-1	Clean surface water run-off from the Ash Disposal Area discharge point	To determine the quality of water immediately downstream of the discharge from leachate lagoon
SWR-2	Clean surface water run-off from the Ash Disposal Area discharge point	To determine the quality of water immediately downstream of the discharge from leachate lagoon

Figure 3.4/1: Hydrological Pattern of the Study Area



Note: EPA 1: EPA monitoring station ID 4053 (Kilcumber Bridge)
EPA 2: EPA monitoring station ID 4055 (Bridge in Clonbullogue)
EPA 3: EPA monitoring station ID 0600 (1 km u/s Figile River confl)

These locations are sampled on a quarterly basis for a number of parameters and annually for a full set of parameters (see Table 3.4/2). The results of the analysis are given in Table 3.4/3–3.4/8.

Table 3.4/2: Monitoring frequency for chemical analysis of Surface water

Parameter	Frequency
pH (pH units)	Q
Conductivity (µS/cm)	Q
Temperature (°C)	Q
Ammonia (mg/l)	Q
COD (mg/l)	Q
Dissolved Oxygen (mg/l)	Q
Total Suspended Solids (mg/l)	Q
Phosphate as P (mg/l)	A
Total Oxidised Nitrogen (mg/l)	A
Cadmium (µg/l)	A
Copper (µg/l)	A
Iron (mg/l)	A
Lead (µg/l)	A
Manganese (µg/l)	A
Zinc (µg/l)	A

Q = Quarterly; A = Annually

TABLE 3.4/3: Chemical Analysis of Surface Water, SW-1
(table continues overleaf)

Parameter	2001				2002			
	Mar	May	Aug	Dec	Jan	Apr	July	Nov
Ammonia (mg/l)	0.4	<0.2	0.2	<0.2	0.39	0.25	No Sample Taken in July 2002	0.51
Chemical Oxygen Demand (mg/l)	58	65	84	66	66	79		235
Conductivity (µS/cm)	489	479	771	650	442	736		395
pH (pH units)	7.84	7.8	7.3	7.2	7.6	7.3		7.5
Total Suspended Solids (mg/l)	6	14	22	8	8	60		1216
Cadmium (µg/l)	-	-	<2	<2	<2	-		-
Copper (µg/l)	-	-	5	3	24	-		-
Iron (mg/l)	-	-	1.9	1.3	0.7	-		-
Lead (µg/l)	-	-	<2	<2	<2	-		-
Manganese (µg/l)	-	-	220	180	92	-		-
Phosphate (mg/l)	-	-	<0.16	<0.16	<0.16	-		-
Total Phosphorous (mg/l)	-	-	-	0.11	-	-		-
Total Oxidised Nitrogen (mg/l)	-	-	0.28	2.1	1.6	-		-
Zinc (µg/l)	-	-	<2	13	12	-		-
Dissolved Oxygen (mg/l)	6.51	9.79	6.14	6.30	-	-		7.12
Visual/Odour	Yellow tint, No odour	Yellow tint, No odour	Yellow tint, No odour	Yellow tint, No odour	Yellow tint, No odour	Yellow tint, No odour		Silty, No odour

TABLE 3.4/3: Chemical Analysis of Surface Water, SW-1 condt.

Parameter	2003				2004			
	Feb	May	July	Oct	Feb	May	Aug	Nov
Ammonia (mg/l)	0.87	0.29	0.15	0.34	0.45	0.02	0.05	0.19
Chemical Oxygen Demand (mg/l)	62	138	59	39	55	45	<10	82
Conductivity (µS/cm)	469	589	594	840	753	661	651	535
pH (pH units)	7.4	7.6	7.33	7.59	7.36	7.45	7.52	7.36
Total Suspended Solids (mg/l)	5	604	5	7	5	6	18	20
Cadmium (µg/l)	-	<2	-	-	-	-	<2	-
Copper (µg/l)	-	14	-	-	-	-	<2	-
Iron (mg/l)	-	30	-	-	-	-	1.8	-
Lead (µg/l)	-	49	-	-	-	-	<2	-
Manganese (µg/l)	-	1611	-	-	-	-	10	-
Phosphate (mg/l)	-	<0.16	-	-	-	-	<0.02	-
Total Oxidised Nitrogen (mg/l)	-	0.29	-	-	-	-	-	-
Zinc (µg/l)	-	84	-	-	-	-	<2	-
Dissolved Oxygen (mg/l)	9.94	8.91	7.9	5.5	5.6	3.9	5.58	5.33
Visual/Odour	Yellow hue,little SS, no odour	Clear,SS, clay odour	Slightly dull, no SS, no odour	Slightly yellow, no odour	Clear, no odour	Clear, stale odour	Stagnant	Dull, High Water

TABLE 3.4/4: Chemical & Bacteriological Analysis of Surface Water, SW-4
(table continues overleaf)

Parameter	2001				2002			
	Mar	May	Aug	Dec	Jan	Apr	July	Nov
Ammonia (mg/l)	0.3	<0.2	0.8	<0.2	1.28	<0.25	No Sample Taken in July 2002	0.89
Chemical Oxygen Demand (mg/l)	46	117	84	235	40	44		67
Conductivity (µS/cm)	571	679	699	589	700	668		439
pH (pH units)	7.57	7.7	7.3	6.6	7.5	7.5		7.3
Total Suspended Solids (mg/l)	6	15	85	316	18	11		12
Cadmium (µg/l)	-	-	<2	<2	<2	-		-
Copper (µg/l)	-	-	7	<2	<2	-		-
Iron (mg/l)	-	-	6.1	4.3	3.9	-		-
Lead (µg/l)	-	-	<2	7	<2	-		-
Manganese (µg/l)	-	-	846	5050	3216	-		-
Phosphate (mg/l)	-	-	<0.16	<0.16	<0.16	-		-
Total Phosphorous (mg/l)	-	-	-	0.06	-	-		-
Total Oxidised Nitrogen (mg/l)	-	-	0.24	2.6	1.4	-		-
Zinc (µg/l)	-	-	12	6	<2	-		-
Dissolved Oxygen (mg/l)	5.88	7.76	4.15	4.00	-	-		8.46
Visual/Odour	Yellow tint, No odour	Yellow tint, No odour	Grey tint, No odour	Grey tint, No odour	-	-		-

TABLE 3.4/4: Chemical & Bacteriological Analysis of Surface Water, SW-4 Condt.

Parameter	2003				2004			
	Feb	May	July	Oct	Feb	May	Aug	Nov
Ammonia (mg/l)	0.78	0.23	0.37	0.31	1.45	0.14	0.24	0.26
Chemical Oxygen Demand (mg/l)	42	51	57	29	45	39	20	52
Conductivity (µS/cm)	600	301	560	736	921	584	558	575
pH (pH units)	7.6	7.7	7.66	7.63	7.75	7.69	7.64	7.68
Total Suspended Solids (mg/l)	5	55	22	5	5	5	<5	22
Cadmium (µg/l)	-	<2	-	-	-	-	-	-
Copper (µg/l)	-	<2	-	-	-	-	-	-
Iron (mg/l)	-	4.8	-	-	-	-	-	-
Lead (µg/l)	-	2	-	-	-	-	-	-
Manganese (µg/l)	-	428	-	-	-	-	-	-
Phosphate (mg/l)	-	<0.16	-	-	-	-	-	-
Total Oxidised Nitrogen (mg/l)	-	0.86	-	-	-	-	-	-
Zinc (µg/l)	-	13	-	-	-	-	-	-
Dissolved Oxygen (mg/l)	8.71	8.51	3.51	3.95	8.6	6.93	5.4	4.97
Visual/Odour	Yellow hue,little SS, no odour	Dull,SS, clay odour	Coloured	Clear, no ss, no odour	Clear, no odour	Clear, stale odour	Stagnant	Dull, High Water

TABLE 3.4/5: Chemical & Bacteriological Analysis of Surface Water, SW-5

(table continues overleaf)

Parameter	2001			2002			
	May	Aug	Dec	Jan	Apr	July	Nov
Ammonia (mg/l)	1.1	<0.2	0.5	0.5	0.64	0.38	0.25
Chemical Oxygen Demand (mg/l)	53	85	70	59	71	51	79
Conductivity (µS/cm)	665	521	495	479	420	586	375
pH (pH units)	8.1	7.5	7.9	8.2	8.1	8.3	7.6
Total Suspended Solids (mg/l)	18	101	<5	<5	20	6	7
Cadmium (µg/l)	-	<2	<2	<2	-	-	-
Copper (µg/l)	-	2	7	<2	-	-	-
Iron (mg/l)	-	2.5	1	0.7	-	-	-
Lead (µg/l)	-	<2	<2	<2	-	-	-
Manganese (µg/l)	-	312	87	57	-	-	-
Phosphate (mg/l)	-	<0.16	<0.16	<0.16	-	-	-
Total Phosphorous (mg/l)	-	-	0.07		-	-	-
Total Oxidised Nitrogen (mg/l)	-	0.18	2.3	2.48	-	-	-
Zinc (µg/l)	-	8	24	<2	-	-	-
Dissolved Oxygen (mg/l)	8.27	8.9	7.2	7.7	9.8	10.54	9.61
Visual/Odour	Yellow tint, no odour	Yellow tint, high SS, no odour	Yellow tint, little SS, no odour	Yellow tint, low SS, no odour	Dark br., High SS, no odour	Brown, some SS, No odour	Clear some SS, No odour

TABLE 3.4/5: Chemical & Bacteriological Analysis of Surface Water, SW-5 Condt.

Parameter	2003				2004			
	Feb	May	July	Oct	Feb	May	Aug	Nov
Ammonia (mg/l)	0.52	0.45	0.19	0.38	0.54	0.26	0.25	0.18
Chemical Oxygen Demand (mg/l)	54	45	88	34	43	50	54	61
Conductivity (µS/cm)	533	295	468	609	609	541	450	325
pH (pH units)	7.7	8	8.22	8.14	8.39	8.06	7.9	8.02
Total Suspended Solids (mg/l)	6	21	5	5	5	5	<5	12
Cadmium (µg/l)	-	<2	-	-	-	-	<2	-
Copper (µg/l)	-	3	-	-	-	-	<2	-
Iron (mg/l)	-	1.8	-	-	-	-	0.9	-
Lead (µg/l)	-	<2	-	-	-	-	<2	-
Manganese (µg/l)	-	118	-	-	-	-	6	-
Phosphate (mg/l)	-	<0.16	-	-	-	-	<0.02	-
Total Oxidised Nitrogen (mg/l)	-	1.59	-	-	-	-	1.12	-
Zinc (µg/l)	-	7	-	-	-	-	150	-
Dissolved Oxygen (mg/l)	9.98	9.29	7.49	5.74	9.76	8.5	4.2	7.59
Visual/Odour	Yellow hue,foam present, no odour	Yellow hue,some SS, no odour	Slightly Dull, stale odour	Clear, no odour.	Clear, no odour.	Clear, no odour.	Clear, no odour.	Clear, no odour.

TABLE 3.4/6: Chemical & Bacteriological Analysis of Surface Water, SW-6
(table continues overleaf)

Parameter	2001				2002			
	Mar	May	Aug	Dec	Jan	Apr	July	Nov
Ammonia (mg/l)	0.2	0.2	2.56	0.5	2.0	0.77	<0.25	0.25
Chemical Oxygen Demand (mg/l)	52	52	69	69	48	70	46	83
Conductivity (µS/cm)	662	662	564	493	564	424	597	396
pH (pH units)	8.1	8.1	8.2	7.8	8.2	8	8.2	7.5
Total Suspended Solids (mg/l)	<5	<5	<5	<5	<5	18	<5	<5
Cadmium (µg/l)	-	-	<2	<2	-	-	-	-
Copper (µg/l)	-	-	<2	<2	-	-	-	-
Iron (mg/l)	-	-	1	<0.1	-	-	-	-
Lead (µg/l)	-	-	<2	<2	-	-	-	-
Manganese (µg/l)	-	-	94	5	-	-	-	-
Phosphate (mg/l)	-	-	<0.16	<0.16	-	-	-	-
Total Phosphorous (mg/l)	-	-	-	0.11	-	-	-	-
Total Oxidised Nitrogen (mg/l)	-	-	2.1	2.5	-	-	-	-
Zinc (µg/l)	-	-	<2	<2	-	-	-	-
Dissolved Oxygen (mg/l)	-	-	6.5	6.81	8	10	10.99	8.64
Visual/Odour	-	-	Yellow tint, No odour	Yellow tint, No odour	Yellow tint, No odour	Low SS no odour	Brown SS no odour	Clear some ss, No odour

TABLE 3.4/6: Chemical & Bacteriological Analysis of Surface Water, SW-6 Condt

Parameter	2003				2004			
	Feb	May	July	Oct	Feb	May	Aug	Nov
Ammonia (mg/l)	0.52	0.33	0.17	0.17	0.44	0.16	0.11	0.17
Chemical Oxygen Demand (mg/l)	49	71	87	32	28	46	45	52
Conductivity (µS/cm)	533	527	394	843	610	557	779	330
pH (pH units)	7.9	8.1	7.78	7.99	8.18	8.11	7.7	8.2
Total Suspended Solids (mg/l)	5	5	5	5	5	5	5	5
Cadmium (µg/l)	-	<2	-	-	-	-	<2	-
Copper (µg/l)	-	3	-	-	-	-	<2	-
Iron (mg/l)	-	1.8	-	-	-	-	0.8	-
Lead (µg/l)	-	<2	-	-	-	-	<2	-
Manganese (µg/l)	-	118	-	-	-	-	6	-
Phosphate (mg/l)	-	<0.16	-	-	-	-	<0.02	-
Total Phosphorous (mg/l)	-	-	-	-	-	-	<2	-
Total Oxidised Nitrogen (mg/l)	-	1.6	-	-	-	-	1.35	-
Zinc (µg/l)	-	7	-	-	-	-	<2	-
Dissolved Oxygen (mg/l)	8.78	9.01	9.42	4.86	9.95	6.18	3.4	5.8
Visual/Odour	Yellow hue,foam present, no odour	Dull, some SS, no odour	Slightly Dull, stale odour	Clear, no odour.	Clear, no odour.	Clear, no odour.	Clear, no odour.	Clear, no odour.

TABLE 3.4/7: Chemical & Bacteriological Analysis of Surface Water, SWR-1
(table continues overleaf)

Parameter	2001				2002			
	Mar	May	Aug	Dec	Jan	Apr	July	Nov
Ammonia (mg/l)	1.5	<0.2	<0.2	1.6	0.6	1.2	1.02	0.76
Chemical Oxygen Demand (mg/l)	32	40	33	35	42	32	40	51
Conductivity (µS/cm)	488	490	329	501	500	485	618	398
pH (pH units)	7.7	7.9	8.2	7.6	7.8	8.2	8	7.3
Total Suspended Solids (mg/l)	<5	<5	6	<5	<5	84	8	<5
Cadmium (µg/l)	-	-	<2	<2	<2	-	-	-
Copper (µg/l)	-	-	2	3	<2	-	-	-
Iron (mg/l)	-	-	0.4	1.4	1.4	-	-	-
Lead (µg/l)	-	-	<2	<2	<2	-	-	-
Manganese (µg/l)	-	-	29	158	97	-	-	-
Phosphate (mg/l)	-	-	<0.16	<0.16	<0.16	-	-	-
Total Phosphorous (mg/l)	-	-		<0.05	-	-	-	-
Total Oxidised Nitrogen (mg/l)	-	-	<0.04	1.2	1.4	-	-	-
Zinc (µg/l)	-	-	21	5	<2	-	-	-
Dissolved Oxygen (mg/l)	5.49	-	11.6	-	7.7	11.0	11.93	-
Visual/Odour	Yellow tint no odour	Yellow tint, no odour	Yellow tint, low SS, no odour	Yellow tint, low SS, no odour	Yellow tint, no odour	Yellow tint, low SS, no odour	Brown, some SS, no odour	-

TABLE 3.4/7: Chemical & Bacteriological Analysis of Surface Water, SWR-1 condt.

Parameter	2003				2004			
	Feb	May	July	Oct	Mar	May	Aug	Dec
Ammonia (mg/l)	1.57	0.04	0.6	0.42	2.72	0.74	0.06	0.35
Chemical Oxygen Demand (mg/l)	29	18	54	31	36	41	28	31
Conductivity (µS/cm)	515	486	792	575	732	523	522	375
pH (pH units)	7.4	7.6	7.79	8.1	7.91	7.14	7.71	7.41
Total Suspended Solids (mg/l)	5	5	6	5	5	9	<5	8
Cadmium (µg/l)	-	<2	-	-	-	-	<2	-
Copper (µg/l)	-	<2	-	-	-	-	<2	-
Iron (mg/l)	-	1.4	-	-	-	-	1	-
Lead (µg/l)	-	<2	-	-	-	-	<2	-
Manganese (µg/l)	-	90	-	-	-	-	30	-
Phosphate (mg/l)	-	<0.16	-	-	-	-	<0.02	-
Total Phosphorous (mg/l)	-	-	-	-	-	-		-
Total Oxidised Nitrogen (mg/l)	-	0.53	-	-	-	-	<0.2	-
Zinc (µg/l)	-	<2	-	-	-	-	8	-
Dissolved Oxygen (mg/l)	-		9.4	7.69	10.54	6.48	8.36	7.85
Visual/Odour	Yellow hue, little SS, no odour	Clear, little SS, no odour	Slightly dull, no odour	Clear, very low flow	Clear, very low flow, no odour	Clear, stale odour	Clear, no odour	Clear, increased flow

TABLE 3.4/8: Chemical & Bacteriological Analysis of Surface Water, SWR-2

Parameter	2002		2003			2005			
	Apr	Nov	Feb	May	July	Feb	May	Aug	Nov
Ammonia (mg/l)	1.8	1	2.36	0.23	0.18	0.8	0.14	0.04	0.29
Chemical Oxygen Demand (mg/l)	74	61	46	75	102	76	85		72
Conductivity (µS/cm)	236	158	226	298	279	367	342	346	286
pH (pH units)	7.8	7.4	7.5	7.9	7.56	7.5	8.08	8.32	7.5
Total Suspended Solids (mg/l)	8	<5	5	6	5	5	5	5	6
Cadmium (µg/l)	-	-	-	<2	-	-	-	<2	-
Copper (µg/l)	-	-	-	<2	-	-	-	<2	-
Iron (mg/l)	-	-		0.9	-	-	-	0.5	-
Lead (µg/l)	-	-		<2	-	-	-	<2	-
Manganese (µg/l)	-	-	-	52	-	-	-	25	-
Phosphate (mg/l)	-	-	-	<0.16	-	-	-	<0.02	-
Total Phosphorous (mg/l)	-	-	-	-	-	-	-		-
Total Oxidised Nitrogen (mg/l)	-	-	-	-	-	-	-	<0.2	-
Zinc (µg/l)	-	-	-	4	-	-	-	<2	-
Dissolved Oxygen (mg/l)	-	-	-	-	9.47	10.98	7.67	8.62	6.3
Visual/Odour	Yellow tint Low SS	Yellow, some SS, no odour	-	-	-	Clear, low flow	Yellow, stale odour	Clear, low flow	Yellow, no odour

(2) EPA On-Going Monitoring

In addition to the above results, historic Physico-chemical data was obtained from the Environmental Protection Agency (EPA). As part of the national river survey the EPA monitor the rivers of Ireland at a number of locations for chemical and biological characteristics. On the section of the River Figile that flows in the vicinity of the site there are two monitoring stations, one upstream, namely Kilcumber Bridge ("EPA 1" Station ID 0200) and one downstream, namely bridge in Clonbullogue; ("EPA 2" station ID 0300) (refer to Figure 3.4/1 for locations). On the Daingean/philpstown River there is one monitoring station located 1 km upstream of the confluence with the River Figile ("EPA 3" station ID: 0600)

On the River Figile chemical data obtained between 1995 and 1997 can be found in Table 3.4/9 for both locations. There is no chemical data for the River Daingean.

Table 3.4/9 EPA Chemical Analysis Results
Median Concentrations obtained from samples taken bewteen 1/01/95 – 31/12/97

Monitoring Location	pH (pH Units)	Oxidised Nitrogen (mg/l)	BOD_5 (mg/l)	Ammonia (mg/l)	Temperature (°C)
Kilcumber Bridge	8.1	0.7	2.3	0.22	16
Bridge in Clonbullogue	8.1	0.5	2.5	0.39	16

Data sourced from the EPA website (www.epa.ie), can also be obtained from relevant publications

The EPA also undertakes biological surveys at both locations, the results of which can be found in Table 3.4/10 and 3.4/11overleaf. The EPA utilises the Q-rating system, which rates the aquatic organisms found at each location depending on their sensitivity to pollution. A rating of between 1 (heavily polluted) to 5 (unpolluted) is provided for each EPA monitoring location.

Table 3.4/10 EPA Q Ratings assigned to the River Figile adjacent to site			
Year	**Kilcumber Bridge**	**Year**	**Bridge at Clonbullogue**
1986	3-4	1975	3-4
1989	3	1976	4
1993	3-4	1979	4
1997	3	1986	4
2000	3-4	1989	4
		1997	3-4
		2000	4-5

Data sourced from the EPA website (www.epa.ie), can also be obtained from relevant publications

Table 3.4/11 EPA Q ratings assigned to the River Daingean	
Year	**Upstream of River Figile Confl.**
1984	3
1986	3-4
2000	4

3.4.4 INTERPRETATION OF RESULTS

(1) Surface water discharged from the site

Clonbullogue Ash Repository contains a number of surface water drains that were purpose built to allow the collection of surface water from the site to be discharged into the West-East drain that forms part of the southern boundary of the facility. This drain is monitored on a quarterly basis for general wet chemistry and anionic parameters and on an annual basis for additional metal parameters (see Table 2.2/2). There are two monitoring locations on the West-East drain (namely SW-1 and SW-4) and two monitoring locations on the run-off into the West-East drain (namely SWR-1 and SWR-2).

The run-off from the site, flows in a south western direction, and ultimately discharges into the West-East drain, The chemical analysis of this location indicates that the water quality is deemed to be satisfactory with no impact on the operation of the ash repository site on the background surface water quality.

(1) Surface Run-off From the Peatland Area

SWR-1

The quality of the run-off from the site at SWR-1 is of moderate quality with slightly elevated levels of ammonia, which would be expected in the peatland surrounds. pH levels indicated reasonably neutral waters with the pH ranging from 7.3 to 8.8. Conductivity levels are generally low ranging from 329 to 792 µS/cm. Chemical Oxygen Demand (COD) levels ranged from 18 – 54 mg/l. As previously noted the ammonia levels were recorded slightly elevated during a number of monitoring periods with levels recorded up to 2.72 mg/l. Suspended solids levels within the run-off has been low with levels recorded generally below 9 mg/l. The annual monitoring events have indicated that there are no levels of phosphates within the run-off. The metal content in the water is low with no levels of cadmium or lead detected and only trace levels of copper. Concentrations of iron and to some extent manganese were present in slightly higher concentrations.

SWR-2

As with SWR-1 the quality of the run-off water at SWR-2 is moderate with the exception of ammonia which is naturally higher in peatland run-offs. pH levels are close be neutral and conductivity levels are low (range: 158 to 367 µS/cm). Suspended solids where detected were below 8mg/l, while COD levels were

slightly higher than that recorded at SWR-1 (range: 46-102 mg/l). There were no levels of cadmium, copper, or lead detected in the samples while slightly higher levels of iron and manganese were detected.

(2) Surface Monitoring Monitoring

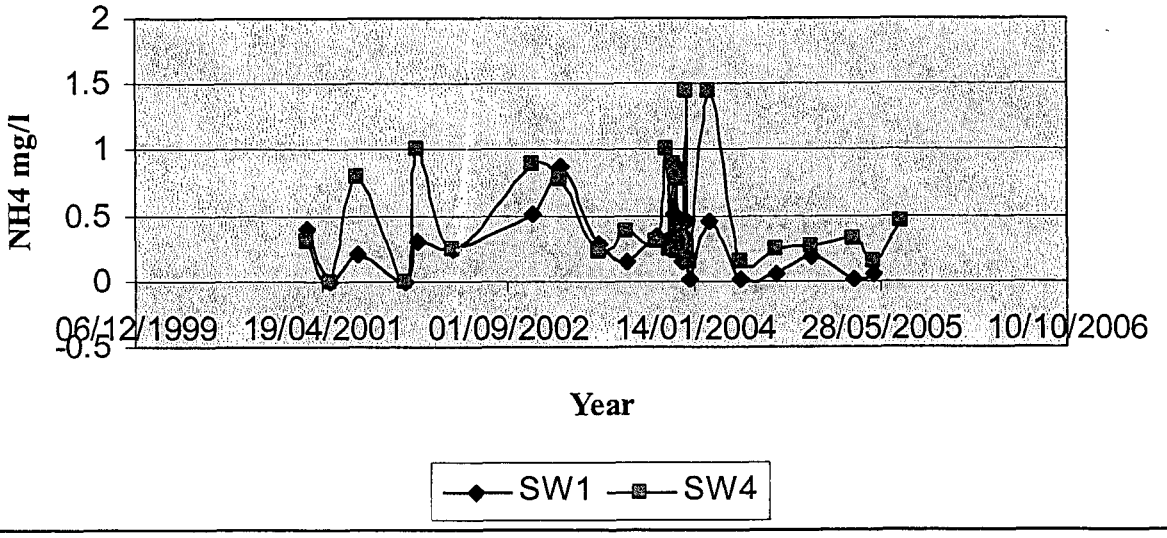
SW 1

pH levels have ranged from 7.2 to 7.8, and conductivity 395 to 840 S/cm. Ammonia levels are generally low with levels ranging between <0.2 mg/l to the highest levels recorded at 0.87 mg/l in February 2003 (see Graph 3.4/1 below). Suspended solids levels have been recorded at levels between8 mg/l to a highest level recorded at 1216 mg/l at November. COD levels where detected have ranged from 39 mg/l to 235 mg/l in November 2002. The annual monitoring have shown no levels of phosphates at a concentration above the detection limit. Of the metal parameters there were no levels of cadmium detected and only low levels of copper (<24 g/l), lead (<19 g/l), and zinc (<84 g/l). Slightly higher levels of iron and manganese concentrations were recorded however higher levels of these parameters are naturally occurring in surface waters.

SW4

pH levels at SW4 ranged from 6.6 to 7.7 while conductivity levels ranged from 301 to 921. Ammonia levels are generally slightly higher at SW4 than SW1 (see graph 3.4/1), with levels ranging between <0.2 to 1.45mg/l in February 2004 (average ammonia levels at SW1: 0.28 mg/l compared to SW4: 0.49 mg/l). Suspended solids tend to be slightly lower than SW1 with levels, were detected ranging from 5 to 316 mg/l. As with SW1 there were no levels of cadmium or phosphates detected in the samples taken. There were low levels of copper (<7), lead (<7), and zinc (<13) while higher levels of iron and manganese were recorded at maximum concentrations of 6.1 mg/l and 5.05 mg/l respectively.

Graph 3.4/1: Ammonia Levels at SW1 and SW4



(3) Surface water quality of the River Figile flowing adjacent to the site.

The River Figile is monitored at the same frequency and for the same parameters as the other surface water locations. It is monitored upstream of the discharge from the site, namely SW-5 and downstream of the discharge from the site, namely SW-6. The chemical results from these monitoring locations are discussed below in conjunction with the chemical and biological results obtained from the EPA.

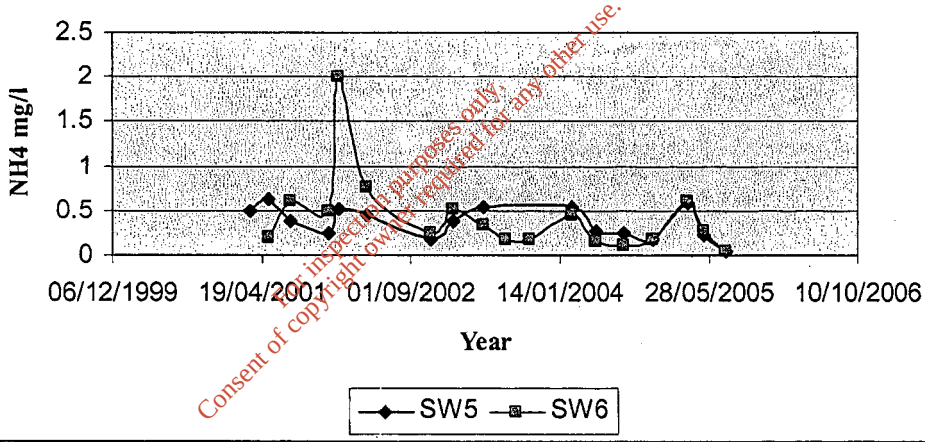
SW5

The results of monitoring quality of the River Figile upstream indicates waters are moderately/slightly polluted. pH levels indicate a relatively netrual waters, and conductivity levels are that of expected from surface waters (range: 295 to 609 µS/cm). COD levels ranged from 34 – 88 mg/l. Ammonia levels in the River Figile at this location are slightly elevated with an average level of 0.37.mg/l. (see graph 3.4/2) Suspended solids were generally low (<21 mg/l) however a elevated level of 101mg/l was recorded in August 2001. There were no levels of phosphates recorded in the any of the sampling events. Levels of the metals analysed for are generally low, with no levels of cadmium and lead recorded and only trace levels of copper (<10 µg/l). While zinc levels are generally recorded as low (<24 µg/l) an elevated level (150 µg/l) was recorded in August 2004.

SW6

The surface water monitoring station SW6 is located downstream of both the facility and the confluence of the Figile with the River Daingean. The pH, conductivity (330 – 843 µS/cm), and COD (28 – 87mg/l) levels are similar to that of monitoring location SW5. Ammonia levels are were also recorded at similar concentrations to SW5 (see graph). Levels of ammonia ranged from <0.25mg/l to 2.56 mg/l in August 2001 (average concentration: 0.43 mg/l). Suspended solids in the surface water are low with levels lying below 18 mg/l. There were no levels of phosphates detected in any of the samples taken. As with SW5, the levels of metals recorded are low with no levels of cadmium, copper or lead detected in the samples and generally low levels of iron and manganese detected indicating the dilution of the peatland waters in the surface water body.

Graph 3.4/2: Ammonia Levels at SW5 & SW6



3.4.5 SURFACE WATER FLOW RATES

Hydrometric data was obtained through the Environmental Protection Agency. There is a one monitoring station located on the River Figile for which data is available. It should be noted that the hydrometric data available is taken as spot measurements and such as the information has limited value. The station is located downstream from the discharge point from the site, at Clonbullogue (station No. 14004)

The catchment area for the River Figile at this location is 268 km^2. There is an estimated dry weather flow of 0.17 and a 95 percentile flow of 0.35 m^3/s. (Data obtained from the EPA website).

3.4.6 ENVIRONMENTAL IMPACTS

The nature of the proposed development is a change in the composition and quantities of the waste types accepted at the facility. There are no significant changes to any infrastructural or operation aspects of the currently facility on site.

Environmental monitoring of the surface waters adjoining the facility has indicated that the facility has not had any negative impacts since operations and monitoring commenced in 2001.

The operational procedures at the facility (refer to section ??) will be maintained at the facility and as such the there will be no discharge to surface water of any potential contaminated waters from the site.

The environmental impacts associated with the proposed developments at Clonbullogue Ash Repository on the local surface water regime are considered over the full lifetime of the project i.e. Construction Phase, Operation Phase, and Aftercare Management.

(1) Construction Phase.

The only on-site construction proposed for the existing facility will be the construction of new disposal cells. This construction could result in the exposure and potential mobilisation of peat particles. This peat stockpiles could be discharge into the West-East drain through one of the many on site drainage channels within the site. This could increase the level of suspended solids in the drain as well as deposited material on the substratum of the drain and ultimately the River Figile. Increased peat particles in the drain can effect the chemical and biological quality of the drain, and the River Figile.

(2) Operation Phase

Generation of leachate is the only identified event that may potentially impact on surface water in the area. As part of the EPA waste licence application DIN-leachability tests (DIN 38414-S4: Sludge and sediments – determination of leachability by water) and eco-toxicity tests were undertaken on the fly-ash material. The results are given in attachment 05.

As part the EPA Waste Licence (49-1) samples are taken from the leachate sump L1. This location is sampled on a quarterly bases for a number of parameters and annually for a full set of parameters.

The following observations on the quality of the leachate generated from the site are made:

- The DIN-Leachability test results, on which indicate that the potential leachate has high pH, high conductivity levels, and high calcium content;

- On-going monitoring on of the leachate generated at the site and collected at L1 show high pH and conductivity levels.

In conclusion, it has been observed that with the exception of elevated pH, the leachate produced at the facility are considered environmentally benign.

There will be no handling or storage of potential contaminating material such as fuels, lubricants and hydraulic fluids on-site. Any maintenance/ refuelling of vehicles will take place off-site thus preventing any uncontrolled discharges on the receiving environment.

3.4.7 MITIGATION MEASURES

(1) Construction of new cells.

During the construction of the new disposal cells, 'good engineering practices' will be adhered to. It is anticipated that any excavated stockpiled material shall be kept away from the surface water drains throughout the site, and shall be made secure during the operational phase. Any uncontaminated storm water runoff from the construction area, will be diverted to the surface water drains, and ultimately disposed of to the West-East drain adjacent to the southern boundary of the site. The inputs from these activities can therefore be deemed to be insignificant.

(2) Generation of leachate

Because of the minimal quantities of leachate generated it is considered that the implications of the leachate results reported are negligible. However, in order to eliminate any adverse effects of the possible contaminant inputs to the surface water drainage network, it is proposed to initiate an on-site leachate diversion and containment programme. This will direct any leachate generated from an active cell into the existing leachate collection lagoon.

On completion of capping of a previously active disposal cell, the surface water interceptor ditches surrounding the cell will be diverted from the lagoon such that the innocuous surface water run-off flows directly into the west-east drainage ditch on the Southern end of the site, which in turn flows into the Figile River.

All surface water run-off from an active cell generated during a rainfall event and any leachate generated during operational and decommissioning phases of the ash disposal site will, therefore, be diverted to the leachate lagoon. In the event of the capacity of the lagoon being exceeded during periods of heavy rainfall it is considered that this will coincide with maximum flow in the receiving Figile River and that sufficient dilutions would be available in the River Figile.

3.5 HYDROGEOLOGY

Desk-based information on the hydrogeological conditions beneath the ash repository site was obtained through the Geological Survey of Ireland and intrusive investigations undertaken at the site as part of the initial EIS (April 1998) and on-going groundwater monitoring in compliances of the waste licence (49-1).

3.5.1 GROUNDWATER RECHARGE & MOVEMENT

(1) Quaternary Deposits

Based on the current understanding of water levels prevailing on the site, it is assumed that much of the waters currently above the 70 m OD contour are associated with the saturated peats. The groundwater flow direction within the overburden deposits is shown to flow in a south-easterly (see Drawing No. 2401057-7 Quaternary Piezometric Map).

Site boundaries are separated by drainage ditches oriented in a North - South direction. The Figile River is located East of the Site, and the Philipstown River is located South of the Site. Surface to groundwater (within the Quaternary deposits) interaction is likely to occur at receptive infiltration areas along bog ditches which flow from West to East within the site boundaries, and discharge to the Figile River. Groundwater within the Quaternary deposits may be predominantly influenced by surface hydrology of the peatland environment rather than regional net groundwater movement.

(2) Bedrock

Drawing No. 2401057-8 indicates that groundwater flow within the underlying bedrock is in a south-easterly direction.

3.5.2 GROUNDWATER LEVELS

Groundwater levels are taken from the 7 no. monitoring boreholes at the Ash Repository site as part of the on-going compliance monitoring for their Waste Licence 49-1. The levels taken in 2004 are given in Table 3.5/1 overleaf.

TABLE 3.5/1: Groundwater Levels at Clonreen Ash Repository Site

	2004 (m OD)											
	jan	feb	mar	apr	may	jun	jul	aug	sep	oct	nov	dec
MW05	66.54	66.68	66.53	66.73	66.68	66.38	66.58	66.68	66.58	66.68	66.88	66.78
MW06	68.41	68.36	68.26	68.21	68.11	68.11	68.01	68.11	68.11	68.21	68.41	68.36
MW07	67.26	66.91	66.81	66.66	66.66	66.31	66.26	66.41	66.41	66.61	67.26	67.06
MW08	69.11	68.86	68.66	68.61	68.41	68.01	67.91	68.26	68.26	68.41	69.26	68.96
MW09	66.56	67.31	67.01	67.01	66.76	66.51	66.31	66.16	66.66	67.01	67.71	67.46
MW10	68.19	68.14	68.04	67.99	67.94	67.94	67.84	67.64	67.94	68.04	68.24	68.19
MW11	66.26	65.91	65.76	65.71	65.81	65.61	65.61	65.61	65.61	65.76	66.41	66.06

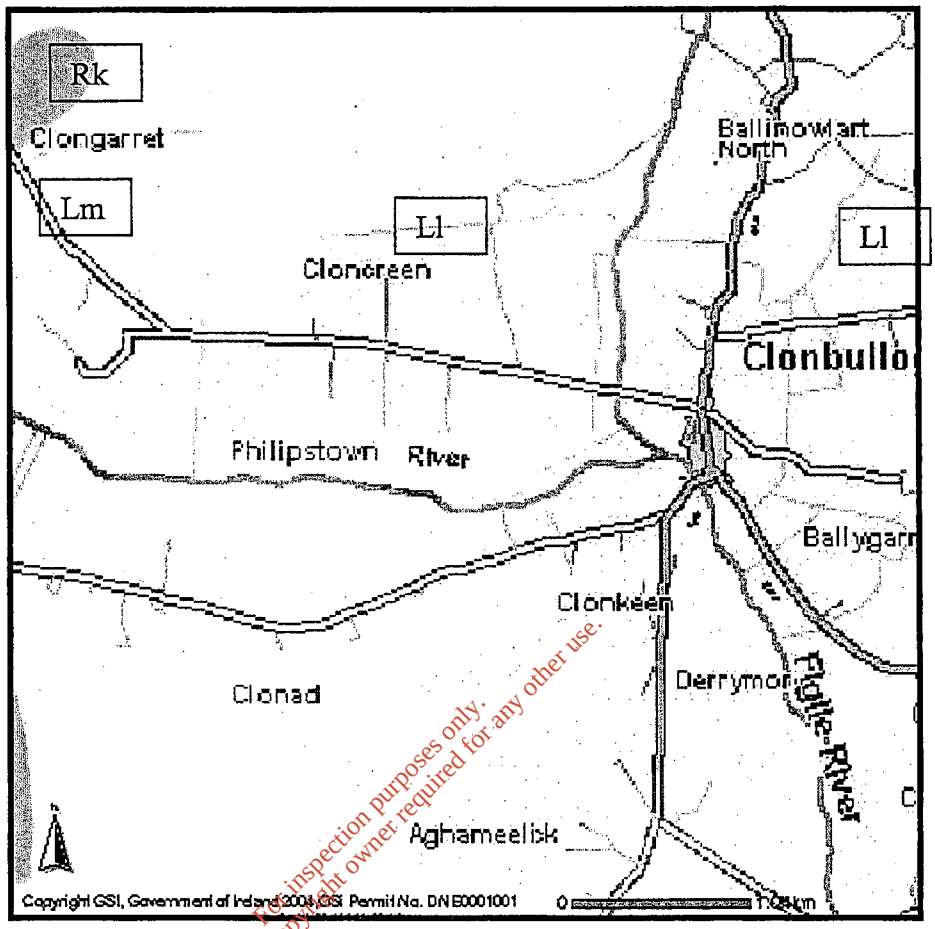
3.5.3 GROUNDWATER RESOURCES & AQUIFER CLASSIFICATION

Productive resources of the underlying bedrock were interpreted from GSI well records as being poor yielding wells capable of < 40m^3/day. The Clonbullogue supply appears to yield notably larger volumes of water in excess of 300 m^3/day as interpreted from GSI map files.

Geologic and hydrogeologic conditions for the site area can be described as a water bearing glacial till comprising of local varied hydrostratigraphic layers be which overlies a limestone bedrock unit with low porosity and permeability.

The groundwater resource protection code is based on the aquifer classification and the groundwater vulnerability rating. These indicate that the site is classified as **Lm/M-H**, a locally important moderately productive aquifer where groundwater is moderately to highly vulnerable (refer to figure 3.5/1).

Figure 3.5/1: Groundwater Aquifer Map



3.5.4 GROUNDWATER USAGE

Clonbullogue's public water supply source is located south east of the site within the village of Clonbullogue. This supply yields approximately 300 m^3 / day to serve a population of about 400 people.

Within the vicinity of the site eight private water well abstraction points have been identified. These are monitored on an annual basis (for conductivity & pH levels) as part of the conditions of the waste licence.

3.5.5 GROUNDWATER VULNERABILITY

Vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activity.

Using the criteria as established by the GSI and based on current assessment data the groundwater resources in the vicinity of the Site may be classified as Moderately to Highly **(M-H)** vulnerable. This is based on low permeability subsoil and a depth to bedrock ranging from known depths (from installation of bedrock boreholes) of 4.5m to 6 m.

3.5.6 GROUNDWATER QUALITY

In compliance with the Waste Licence (49-1), on-going monitoring of the groundwater monitoring boreholes at the ash repository site are undertaken. The analytical results for the 2001-2005 are given in Tables 3.5/2 – 3.5/11.

TABLE 3.5/2: Groundwater Monitoring Results for MW02 (Monthly Results)

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	pH pH units	7.8	8.2	7.2	7.62	7.62	7.64	7.56	8.00	7.46	7.61	7.60	7.9
	Conductivity (µS/cm)	541	534	631	571	524	509	403	493	430	456	453	563
	Temperature °C	8.3	9.1	9.3	8.7	10.9	9.8	11.1	12.3	12.5	12.0	11.0	10.3
	Ammonia N mg/l	5.0	5.4	1.6	7.8	3.7	4.6	4.3	9.5	5.0	5.0	5.8	5.1
	Oxidised Nitrogen mg/l			< 0.1		< 0.04			0.18			<0.04	<0.04
2002	pH pHunits	8.3	7.6	7.5	8.2	7.4	7.0						
	Conductivity (µS/cm)	547	673	657	517	486	494						
	Temperature °C	10.0	9.1	10.0	9.0	9.8	10.6						
	Ammonia N mg/l	21.8	5.5	5.1	7.7	5.6	5.4						
	Oxidised Nitrogen mg/l	<0.04			<0.04								
	Cadmium (µg/l)	<2	<2	<2									

TABLE 3.5/3: Groundwater Monitoring Results for MW02 (Annual Results)

		2001		2002		
	Parameter	Nov	Dec	Jan	Feb	Mar
	Cadmium (µg/l)	<2	<2	<2	<2	<2
	Dissolved Copper (µg/l)	<2	2	<2	<2	<2
	Fluoride (mg/l)	0.4	0.4	0.5	0.4	0.5
	Total Iron (mg/l)	0.1	0.2	0.1	0.1	0.2
	Total Lead (µg/l)	<2	<2	<2	<2	<2
	Total Manganese (µg/l)	211	236	166	166	170
	Orthophosphate (mg/l)	<0.16	<0.16	<0.16	<0.16	<0.16
	Total Zinc (µg/l)	78	75	42	42	28

TABLE 3.5/4: Groundwater Monitoring Results for MW03 (Quarterly Results)

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	pH pHunits	7.5	7.8	7.5	7.22	7.27	7.25	7.22	7.50	7.12	7.22	7.17	7.8
	Conductivity (µS/cm)	638	641	678	735	697	703	537	632	585	583	599	709
	Temperature °C	8.6	9.1	9.1	9.2	10.0	10.4	10.8	10.6	12.2	11.6	11.2	10.4
	Ammonia N mg/l	5.0	5.2	5.3	6.2	3.8	5.0	4.7	5.80	5.6	5.6	5.6	4.8
	Oxidised Nitrogen mg/l			< 0.1		< 0.04			0.10			0.06	0.1
2002	pH pH units	7.7	7.06	7.14	7.7	7.0	7.0						
	Conductivity (µS/cm)	693	693	883	751	696	724						
	Temperature °C	10.2	10.2	10.0	9.3	10.0	10.8						
	Ammonia N mg/l	6.7	5.5	5.0	12.8	5.7	5.5						
	Oxidised Nitrogen mg/l	<0.04			<0.04								

TABLE 3.5/5: Groundwater Monitoring Results for MW03 (Annual Results)

	2001			2002		
Parameter	Aug	Nov	Dec	Jan	Feb	Mar
Cadmium (µg/l)	<2	<2	<2	<2	<2	<2
Dissolved Copper (µg/l)	12	<2	2	<2	<2	<2
Fluoride (mg/l)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Iron (mg/l)	0.4	1.4	0.3	0.2	0.3	0.3
Total Lead (µg/l)	<2	<2	<2	0.2	<2	<2
Total Manganese (µg/l)	308	387	463	486	437	467
Orthophosphate (mg/l)	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
Total Zinc (µg/l)	7	55	91	40	21	26

TABLE 3.5/6: Groundwater Monitoring Results for MW04 (Quarterly Results)

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
pH pHunits	7.0	7.7	7.8	6.78	6.89	7.0	6.77	7.40	6.92	6.92	7.04	7.5
Conductivity (µS/cm)	646	651	545	669	640	658	580	679	595	581	598	695
Temperature °C	6.9	9.3	8.1	9.2	9.8	10.3	11.8	13.2	11.3	10.7	10.5	9.7
Ammonia N mg/l	1.6	1.4	5.3	1.0	1.2	1.3	1.2	1.10	2.0	2.0	2.0	1.6
Oxidised Nitrogen mg/l			< 0.1		< 0.04			< 0.04				<0.04
pH pHunits	8.0	6.7	6.9	7.5	6.9	6.8						
Conductivity (µS/cm)	730	599	691	660	523	538						
Temperature °C	10.3	9.1	10.1	9.7	10.1	10.6						
Ammonia N mg/l	6.8	0.9	2.3	1.7	1.2	1.1						
Oxidised Nitrogen mg/l	<0.04			<0.04								

TABLE 3.5/7: Groundwater Monitoring Results for MW04 (Annual Results)

	2001			2002		
	Aug	Nov	Dec	Jan	Feb	Mar
Cadmium (µg/l)	<2	<2	<2	<2	<2	<2
Dissolved Copper (µg/l)	18	3	2	<2	<2	<2
Fluoride (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Iron (mg/l)	<0.1	0.3	1	0.3	1.1	0.3
Total Lead (µg/l)	<2	<2	<2	0.3	<2	<2
Total Manganese (µg/l)	532	582	575	731	247	168
Orthophosphate (mg/l)	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
Total Zinc (µg/l)	424	142	47	39	26	27

TABLE 3.5/8: Groundwater Monitoring Results for MW05 (Quarterly Results)

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	pH pHunits	7.2	7.7	7.4	7.04	7.12	7.09	6.96	7.20	7.01	7.06	7.03	7.5
	Conductivity (µS/cm)	632	625	687	670	677	665	545	691	546	587	600	748
	Temperature °C	9.3	9.6	9.9	9.9	10.7	10.2	10.8	-	12.5	10.7	10.3	10.2
	Ammonia N mg/l	5.6	6.0	3.4	7.0	4.6	4.4	5.7	1.60	7.0	7.0	6.6	6.3
	Oxidised Nitrogen mg/l			< 0.1		< 0.04			< 0.04			<0.04	<0.04
2002	pH pHunits	8	7.08	6.95	8	6.92	7	7.8	7.01	7.01	6.76	7.4	7.1
	Conductivity (µS/cm)	751	903	900	778	673	665	756	768	706	797	802	825
	Temperature °C	10.3	10.2	10.3	9.8	10.3	10.9	11.1	11.5	10.9	10.7	10	10.4
	Ammonia N mg/l	25.6	6.6	6.4	9	6.8	6.3	8.7	13	6.3	7.9	8.1	7
	Oxidised Nitrogen mg/l	<0.04			<0.04			<0.04				<0.04	
2003	pH pHunits	7	7.4	6.87	6.9	6.9	6.86	7.07	7.1	6.94	7	6.97	6.95
	Conductivity (µS/cm)	748	814	749	760	828	841	830	832	818	825	827	827
	Temperature °C	9.8	10.5	10.8	11.6	12.6	12.8	12.4	11.9	11.9	10.9	10.9	10.4
	Ammonia N mg/l	6.8	8.45	7.8	7.1	8.6	8.1	7	6.1	6.3	4.96	6.8	6.8
	Oxidised Nitrogen mg/l		<0.04			<0.04		0.07			0.07		
2004	pH pHunits	6.98	6.98	7	6.96	7	7.03	6.99	7.24	7.03	7.14	7.04	7.03
	Conductivity (µS/cm)	830	822	816	833	658	671	645	622	573	554	595	780
	Temperature °C	9.7	9.1	9.4	10.3	10.9	11.3	11.2	13	12.1	10.7	10.7	10.2
	Ammonia N mg/l	7.4	7.7	7.5	7	7.1	7.1	7	8.8	6.4	6.7	6.9	7.1
	Oxidised Nitrogen mg/l		0.07			0.07			<0.2			0.07	
2005	pH pHunits	6.98	6.98	7	6.96	7	7.03	6.99	7.24	7.03	7.14	7.04	7.03
	Conductivity (µS/cm)	830	822	816	833	658	671	645	622	573	554	595	780
	Temperature °C	9.7	9.1	9.4	10.3	10.9	11.3	11.2	13	12.1	10.7	10.7	10.2
	Ammonia N mg/l	7.4	7.7	7.5	7	7.1	7.1	7	8.8	6.4	6.7	6.9	7.1
	Oxidised Nitrogen mg/l		0.07			0.07			<0.2			0.07	

TABLE 3.5/9: Groundwater Monitoring Results for MW05 (Annual Results)

	2001			2002			2003	2004
Parameter	**Aug**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**May**	**Aug**
Cadmium (µg/l)	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Copper (µg/l)	9	2	3	<2	<2	<2	9	<2
Fluoride (mg/l)	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Iron (mg/l)	<0.1	0.5	0.4	0.3	0.3	0.4	0.8	1.2
Total Lead (µg/l)	<2	<2	<2	<2	<2	<2	<2	<2
Total Manganese (µg/l)	997	1539	1790	2117	1805	791	1430	760
Orthophosphate (mg/l)	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16	<0.02
Total Zinc (µg/l)	57	69	76	40	29	71		<2

TABLE 3.5/10: Groundwater Monitoring Results for MW06 (Quarterly Results)

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	pH pHunits	7.4	5.4	5.2	8.2	5.6	5.6	7.6	11	6.8	5.3	6.3	5.4
	Conductivity (µS/cm)	738	859	856	700	664	664	712	785	805	779	679	751
	Temperature °C	10.7	9.9	9.6	9.8	10.4	10.7	10.8	11.6	10.3	10.5	9.9	9.5
	Ammonia N mg/l	7.4	5.4	5.2	8.2	5.6	5.6	7.6	11	6.8	5.3	6.3	5.4
	Oxidised Nitrogen mg/l	0.09						<0.04					
2003	pH pHunits	6.95	7.1	6.83	6.84	7.1	6.87	7.11	7.1	6.96	6.95	6.92	6.96
	Conductivity (µS/cm)	663	682	668	702	710	774	748	776	778	787	820	786
	Temperature °C	10.1	10.4	10	10.7	11.2	11	10.5	11.3	11.1	10.1	10.9	9.7
	Ammonia N mg/l	5.1	7.3	5.5	2.78	7.3	6.8	5.4	5.3	5.3	4.97	5.9	5.8
	Oxidised Nitrogen mg/l		<0.04			<0.04		0.13			0.07		
2004	pH pHunits	6.99	6.95	7.06	6.94	7	6.94	6.85	6.84	7.02	6.98	6.98	6.98
	Conductivity (µS/cm)	758	760	753	787	608	633	670	661	666	626	605	786
	Temperature °C	9.8	10.1	8.7	10.4	10.6	11.6	11.2	11.6	11.1	10.1	10.3	9.2
	Ammonia N mg/l	5.6	5.7	5.6	6.2	5.7	6.6	6	8.5	6.2	6.6	5.5	5.9
	Oxidised Nitrogen mg/l			0.07			0.07			<0.2			
2005	pH pHunits	7.1	6.89	6.83	6.93	6.94	6.83	7.08					
	Conductivity (µS/cm)	760	771	792	771	771	811	794					
	Temperature °C	9.7	8.5	10.3	10.6	10	10.4	9.8					
	Ammonia N mg/l	5.7	6.2	6.4	6.1	5.7	6	6.2					
	Oxidised Nitrogen mg/l			0.22		0.08		0.08					

TABLE 3.5/11: Groundwater Monitoring Results for MW06 (Annual)

	2002			2003	2004
Parameter	**Dec**	**Jan**	**Feb**	**May**	**Aug**
Cadmium (µg/l)	<2	<2	<2	<2	<2
Dissolved Copper (µg/l)	<2	<2	<2	12	<2
Fluoride (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1
Total Iron (mg/l)	0.2	0.2	0.3	0.6	1
Total Lead (µg/l)	<2	<2	<2	<2	<2
Total Manganese (µg/l)	2874	1752	1385	988	836
Orthophosphate (mg/l)	<0.16	<0.16	<0.16	<0.16	<0.02
Total Zinc (µg/l)	122	50	49	36	81

TABLE 3.5/12: Groundwater Monitoring Results for MW07

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2001	pH pHunits	7.1	7.9	7.7	6.96	6.98	6.97	6.97	7.20	7.07	7.08	7.25	7.1
	Conductivity (µS/cm)	678	709	321	744	688	727	590	701	597	587	598	726
	Temperature °C	6.8	9.8	9.5	10.2	11.1	10.3	10.5	11.2	10.8	10.5	10.3	9.7
	Ammonia N mg/l	2.4	2.2	5.7	2.6	2.4	2.0	2.4	3.20	2.4	2.4	2.6	2.3
	Oxidised Nitrogen mg/l			<0.01		<0.04			<0.04			<0.04	<0.04
2002	pH pHunits	7.6	7.12	7.21	7.5	6.91	7	7.5	7.1	7.12	6.94	7.5	7.3
	Conductivity (µS/cm)	721	815	824	700	660	665	717	762	765	772	709	770
	Temperature °C	10.4	9.4	10	9.8	10.1	10.6	10.7	11.5	10.7	10.7	10.4	9.8
	Ammonia N mg/l	2.6	2.1	2	2.7	2.4	2.3	3.3	4.4	2.9	2.2	2.8	2
	Oxidised Nitrogen mg/l	<0.04			<0.04			<0.04				<0.04	
2003	pH pHunits	7.03	7.1	7.01	6.99	7.1	6.99	7.16	7.18	7.02	7.04	7.12	7.08
	Conductivity (µS/cm)	705	728	700	675	732	769	800	793	789	791	831	840
	Temperature °C	9.4	10.4	9.2	11.1	11.7	11.5	10.9	11.5	11.4	9.4	10.5	10.3
	Ammonia N mg/l	2.7	2.79	2.3	0.93	2.9	3	2.28	2	2.27	2.1	2.21	2.29
	Oxidised Nitrogen mg/l		<0.04			<0.04		0.13			0.07		
2004	pH pHunits	7.04	7.18	7.04	7.1	7.01	7	7.01	7.33	7.08	7.02	7.14	6.98
	Conductivity (µS/cm)	813	812	798	851	642	630	642	661	654	633	650	825
	Temperature °C	9.5	9.2	9.6	9.9	11.5	11.4	11.4	12.5	11.3	10.2	10.7	10
	Ammonia N mg/l	2.27	2.34	2.46	2.41	2.34	2.28	2.29	3.1	2.59	2.54	2.39	2.37
	Oxidised Nitrogen mg/l		0.07			0.07			<0.2			0.07	
2005	pH pHunits	7	6.96	7.32	6.85	7.05	6.84	7.01					
	Conductivity (µS/cm)	835	836	830	829	821	822	807					
	Temperature °C	10.1	9.5	10.5	9.8	10.5	10.2	10.2					
	Ammonia N mg/l	2.25	2.26	2.31	2.23	2.33	2.3	2.43					
	Oxidised Nitrogen mg/l			0.22		0.08		0.08					

TABLE 3.5/13: Groundwater Monitoring Results for MW08

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	pH pHunits	7.5	7.06	7.09	7.9	7.09	7.05	7.6	7.14	7.09	6.74	7.6	7.8
	Conductivity (µS/cm)	709	1036	903	724	750	710	715	720	725	814	707	719
	Temperature °C	10.2	9.9	10.2	9.1	10.1	10.5	10.8	12.5	10.9	11.5	10.1	10.1
	Ammonia N mg/l	4.6	1.7	1.3	4.5	2.3	1.6	5.1	4	0.2	2.3	1.4	0.8
	Oxidised Nitrogen mg/l	<0.04			0.04			0.1				0.05	
2003	pH pHunits	7	7.4	6.87	6.9	6.9	6.86	7.07	7.1	6.94	7	6.97	6.95
	Conductivity (µS/cm)	748	814	749	760	828	841	830	832	818	825	827	827
	Temperature °C	9.8	10.5	10.8	11.6	12.6	12.8	12.4	11.9	11.9	10.9	10.9	10.4
	Ammonia N mg/l	6.8	8.45	7.8	7.1	8.6	8.1	7	6.1	6.3	4.96	6.8	6.8
	Oxidised Nitrogen mg/l		<0.04			<0.04		0.07			0.07		
2004	pH pHunits	7.15	7.18	7.2	7.17	7.41	7.21	7.07	7.18	7.28	7.31	7.22	7.17
	Conductivity (µS/cm)	896	861	825	833	636	625	653	632	598	586	691	873
	Temperature °C	10	9.6	9.3	10.1	10.1	10.1	11.3	10.9	10.6	10.6	10.6	10.4
	Ammonia N mg/l	1.7	2.1	2.62	2.47	2.71	3.19	3.1	3.9	3.97	3.51	1.96	2.25
	Oxidised Nitrogen mg/l		0.1			0.1			<0.2			0.07	
2005	pH pHunits	7.31	7.06	7.1	7.1	7.15	7.18	7.25					
	Conductivity (µS/cm)	385	992	903	917	928	851	807					
	Temperature °C	10.4	9.9	10.4	9.9	10.8	10.4	10.1					
	Ammonia N mg/l	1.04	1.67	2.06	1.08	1.53	2.77	3.11					
	Oxidised Nitrogen mg/l			0.22		0.08		0.08					

TABLE 3.5/14: Groundwater Monitoring Results for MW09

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	pH pHunits	7.6	7.05	7.04	7.7	7.15	6.95	7.5	7.08	7.1	6.77	7.3	7.8
	Conductivity (µS/cm)	648	810	796	649	626	630	684	717	718	778	728	753
	Temperature °C	10	10	10.7	9.8	10.4	10.7	11.2	11.6	10.9	10.7	10	10.3
	Ammonia N mg/l	10.1	2.3	1.1	3.6	2.4	2.4	3.5	2.3	3	2.1	2.7	1.9
	Oxidised Nitrogen mg/l	<0.04			<0.04			<0.04				<0.04	
2003	pH pHunits	7.02	7.2	6.91	7.06	7	6.96	7.15	7.18	7.08	7.1	7.03	7
	Conductivity (µS/cm)	685	739	663	666	745	746	745	743	714	732	774	778
	Temperature °C	9.4	9.9	10.7	10.9	11.8	10.8	11.2	11.1	11.4	11.8	11	10.9
	Ammonia N mg/l	2.8	2.79	2.4	1.28	2.9	2.9	2.32	2.11	2.48	2.49	2.3	2.33
	Oxidised Nitrogen mg/l		<0.04			<0.04		0.07			0.07		
2004	pH pHunits	7.08	7.1	7.12	7.11	7.36	7.18	7.06	7.2	7.1	7.12	7.15	7
	Conductivity (µS/cm)	743	748	754	769	602	586	592	598	604	621	611	776
	Temperature °C	10.4	9.7	9.4	10.6	10.8	10.7	11.2	11.4	11.1	11.2	10.8	10.6
	Ammonia N mg/l	2.39	2.46	2.66	2.64	2.47	2.42	2.37	3	2.51	2.34	2.28	2.32
	Oxidised Nitrogen mg/l		0.07			0.07			<0.2			0.07	
2005	pH pHunits	7.04	7.02	7.03	6.98	7.08	6.96	7.25					
	Conductivity (µS/cm)	742	777	762	763	766	758	724					
	Temperature °C	10.6	10.3	10.4	11.1	10.7	10.7	10.9					
	Ammonia N mg/l	1.03	2.25	2.39	2.16	2.26	2.33	2.54					
	Oxidised Nitrogen mg/l			0.22		0.08		0.08					

TABLE 3.5/15: Groundwater Monitoring Results for MW10

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	pH pHunits	7.5	7.7	7.07	7.08	7.7	7.04	7.06	7.5	7.05	7.05	6.86	7.3
	Conductivity (µS/cm)	565	536	646	633	539	501	505	544	610	623	584	541
	Temperature °C	9.5	10.2	9.4	10	9.6	9.7	10.4	11.5	11.1	10.2	10.4	9.9
	Ammonia N mg/l	2.3	2.6	2.3	2.2	3.5	2.1	2.4	3.1	2.2	1.9	2	2.8
	Oxidised Nitrogen mg/l	<0.04	<0.04			<0.04			<0.04				<0.04
2003	pH pHunits	7.18	7.4	7.08	7.14	7.1	7.05	7.27	7.3	7.14	7.31	7.2	7.15
	Conductivity (µS/cm)	526	429	513	536	483	581	583	593	610	611	580	584
	Temperature °C	9.1	10.1	9.8	10.9	11.4	10.9	10.9	10.8	11.6	10.1	10.3	9.8
	Ammonia N mg/l	0.2	2.43	2.1	2.43	2.5	2.7	2.28	2.18	2.39	2.42	2.34	2.39
	Oxidised Nitrogen mg/l		<0.04			0.2		0.13			0.07		
2004	pH pHunits	7.22	7.33	7.19	7.24	7.19	7.18	7.21	7.16	7.22	7.23	7.29	7.18
	Conductivity (µS/cm)	571	574	579	585	568	497	495	504	489	465	455	602
	Temperature °C	9.6	10.4	9.1	9.9	10.3	11.1	10.4	10.5	10.4	10.5	9.7	8.5
	Ammonia N mg/l	2.32	2.48	2.7	2.61	2.6	2.47	2.58	3.3	2.75	2.44	2.43	2.47
	Oxidised Nitrogen mg/l		0.07			0.07			<0.2			0.07	
2005	pH pHunits	7.19	7.14	7.18	7.11	7.14	7.2	7.57					
	Conductivity (µS/cm)	582	585	583	572	573	581	618					
	Temperature °C	10	9.1	10.1	9.6	9.7	9.6	9.6					
	Ammonia N mg/l	2.39	2.4	2.34	2.3	2.37	2.5	2.46					
	Oxidised Nitrogen mg/l			0.22		0.08		0.08					

TABLE 3.5/16: Groundwater Monitoring Results for MW11

	Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2002	pH pHunits	7.5	7.03	7.01	7.5	6.88	6.93	7.5	6.94	6.92	6.77	7.4	6.5
	Conductivity (µS/cm)	655	779	789	666	620	622	680	705	708	716	668	715
	Temperature °C	10.5	10.2	10.8	9.6	10.6	10.7	11.8	11.2	10.9	11.5	10.1	9.4
	Ammonia N mg/l	3.6	2.6	2.6	3.7	2.7	2.9	3.7	2.8	3.3	2.2	3.3	3.4
	Oxidised Nitrogen mg/l	<0.04			<0.04			<0.04				0.1	
2003	pH pHunits	7.05	7.3	6.95	7	7.1	6.83	7.18	7.17	7.01	7.18	7.09	7.1
	Conductivity (µS/cm)	647	617	650	662	279	735	730	745	737	739	731	739
	Temperature °C	9.9	10.6	10.5	11.1	11.5	12.3	11.3	11.4	11.4	9.8	11	10.7
	Ammonia N mg/l	2.6	3.33	2.8	1.4	3.67	3.9	2.93	2.88	2.97	3.1	2.96	2.95
	Oxidised Nitrogen mg/l		<0.04			0.06		0.19			0.07		
2004	pH pHunits	7.16	7.34	7.15	7.13	7.39	7.19	7.16	7.62	7.23	7.2	7.55	7.06
	Conductivity (µS/cm)	1058	1150	1056	1018	868	870	834	744	707	666	755	956
	Temperature °C	10.7	9.7	9.9	10.3	11.1	11.9	11.1	11.7	11.2	9.9	10.5	10.2
	Ammonia N mg/l	3.45	3.41	3.63	3.4	3.01	3.45	3.5	3.6	3.7	3.5	3.49	3.58
	Oxidised Nitrogen mg/l												
2005	pH pHunits	7.04	7.02	7.03	6.98	7.08	6.96	7.25					
	Conductivity (µS/cm)	906	895	900	933	971	986	1038					
	Temperature °C	10.2	9.9	10.5	10.5	10.4	10.7	10.6					
	Ammonia N mg/l	3.54	3.53	3.53	3.64	3.76	3.66	3.71					
	Oxidised Nitrogen mg/l			0.22		0.08		0.08					

TABLE 3.5/17: Annual Groundwater Monitoring Results for MW07 –MW11

	MW07		MW08		MW09		MW10		MW11	
Parameter	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**	**2003**	**2004**
Cadmium (µg/l)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Copper (µg/l)	3	<2	<2	<2	<2	<2	<2	<2	<2	<2
Fluoride (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Iron (mg/l)	0.7	1	0.9	1	0.7	1.1	1	0.8	1	0.9
Total Lead (µg/l)	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Manganese (µg/l)	370	360	298	396	239	204	186	237	395	313
Orthophosphate (mg/l)	<0.16	<0.02	<0.16	<0.02	<0.16	<0.02	<0.16	<0.02	<0.16	<0.02
Total Zinc (µg/l)	30	72	31	59	64	59	29	50	88	67

Groundwater quality results as given in Tables 3.5/2 – 3.5/13 are compared to the EPA's Interim Guideline Values (IGV's). *EPA Interim Report: Towards setting guideline values for the Protection of Groundwater in Ireland.*

Groundwater Quality in the Quaternary Deposits

Groundwater monitoring boreholes MW02 – MW07 are within the quaternary deposits. The quality of the groundwater in generally good with the exception of which are naturally elevated. Background levels of ammonia tend to be elevated due to the conditions of the overland peats. Under the agreement of the EPA, groundwater monitoring in MW02, MW03, and MW04 ceased in June 2002 within the Quaternary deposits. Monitoring boreholes MW-03, MW-06 are classified up-gradient, MW-07 downgradient, and MW-05, MW-02 and MW-04 across gradient from the existing active cells.

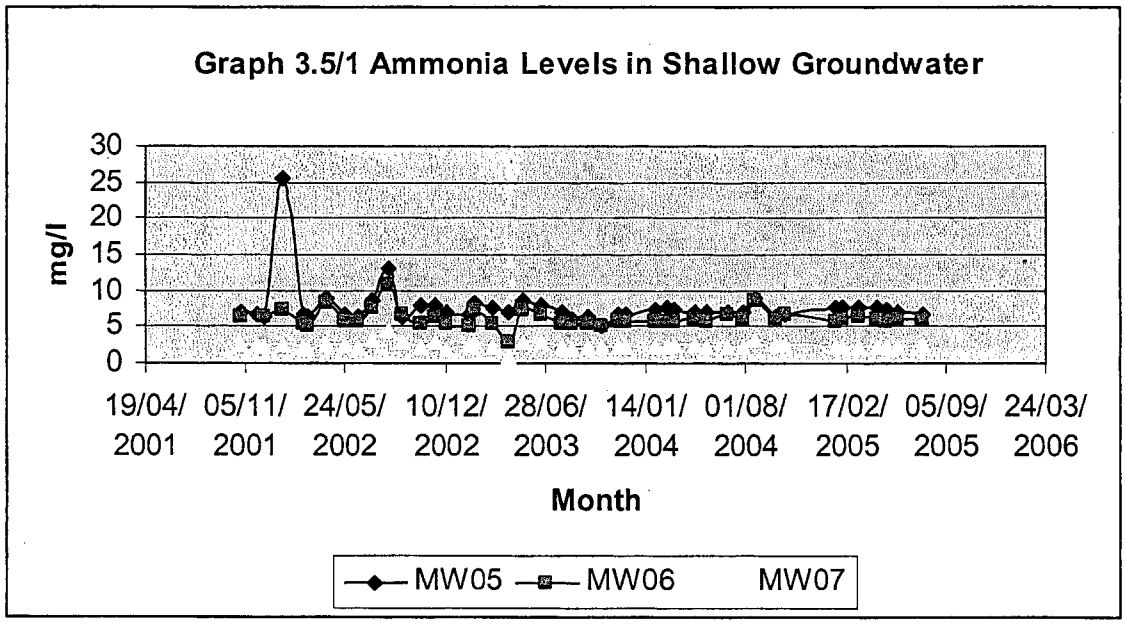
- pH and Conductivity

The pH levels recorded in the shallow groundwaters are slightly alkaline normally ranging from 6.7 – 8.2. The pH in monitoring borehole MW02, tended to be slightly more alkaline when compared to the other shallow boreholes while the pH tends to be more acidic in MW06. The level of conductivity levels recorded and normal with a maximum level of 903 µS/cm which lies well within the groundwater IGV value of 1000 µS/cm.

- Ammonia & Oxidised Nitrogen

As stated above, ammonia levels recorded are elevated with levels up to 9.5 mg/l recorded in the shallow groundwaters. Levels tend to fluctuate slightly however there are no real trends in quality levels are discernible (refer to graph 3.5/1 below), with results remaining similar.

Since monitoring commenced in 2001, there are higher levels of ammonia detected in MW05, and MW06 with levels generally recorded higher than 5 mg/l. This is not considered to be a result of the activities on the landfill as these boreholes are located up-gradient and across gradient respectively.



Levels of oxidised nitrogen detected tend to be low, with levels generally below the limit of detection. Higher levels of nitrogen (> 0.1 mg/l) were detected in MW02 in Aug 2001 and in MW03 in Aug and Dec 2001, in MW06 in July 2003.

- Metals

Iron and manganese levels detected in the boreholes tend to be elevated, which is common in many Irish groundwaters due to geological conditions. Levels of manganese range from 166 – 236 µg/l in MW02, 308 – 486 µg/l in MW03, 168 – 731 µg/l in MW04, 791 – 1805 µg/l in MW05, 836 – 2874 µg/l in MW06.

Levels of iron were recorded higher than the manganese with the following levels recorded: MW02: 0.1 – 0.2 mg/l; MW03: 0.2 – 1.4 mg/l; MW04: <0.1 – 1.1 mg/l; MW05: <0.1 – 1.2 mg/l; MW06: 0.2 – 1 mg/l; and MW07: These levels all lie above the IGV of 50 and 200 µg/l for manganese and iron respectively.

There were no levels of cadmium or lead detected in MW02, MW03 (exception Jan 2002: 0.2 µg/l lead), and MW04 (exception Jan 2002: 0.3µg/l lead). Zinc levels were generally detected below the IGV level of 100, with the maximum concentration detected at MW06 at a level of 122 µg/l, only slightly above the IGV. Higher levels of zinc were encountered in MW04 with levels recorded ranging from 26 µg/l to 424 µg/l (recorded in Aug 2001).

Groundwater Quality in the Bedrock

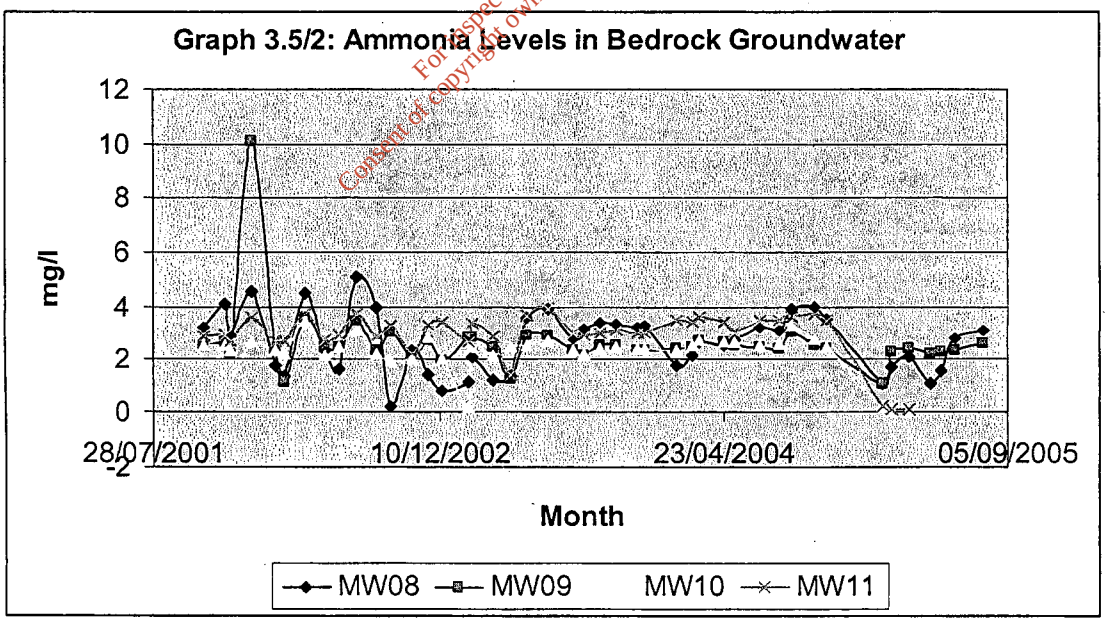
Groundwater monitoring boreholes MW08-MW11 were drilled and installed in 2001 into the underlying bedrock geology. Of these monitoring boreholes, MW-08 and MW-10 are up-gradient of the existing active cells while MW-09 and MW-10 are located down-gradient.

- pH and Conductivity

The pH levels recorded in the deeper/bedrock groundwaters are generally neutral ranging from 6.7 – 7.8. The level of conductivity levels recorded are generally normal with the majority of values recorded within the IGV value of 1000 µS/cm (exception of MW-11 in Jan - Apr 2004).

- Ammonia & Oxidised Nitrogen

The ammonia levels in the bedrock groundwater are naturally elevated (as with the shallow groundwaters), due to the natural of the peat overburden (refer to graph 3.5/2). Levels of ammonia in the up-gradient and down-gradient boreholes are similar and as such the activities in the landfill do not appear to be impacting of the quality of the groundwaters. There has been fluctuations in the level of the ammonia in the boreholes however these occur both in the up-gradient and down-gradient boreholes.



Levels of ammonia in MW-08 (up-gradient wells) range from 0.2 mg/l in September 2002 to 8.45 mg/l in February 2002. MW-11 (upgradient) appears to be slightly high ranging from 1.4 mg/l to 3.9 mg/l.. In MW-09 and MW-10,

(down-gradient wells) levels appear to be lower ranging from 1.03 in January 2005 to 3.6 mg/l in April 2002 and from 0.2 mg/l in January 2003 to 3.5 mg/l in May 2002 respectively.

There are low levels of nitrogen detected in the deeper groundwater monitoring boreholes with all levels lying below 0.2 mg/l.

- Metals

There are no levels of cadmium, fluoride or lead detected in any of the deeper groundwater monitoring boreholes. Low levels of copper were detected in only one sample event in MW07 (2003) at a level of 3 mg/l. As with the shallow groundwaters the levels of iron and manganese are elevated. Iron levels range from 0.8 mg/l to 1.1 mg/l and manganese levels range from 186 µg/l to 396 µg/l.

3.5.7 ENVIRONMENTAL IMPACTS

The nature of the proposed development is a change in the composition of the waste types accepted at the facility. There are no significant changes to any infrastructural or operation aspects of the currently facility on site. A landfill lining system is installed within the active cells thus preventing any discharge to the underlying groundwaters. The lining system will be constructed inline with conditions of the waste licence (49-1) as agreed by the EPA.

Environmental monitoring of the ground waters adjoining the facility have indicated that the facility has not had any negative impacts since operations and monitoring commenced in 2001.

(1) Leachate Generation

As part of the EPA waste licence application DIN-leachability tests (DIN 38414-S4: Sludge and sediments – determination of leachability by water) and eco-toxicity tests were undertaken on the fly-ash material. The results are given in attachment 05.

As part the EPA Waste Licence (49-1) samples are taken from the leachate sump L1. This location is sampled on a quarterly bases for a number of parameters and annually for a full set of parameters (refer to section 2.2.8).

The following observations on the quality of the leachate generated from the site are made:

- The DIN-Leachability test results indicate that the potential generated leachate has high pH, high conductivity levels, and high calcium content;

- On-going monitoring on of the leachate generated at the site and collected at L1 show high pH and conductivity levels.

In conclusion, it has been observed that with the exception of elevated pH, the leachate produced at the facility are considered environmentally benign.

The generation of leachate on the existing cells of the ash repository site is minimal. In addition, the groundwater beneath the site is protected on due to the presence of low permeable peats and clays underlying the site. Based on this, the ash repository facility does not pose a significant risk to the underlying aquifer.

3.6 AIR

The air study for the existing ash repository site and its environs was undertaken using the following information:

- As part of the initial EIS undertaken at the facility, baseline air quality was carried out by Bord na Móna Environmental Consultancy Services in April 1988.

- Since the granting of the Waste Licence 49-1 in April 2000, on-going monitoring for dust deposition and PM_{10} has taken place at the facility as part of the monitoring requirements of the waste licence.

- An EIS and revised IPPC licence application that was carried out as part of the planning /licensing process for the co fuelling of peat with biomass and or MBM at the Edenderry Power Ltd. facility

These were subsequently assessed to predict the potential impact of the development.

3.6.1 OVERVIEW OF POTENTIAL POLLUTANTS

Dust/Particulate matter (PM_{10}) are considered the main potential pollutants that may impact on the air quality during the construction and operational phases of the proposed development. As the facility is an operational ash repository, there is also limited potential for generation of odours during the operation of the site.

If uncontrolled, the operation of the ash repository site can give rise to the following air emissions.

- Dust
- Fine Particulate Matter
- Odour

(i) Dust

Airborne particulate matter varies widely in its physical and chemical composition, source and particle size. Particles are often classed as either primary (those emitted directly into the atmosphere) or secondary (those formed or modified in the atmosphere from condensation and growth). Particulate matter arises from both man-made and natural sources. Natural sources include wind-blown dust, sea-salt and biological particles e.g. pollen. Man-made sources include large carbon particles from incomplete combustion, ash, dust particles from quarrying and construction activities and road traffic generated dust. In general large particles do not stay in the atmosphere for long and are deposited close to their source, whereas small particles can be transported long distances.

Particles, which are deposited to ground, give rise to problems such as soiling of buildings and other materials and also cause a general nuisance. The Technical Instructions on Air Quality Control TA Luft - 1986 recommended guideline value for dust emissions is 350 mg/m^2/day.

The German T.A. Luft Standard (1986) recommended value for dust emissions of 350 mg/m^2/day is based on the combined weight of dissolved and undissolved solids, measured over one month using the Bergerhoff dust gauge. The EPA in Ireland has adopted the German sampling methodology and guideline value of 350 mg/m^2/day. This limit value has also been adopted as the stipulated limit value under the existing licence.

The incorporation of MBM ash into the waste ash to be deposited at the site may give rise to additional significant health risks. The most significant of these would be the potential levels of dioxins in the ash material and also the possible BSE infectivity.

(ii) Fine Particulate Matter

In recent years, interest has focused on the levels of particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}) which have been shown to have health implications at elevated levels, due to their ability to penetrate into the tracheo-bronchial system. A major man-made source of fine primary particles are combustion processes, primarily road transport and coal burning activities. However, road transport is estimated to be the single biggest primary man-made source of PM_{10} in most EU countries (Ireland's *Environment- A Millennium*

Report' EPA April 2000). Of particular concern is diesel combustion, where transport of hot exhaust vapour into a stack can lead to spontaneous nucleation of 'carbon' particulates before emission. An estimated 30 to 70 times more particulates are emitted by diesel engines than petrol fuelled vehicles equipped with catalytic converters and burning unleaded fuel.

Secondary particles are typically formed when low volatility products are generated in the atmosphere, for example the oxidation of sulphur dioxide to sulphuric acid. The atmospheric lifetime of particulate matter is strongly related to particle size, but may be as long as 10 days for particles of approximately 1mm in diameter. With the general rise in traffic, especially in urban areas, levels are likely to continue to increase. Significant natural sources of PM_{10} particles include re-suspension of fine soil material in rural areas, volcanic activity, sea spray, forest fires and reactions between natural gaseous emissions.

Such emissions may arise from the ash repository facility as a result of handling and movement of the ash.

3.6.2 EXISTING ENVIRONMENT

(i) Dust Deposition

Sampling Methodology

Sampling involved placing the labelled containers in the protecting cages. The date of erection of the cages was noted. Following exposure for 28-32 days, the vessels were sealed and brought back to the laboratory for analysis for dust. All samples returned to the laboratory were stored at 4°C. Subsequent analysis of all samples was carried out gravimetrically for dust and strictly followed the standard VDI 2119.Total deposited dust has been monitored at five locations at the existing ash facility. These locations (DM-01 to DM-04) are highlighted in attachment 3 Drawing No. 2401057-6

Results

The results of the annual dust monitoring from 2001 to 2004 are detailed in Tables 3.6/1 and 3.6/2 overleaf:

TABLE 3.6/1: HISTORICAL DUST DEPOSITION RESULTS						
Emission Pt	**Emission mg/m²/day**					
	2001			2002		
Sampling period	15/06/01-13/07/01	13/07/01-10/08/01	10/08/01-06/09/01	14/06/02-12/07/02	12/07/02-09/08/02	09/08/02-06/09/02
DM-01 (South east boundary)	83.3	60.8	88	49	86	<18
DM-02 (South west boundary)	178.6	79	94	135	135	178
DM-03 (West boundary)	267.9	67	75.5	43	86	49
DM-04 (East boundary)	107.1	60.8	75.5	61	104	18
DM-05 (Mulrennan Dwelling)	41.7	73	75.5	Note 1	Note 1	Note 1

Note 1 : Access Denied

TABLE 3.6/2: HISTORICAL DUST DEPOSITION RESULTS						
Emission Pt	**Emission mg/m²/day**					
	2003			2004		
Sampling period	21/06/03-22/07/03	22/07/03 – 21/08/03	21/08/03 – 19/09/03	04/06/04 - 02/07/04	02/07/04 - 30/07/04	30/07/04 - 27/08/04
DM-01 (South east boundary)	67	50	113	82057[Note 2]	977[Note 2]	<19
DM-02 (South west boundary)	111	100	528[Note 3]	111	49	210
DM-03 (West boundary)	455[Note 3]	133	71	43	172	<19
DM-04 (East boundary)	83	94	56	43	43	76
DM-05 (Mulrennan Dwelling)	Note 1	Note 1	Note 1	Note 1	Note 1	Note 1

Note 1 : Access Denied

Note 2 : Contaminated by road construction material

Note 3 : Came under the influence of adjacent peat harvesting

(ii) Particulate Matter (PM_{10})

Sampling Methodology

PM_{10} ambient monitoring was carried out at two locations (CM-01 and CM-02) on a biannual (1 day sampling periods) basis. Airborne particulate matter (PM_{10}) with an aerodynamic diameter equal or less than 10µm was monitored at 2 locations using a Partisol-Plus Model 2025 Sequential Air Sampler manufactured by Rupprecht and Pataschnick. This sampler draws a measured volume of air through a chamber containing pre-conditioned and pre-weighed filters meeting the US EPA protocol for PM_{10} sampling. Sample air was drawn in from all directions at a flow rate of 16.7L/min. ($1m^3$/hr flow rate through a single filter). Following completion of the sampling episode, the filters were then re-weighed at the Bord na Móna Environmental Limited laboratory complex and a weight gain determined. The results are expressed as $\mu g/m^3$.

Results

Results of the PM_{10} monitoring carried out at the ash repository facility at Cloncreen, Clonbullogue, Co. Offaly for the sampling period 2001 to 2004 are highlighted in Table 3.6/3 below. Comparison of the recorded levels is made to the ambient air daily limit value of $50\mu g/m^3$. This limit value was originally stipulated in the EU Directive 1999/30/EC. This directive was passed into Irish legislation as part the Air Quality Standards Regulations 2002. The 24 hour (daily average) limit value came into force in 2005 and is not to be exceeded greater than 35 times per year.

TABLE 3.6/3:DAILY AVERAGE PM_{10} RESULTS ($\mu g/m^3$)

	2001		2002		2003		2004	
Sampling Location	**Date**	**Conc.**	**Date**	**Conc.**	**Date**	**Conc.**	**Date**	**Conc.**
CM-01 (Northern Site Boundary)	Oct	23.6	Dec	<12	Oct	12.1	Oct	12.1
CM-02 (Nearest potential dust sensitive location)	Oct	17.1	Dec	12.5	Oct	12.5	Oct	12.1
Ambient Limit value[Note 1]	*50*							

Note 1: Air Quality Standards Regulations 2002- S.I No. 271 of 2002

Comparison of the recorded levels over the 2001 to 2004 monitoring period indicates that the impact of the existing operation on the PM_{10} levels in the surrounding environment is not significant.

(iii) Odour

Monitoring of odour at the facility is not carried out as the existing process does not give rise to significant odour production. Subjective assessment carried out by personnel during routine monitoring and operation indicates that no characteristic or distinguishable odours were identified above those of background sources.

3.6.3 ENVIRONMENTAL IMPACTS

(i) Dust Deposition

The impact of dust emissions from the operation of the ash repository facility is minimal. Dust deposition monitoring is carried out three times a year at the 5 no. sampling locations (as detailed in Table 3.6/2) in accordance with Clonbullogue Waste licence No. 49-1. Dust monitoring locations (DM-01 to DM-05) are those as set out in waste licence (Register No. 49-1) and accurately indicated in Drawing A1.2: Environmental Monitoring and Sampling Points.

Dust monitoring has exceeded the emission limit of 350 $mg/m^2/day$ at a monitoring location on 4 occasions during the 2001 to 2004 sampling period. These exceedences are associated with external dust generating activities. It can be concluded therefore the dust control procedures that are implemented on the site are effective and consequently immissions in the surrounding areas would not be considered significant (Tables 3.6/1 and 3.6/2). The average dust deposition level in the area of the facility over the four year monitoring period is $92mg/m^2/day$ which is well within the stipulated limit value.

As part of the EIS carried out for the co fuelling of Peat with biomasss and/or MBM, the potential levels of dioxin the peat/MBM ash was assessed. The results of these tests are summarised in appendix five. The dioxin level determined for the peat/MBM was 3.3ng/kg I-TEQ. This level is within the range for an EPA survey of Irish soils (0.6-10ng/kg I-TEQ) (Dr. Kevin McDonnell Risk Assessment).

Included in attachment 5 is a risk assessment on the potential levels of BSE Infectivity in the Ash material carried out by Dr Kevin McDonnell of UCD. (Full ref). This assessment concluded that there would be negligible risk to humans from burning of MBM (including SRM). The revised IPPC licence for the co fuelling of peat and MBM in the Edenderry power facility allows the use of category one MBM only (No SRM material). This reduces the potential risk of significant BSE infectivity even further.

(ii) Particulate Matter (PM_{10})

Uncontrolled migration of fine particle matter from the ash repository has the potential to result in a negative impact particularly from the point of view of health and safety of those people living in the immediate vicinity of the site.

65 – 90% of fly ash material which is disposed of at the ash repository site is deemed finer than 10μm in diameter. Uncontrolled migration of this fine particle matter from the ash disposal site may result in breach of the standard of 10 $\mu g/m^3$ for total inhalable dust or 5 mg/m^3 for respirable dust, and subsequently results in a negative impact particularly of those people living in the immediate vicinity of the site. This migration may also result in the exccedence of the stipulated ambient air limit value of 50$\mu g/m^3$ as a daily average or the annual limit value of 40$\mu g/m^3$.

Mitigation measures as detailed in the following section will minimise direct emissions of dust and associated fine and particulate mater/PM_{10} emissions to atmosphere. In addition, given the non-hazardous nature of the ash to be disposed of on site, no direct emissions of aerosols and associated microbial emissions to atmosphere will occur. PM_{10} monitoring has not exceeded the emission limit of 50 $\mu g/m^3$ in the monitoring period of 2001 to 2004 illustrating the effectiveness of the mitigation measures.

(iii) Odour

The nature of the proposed ash material being disposed of in the facility is such that no odours above those of the naturally occurring background odour concentrations are likely to be detected. As no biodegradable waste will be accepted at the facility, no odour nuisance or adverse effects on the surrounding environment and/or nearest residential location is likely to occur.

3.6.4 MITIGATION MEASURES

(1) Dust Control

Presently there are a significant number of dust control measures implemented at the facility as part of the operation of the existing waste licence. Dust control procedures are implemented at the ash repository facility on a daily basis thus greatly reducing any local problem due to dust deposition. These procedures include the following:

- Fly ash material is dampened with water (40:1 w/w Fly Ash:H20 ratio) at source prior to delivery to the ash repository. This aids in the prevention of dust dispersion when the material is deposited from the saddle wagons.

- Further dampening of the deposited ash is carried out using an on-site water spray/sprinkler system. This operates continuously until such time as the material has reached maximum absorptive capacity, after which time intermittent sprinkling is carried out, as and when required, to suppress dust dispersion.

- Waste handling is suspended in wind conditions of greater than 39km/hr (EPA agreed wind trigger level)

- All waste ash is compacted prior to the end of each working day

- All cells are capped and revegetated upon completion.

Implementation of these waste handling procedures outlined above reduce and eliminate the potential for dust emissions from the site. In addition, due to the relative remoteness of the site in relation to the location of the nearest dwelling, it is unlikely that the dust immission levels will exceed the existing waste licence stiplulated limit value of 350 mg/m^2/day.

(2) Odour Control

There is no significant potential for odour production due to the acceptance of the proposed waste at the facility. Therefore no mitigation measures are proposed.

3.7 NOISE

3.7.1 EXISTING NOISE ASSESSMENT

A survey of the baseline noise levels at the proposed development site was carried out by Bord na Móna Environmental Consultancy Services, in order to establish baseline noise levels at the development site as part of the original EIS in April 1998.

A day time acoustic assessment (as the site shall only operate during the daytime 08:00 – 18:00 hours) was undertaken in April 1998 at the locations given in Table 3.7/1 overleaf and shown in Drawing No. 2401057-6: Environmental Monitoring and sampling locations.

Established acoustics methodologies as outlined below were applied through the assessment and subsequent interpretation of the resultant data.

(1) Standards and Guidance

The acoustic assessment and subsequent reporting are in accordance with International Standard Organisation (ISO) 1996 Acoustics – Description and Measurement of Environmental Noise Part 1, 2, and 3 in addition to relevant sections of the Environmental Protection Agency Integrated Pollution Control Licensing Guidance Note for Noise In Relation To Scheduled Activities.

(2) Tonal and Impulsive Characteristics

For the purpose of this assessment, tonal noise is characterised in accordance with ISO 1996-2, which indicates that a noise source being tonal at a particular frequency is either clearly audible or exceeds the level of the adjacent bands by 5dB or more.

An impulsive noise is of short duration (typically less than one second), it is brief and abrupt, its startling effect causes greater annoyance than would be expected from a simple measurement of sound pressure level. For example an instantaneous bang/thud that may associated with pile driving, hammering etc. At present current guidance (EPA) recommends that ***audible*** impulsive noise at sensitive locations at night should be avoided, irrespective of the noise level.

Table 3.7/1 below presents the geographical description of the four site boundaries and our nearest noise sensitive location selection to determine the site specific noise environment.

TABLE 3.7/1: LOCATION OF NOISE MONITORING POINTS

Sample Point Reference ID	Location (geographical reference from site centre)	Justification
N1	South east Corner	To assess the background noise levels at the perimeters of the site
N2	South west Corner	
N3	North West Corner	
N4	North East North	
N5	ca. 580 m from the site perimeter	Nearest sensitive receptor

Equipment used

Quest Technologies Model No: Integrated sound level meter (Serial No. CC9060018) with B&K 4936 microphone (Serial No: 2064721) and tripod. A current certified UK National Physical laboratory (BS EN ISO 9001 & BS EN 46001) calibrating meter QC-20 (Serial No. Q09060028) was used to calibrate the instrument immediately before and after the measurement periods. No drift in the calibration level was noted and field calibration is considered satisfactory.

Bruel & Kjaer Real-Time Noise Analyzer Type 2260 Observer with Sound Analysis Software BZ 7210:

Model No: 2260	Serial No. 2418359
Date of Certificate and Calibration	28th January 2004
Microphone Type: B&K 4936	Serial No:2417709
Tripod	

- Certified current annual calibration certificates are available for the meter upon request.

On site Calibration.

The instrument was calibrated to 94 dB A immediately before sampling and was subsequently checked after the measurement periods with no drift in calibration level noted.

Site Information

All measurements were taken with the noise meter positioned at 1.5m height above local ground level and 1-2m away from reflective surfaces.

Wind speed was less than 5m/s during the measurement periods. On-site weather conditions were mild, dry, and calm during the measurement periods.

Each ambient noise level measurement was taken over a 30 minutes monitoring period. The monitoring equipment was manned throughout the sampling intervals and observations on noise sources on and off site was noted in order to aid the interpretation of the results.

Measurement Parameters

At each of the monitoring locations the following data parameters were recorded:

- L_{eq} Values

  L_{eq} (t) values represent the continuous equivalent sound level over a specified time (t). This value expresses the average levels over time and is a linear integral.

- L_{AF} Max Values

  The maximum RMS, A-Weighted sound pressure level occurring within a specified time period.

- L_{90} and L_{10} Values

  The L_{90} and L_{10} values represent the sound levels exceeded for a percentage of the instrument measuring time. L_{10} indicates that for 10% of the monitoring period, the sound levels were greater than the quoted value. L_{10} is a good statistical parameter for expressing event noise such as passing traffic. The L_{90} represents post event sound levels and is a good indicator of background noise levels.

Tonal Characteristics

For the purpose of this report, tonal characteristics of the noise are defined in accordance with IS0 1996-2, *Acoustics – Description and measurement of environmental noise-Part2: Acquisition of data pertinent to land use* which indicates that a noise source being tonal if a particular frequency is either clearly audible or 5dB greater than the flanking frequencies. The frequency spectrum range used of 31.5 Hz to 4 kHz is within the normal hearing range of humans.

3.7.2 RESULTS OF ON-GOING NOISE SURVEYS

Table 2.7/2 overleaf presents the on-going results of the noise survey undertaken at the facility for 2001 to 2005.

TABLE 2.7/2: SITE NOISE MEASUREMENTS

	Map Ref.	Period (mins)	L_{eq} dB(A)	L_{10} dB(A)	L_{90} dB(A)	L_{AF} Max dB(A)
2001	N1	30	42	45	38	54
	N2	30	30	32	25	50
	N3	30	29	30	26	56
	N4	30	36	37	32	60
	N5	30	62	60	29	82
2002	N1	30	49	52	36	85
	N2	30	49	50	34	94
	N3	30	42	45	33	82
	N4	30	51	55	37	66
	N5	30	54	48	35	104
2003	N1	30	49	47	32	78
	N2	30	55	59	28	75
	N3	30	41	40	28	66
	N4	30	51	53	32	74
	N5	30	49	53	32	69
2004	N1	30	38	41	31	64
	N2	30	34	37	<30	63
	N3	30	41	42	32	74
	N4	30	39	42	<30	55
	N5	30	48	50	39	69
2005	N1	30	36	39	28	60
	N2	30	36	33	27	65
	N3	30	36	39	27	64
	N4	30	38	37	26	67
	N5	30	53	37	25	79

The day time noise surveys carried out between 2001 to 2005 at the site boundaries recorded Leq levels (N1-N4) ranging from 29-62 dB A. The L_{90} values (noise levels experienced for 90% of the monitoring period) ranged from 25-39 dBA and this indicates the background noise levels. A significant element of this noise determined for the noise assessments may be attributed to vehicle traffic noise generated on-site, passing farm machinery on the laneway adjacent to the eastern boundary of the landfill and low-lying aircraft's as demonstrated by the L_{10} values which range from 30-60 dB A.

The daytime noise limit for the nearest noise sensitive location is 55 dB A as specified in Waste Licence No 49-1. A determined L_{eq} value of 62.0 dB (A) measured during the 2001 monitoring event was the only time the L_{eq} was above the limit over the past four years. On site observations made during the monitoring survey suggest that the dominant noise source at this location was that of passing traffic along the road to the south of the monitoring location and on the laneway adjacent to the monitoring location. The L_{90} during the monitoring interval (which shows the noise levels experienced for 90% of the monitoring period) was 29 dB (A) which indicates that the site activity is not impacting on the local noise environment.

TABLE 2.7/3: ONE THIRD OCTAVE FREQUENCY SPECTRUM FOR 2001

Map Ref.	N 1	N 2	N 3	N 4	N 5
Frequency Hz	dB	dB	dB	dB	DB
31.5	50.6	43.1	40.5	43.6	22.5
40	51.8	42.3	40.0	41.5	27.0
50	51.3	45.6	39.9	42.2	27.4
63	50.2	41.0	37.2	38.4	37.0
80	49.1	35.9	36.1	39.1	55.0
100	45.0	32.4	30.5	32.0	53.8
125	34.2	26.0	29.6	26.7	36.1
160	32.4	24.2	28.1	24.4	26.5
200	30.1	22.8	22.1	23.6	22.8
250	31.5	20.9	20.8	22.0	20.3
315	28.9	20.1	20.5	22.4	19.9
400	33.1	18.5	19.2	21.5	22.2
500	31.9	18.0	18.1	21.6	23.1
630	32.3	16.7	17.6	20.5	29.2
800	29.1	17.7	16.9	19.3	29.4
1K	27.3	16.0	15.5	20.5	40.5
1.25K	27.1	16.3	15.3	16.5	47.3
1.6K	26.4	13.9	15.0	17.4	50.3
2K	23.4	13.7	15.1	15.1	54.0
2.5K	23.6	12.7	16.0	13.5	49.4
3.15K	20.4	12.6	19.2	15.2	49.3
4K	18.4	11.9	31.5	15.5	50.5

TABLE 3.7/4: ONE THIRD OCTAVE FREQUENCY SPECTRUM FOR 2002

Map Ref.	N 1	N 2	N 3	N 4	N 5
Frequency Hz	dB	dB	dB	dB	DB
12.5	53.7	65.2	55	55	71.1
16	53	64.6	51.3	48.2	64.1
20	50.9	54.8	55	44.8	51.1
25	53.14	68	55	49.1	51.1
31.5	49.5	53.8	55	49.7	47
40	46.9	51.3	52.4	49.8	47.9
50	48.5	48	52	49.8	46.4
63	51.1	49.1	48.3	45	53.8
80	39.2	42.7	41.9	36.2	51.1
100	37.8	38.5	39.9	32.6	41.6
125	41.3	38.9	34	35	38.3
160	34.8	36	37.1	37.5	29
200	33.1	34.4	27.4	38	27
250	36.6	33.2	29.4	38	28.1
315	33.6	38.1	30.2	33.2	27.7
400	37	30.4	25.9	34.5	26.5
500	35.8	29.9	20.2	30.8	25.4
630	26.1	27.8	22.9	30.4	25.7
800	23.8	27.1	20.1	32.4	34.3
1K	23.5	24	19.7	36	34.4
1.25K	22	22.8	18.5	31.9	37.3
1.6K	22.7	23	20.1	31.8	24.4
2K	19.1	22	17.2	29.8	25.1
2.5K	18.4	22.4	17.1	28.5	26.5
3.15K	16.5	20.9	18.1	22.4	27.4
4K	19.8	23.3	17.4	19.7	27.8
5K	21.8	21.9	14.6	21.9	24.1
6.3K	22	23	13.5	15.6	21.3
8K	21.4	24.6	13.1	12.2	22.1
10K	31.6	22	12.3	12.1	21.3
12.5K	31.6	20.6	12.9	11.6	16.4
16K	31.6	16.6	13.3	11.6	13.7
20K	31.6	13.1	11.7	11.6	11.8

TABLE 3.7/5: ONE THIRD OCTAVE FREQUENCY SPECTRUM FOR 2003

Map Ref.	N 1	N 2	N 3	N 4	N 5
Frequency Hz	dB	dB	dB	dB	DB
12.5	12.2	18.3	12.0	12.1	12.5
16	13.6	21.9	13.5	15.8	14.5
20	11.6	27.5	12.3	22.6	16.1
25	21.5	25.3	14.4	23.0	17.1
31.5	18.1	27.1	12.6	35.0	16.4
40	20.9	35.0	15.9	39.1	26.0
50	29.6	26.6	15.1	39.2	32.6
63	25.0	32.9	18.8	40.2	35.1
80	32.6	30.8	16.6	43.9	31.1
100	28.7	42.4	20.6	45.8	30.5
125	30.7	28.7	15.7	30.7	31.2
160	23.4	33.8	18.7	45.5	18.6
200	25.0	30.5	21.5	44.5	14.6
250	22.9	30.2	23.9	32.1	20.0
315	27.3	39.5	25.0	26.6	24.9
400	26.6	40.5	21.6	30.6	23.5
500	29.9	43.2	23.3	25.1	24.4
630	41.8	34.2	23.1	28.2	25.6
800	36.2	31.2	22.0	34.7	21.7
1K	25.1	29.7	21.9	28.4	23.0
1.25K	27.4	24.6	20.9	36.5	22.2
1.6K	25.9	21.6	19.3	29.0	23.6
2K	25.7	22.7	20.0	32.9	22.0
2.5K	23.5	22.4	18.2	27.9	25.1
3.15K	27.4	19.3	16.6	30.1	22.9
4K	29.5	21.7	15.6	25.8	21.6
5K	20.4	22.3	15.4	22.8	19.8
6.3K	16.5	22.7	16.6	25.4	19.9
8K	13.8	22.4	16.8	18.3	15.5
10K	16.8	20.3	14.1	27.4	15.1
12.5K	15.4	21.2	12.5	30.3	14.8
16K	19.2	22.6	13.6	31.1	12.9
20K	15.1	11.6	11.6	11.6	11.6

Frequency spectrum data determined at the 4 boundaries (N1-N4) and noise sensitive location N5 is presented in Table 3.7/2 for 2001, 3.7/4 for 2002, 3.7/5 for 2003 and shown graphically in Appendix 1 for 2004. It is noted at the noise sensitive location (N5) that tonal noise emissions were variable during the 2001, 2002 and 2003 monitoring intervals indicating that noise sources are not uniform as observed via each variable noise frequency spectrum determined at this location. It must be noted that no tonal noise was recorded at the noise sensitive receptor during the 2004 and 2005 monitoring surveys.

3.7.3 ENVIRONMENTAL IMPACTS

Noise is described as unwanted sound and, because of its subjective nature, the level of annoyance is difficult to measure. There are standards which define levels of acceptability for various commercial and residential developments and these are detailed in the previous section 3.7.1. In addition , the daytime noise limit for the nearest noise sensitive location is 55 dB A as specified in Waste Licence No 49-1 (refer to Attachment 1).

(1) Construction/Operation Phases

During the construction phases excavation works on the site will temporarily increase the noise levels in the immediate vicinity during cell construction/capping phases, due to the use of excavation and soil removal equipment. Typical noise levels for the construction machinery range from 80 to 100 dB(A). However, the negative impact caused by this disturbance will be minimised due to the "setback" distance from the site to the nearest residential dwelling. In addition the noise generation from cell construction/capping will be short term and will occur only on an annual basis.

According to the noise survey carried out two potential noise sources have been identified which may occur during the operation of the ash disposal facility. Firstly, rail wagons taking waste to the site from the power station and secondly, an excavator employed to level deposited ash at the active disposal cell and to cap the waste ash with intermediate/final cover material. Predictions of the contribution of the two noise sources (excavator and wagons) to the noise levels at boundary of the nearest dwelling are 24 and 36 dB (A), respectively.

A tractor mounted pump on-site draws water from the interceptor lagoon for the purpose of dampening deposited ash using a water spray/sprinkler system. The

operation of the tractor mounted pump will occur for no more than a hour per day during the operational hours of the site. It is assumed that the specific noise reference of the tractor/pump unit will be at approximately 92 dB(A), which is a similar level to that of the excavator to be used on site.

However, as there is no direct line of sight from the landfill to the dwelling house, the actual levels would be reduced significantly. In addition, the operation of the excavator is likely to be intermittent, and it is anticipated that no more three trains per day will arrive at and leave the site. Taking into account the location of the landfill site in relation to the nearest dwelling, the results of the noise monitoring programme indicate that the noise generated at the facility will not have any undesirable effects on the existing neighbouring environment.

This is confirmed by the on-going noise monitoring at the facility in compliance with the waste licence 49-1.

3.7.4 MITIGATION MEASURES

As detailed above, the ash repository site is situated in a relatively isolated location, with the nearest dwelling > 500 m away. The results of the on-going noise monitoring programme indicates that the noise generated at the facility dose not have any undesirable effects on the existing noise environment. The noise monitoring which has been carried out over the past four years has been in compliance with the limit of 55 dB (A) as stated in the waste licence. There is to be no changes to the practices carried out on site which would impact on the local noise environment therefore no mitigation measures are a required.

Figure 3.7/1 Octave monitoring data spectrum at N5 (Noise Sensitive Location)

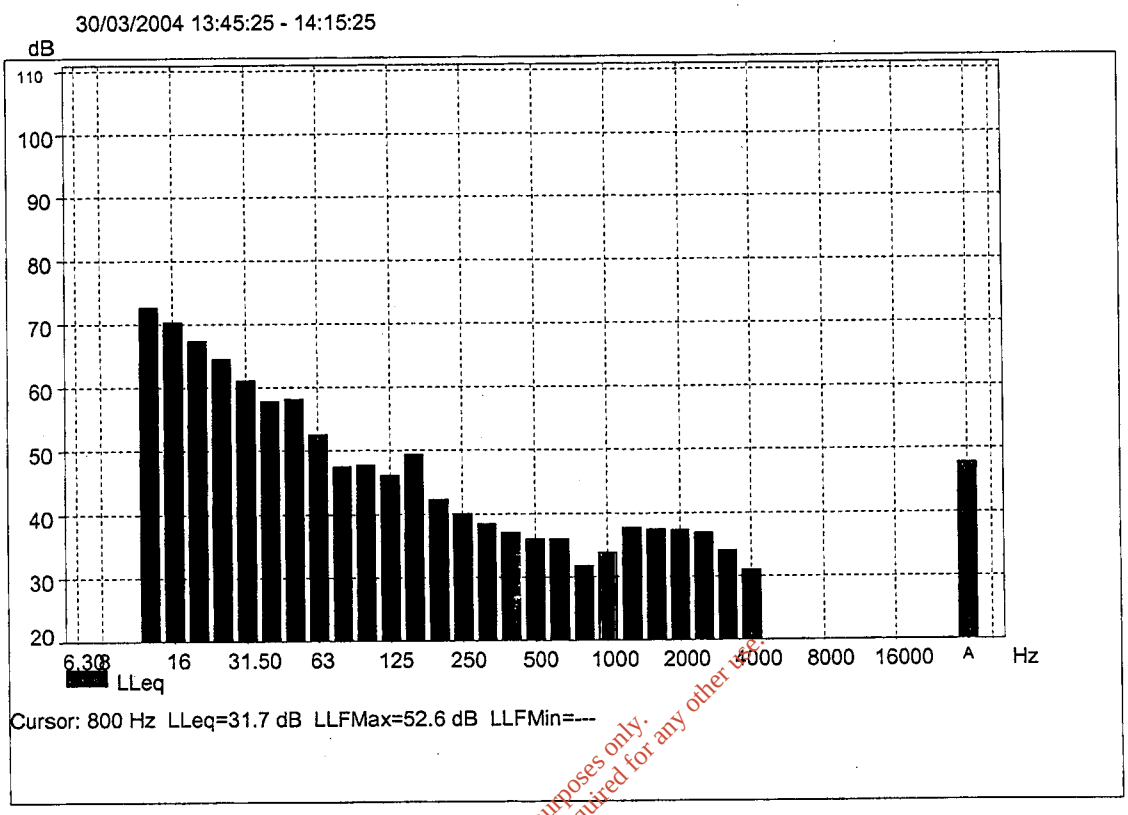
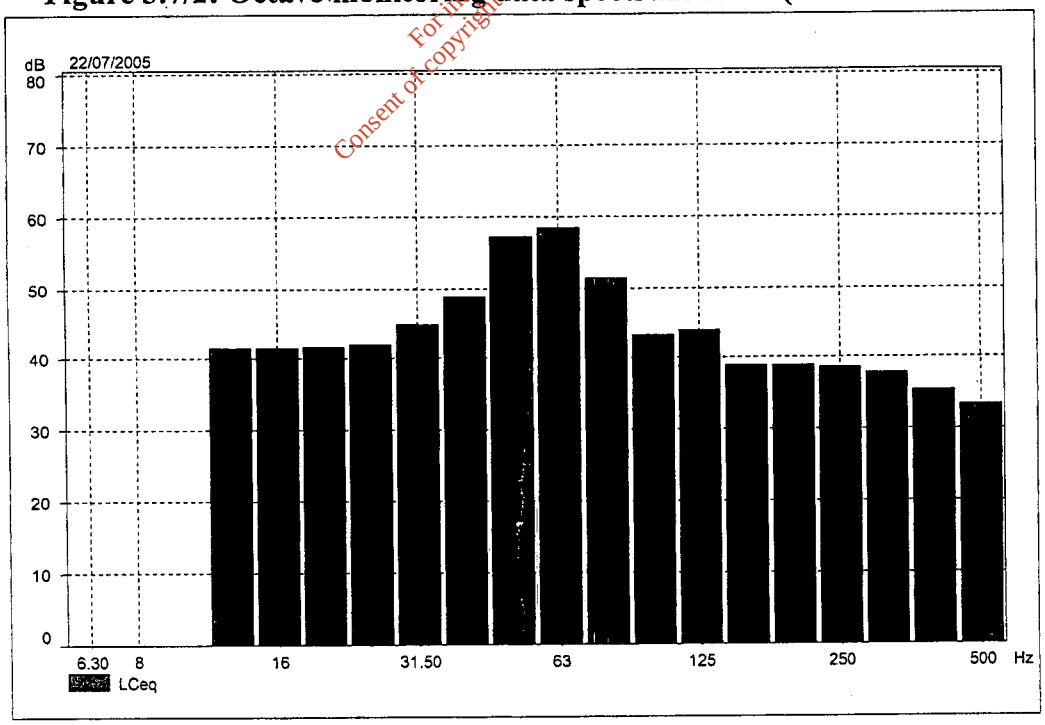


Figure 3.7/2: Octave monitoring data spectrum at N5 (Noise Sensitive Location)



3.8 LANDSCAPE & CULTURAL HERITAGE

Any change in an area has a corresponding impact on the character of that particular area. However, the extent of impact depends on cultural associations, uniqueness and degree of change in the landscape and the nature of the surrounding land-uses.

3.8.1 SITE DESCRIPTION/LANDSCAPE CHARACTER

The proposed development site is a greenfield site located approximately 8 km South West of the town of Edenderry and 2 km North West of Clonbullogue village. The facility is setback approximately 0.75 km from the Clonbullogue to Daingean road and is within a predominantly low intensity farmland and cut-away peatland.

The topography of the area is that of flat landscape, and the ash repository site has been designed to minimise any visual impacts on the surrounding areas.

The ash repository facility is not located within a formal or proposed area of landscape or scenic value (as detailed in the Offaly County Council County Development plan 2003-2009). It is described in the county development plan as low sensitivity rural areas and agricultural areas.

3.8.2 ENVIRONMENTAL IMPACTS

- Due to the setback distance of the site from the Clonbullogue to Daingean road, the site will pose no impact on the natural landscape and any views from this road. There will be no constructional buildings associated with the site and the excavation of soil as part of the construction phase will only be short term posing little impact on the surrounding areas.

- The proposed final elevations of the deposited ash are shown on Drawing No 2401057-5: Sections. The final elevation of the ash disposal facility is considered to pose no visual impact due to the (i) setback distance from the roadway and adjacent private dwellings; (ii) back drop of extensive drained and

cut-back peatlands; and (iii) the low elevation of the landfill above the surrounding lands.

- The design of the restoration plan and the final landscape plan will ensure the visual integration of the landfill into the surrounds in order to minimise the visual intrusion of the landfill development.

2.8.3 BASELINE CULTURAL HERITAGE ASSESSMENT

A cultural heritage assessment of the ash repository facility and its environs was undertaken by a specialist on behalf of Bord na Móna Environmental Consultancy Services as part of the original EIS in April 1998. In addition archaeological monitoring was carried out during groundworks at the facility in August 1999.

This assessment is undertaken to examine Archaeological, Architectural and Historical assets of the area. This includes all humanly created features on the landscape, including portable artefacts, which might reflect the prehistoric, historic, architectural, engineering and/or social history of the area. The cut-off point is based on obsolescence, e.g. having gone out of common use and/or reflective of skills and techniques no longer practised.

The study involved documentary search, discussions with a local historian and on-site field inspection of the area. As part of a documentary search, the following sources were examined from which a list of sites and areas of archaeological potential was compiled:

- Record of Monuments & Places – Co. Offaly.
- National Museum of Ireland – Topographical Files.
- Ordnance Survey 6" maps for Co. Offaly.
- Stereoscopic photographic coverage carried out by Geological Survey.
- Documentary & Cartographic Sources in Laois County Library.
- Offaly County Development Plan 1996.
- Documentary sources in Offaly County Library (Tullamore).

From the preceding Paper Survey, a list of archaeological sites/sites of archaeological interest was compiled for detailed inspection during the field

inspection. In addition, the faces of the existing open drains and the 100 m wide corridor of the rail-link route was examined.

(1) Archaeology

The archaeological heritage of wetland/bog areas is a rich and diverse resource. Within the spongy wet layers of dead plant life, bacteria which cause the decay and degeneration of plant remains and animal tissue, cannot survive. Thus buildings, roadways and everyday objects survive for countless centuries within peat. This acts as a storehouse for microscopic plant pollen and insect remians which can tell us about the vegetation cover surrounding earlier settlements. Traditional peat cutting has yielded many significant discoveries including prehistoric weapons, personal ornaments, leather containers, wooden vessels and wicker objects of all kinds.

Preliminary studies by the Irish Archaeological Wetland Unit in north-west Co. Offaly have indicated that, on average, one archaeological site exists in every 8 – 10 ha. Of peatland, although in some locations up to 40 individual sites have been recorded in similar areas. Furthermore, given the fact that wetlands make up almost one-third of the area of Co. Offaly, it can be assumed that they served as major obstacles to transport from prehistoric times as will as playing a major role, not only in the siting of settlements, but also in the social organisation of past human communities.

No specific archaeological deposits or artifacts are known from the defined study area.

(2) History

There are no known traditions associated with the site or its immediate environs and consequently the proposed development does not impact on any features or events of historical interest.

(3) Architecture

This section on architecture covers buildings and structures in the vicinity of the development, which are not covered in the Archaeology section. There are no buildings and structures of architecture interest within the vicinity of the development and consequently the proposed development does not pose a threat.

(4) Groundworks Monitoring

Three test trenches were excavated to assess the nature and depth of deposits. These identified preserved timbers, however there were no archaeological materials or deposits encountered.

2.8.4 Environmental Impacts on Cultural Heritage

There will be no increase in the identified impacts as a result of the proposed changes at the facility (i.e. the changes in the composition & quantities of ash).

There were no extant or surface traces of sites of archaeological potential and/or interest identified on the site and as such there are no direct impacts predicted.

However, given the nature of peat as a repository of archaeological/cultural heritage artifacts, structures and deposits, it is possible that material may exist directly in the peat horizons or either on or cut into the underlying subsoil. Indeed a buried topsoil horizon may exist below the peat horizons. The archaeological results presented here are base on conventional archaeological survey, which comprises detailed documentary and cartographic research followed by a physical examination of the surface of the site, as well as the general examination of the open drain faces that exist in the immediate vicinity off the site.

In general, the removal of the existing peat deposits, as well as the reduction of the surface levels of the underlying subsoil, increases the likelihood of disturbing deposits which may contain archaeological remains as well as archaeological structures that might exist within the peat horizon.

2.8.5 Mitigation Measures on Cultural Heritage

In order to minimise the potential of impacts on the unknown deposits during the removal of topsoil and overburden on the development site during both the construction and operational phases all such activities will be monitored by an archaeologist, employed by the developer.

Should archaeological material be discovered during the stripping programme, then provision will be made for the archaeological investigation/excavation of such material, including the arrangement, by the developer, of finances for reporting, conservation and dating, specialist reports, publication, etc.

3.9 CLIMATIC FACTORS

3.9.1 BASELINE DATA

While the development will have no envisaged effects on climate, climatological factors will have a direct impact on possible water and air emissions from the landfill development. In order to determine the environmental effects of leachate generation and air pollution dispersion various climatic factors must be considered. The source and magnitude of these emissions are examined in sections 3.6: Air, 2.4: Hydrology and 2.5: Hydrogeology respectively. This section describes the effect of climatological factors on leachate generation and air pollution dispersion.

In compliance with the waste Licence (49-1) meteorological monitoring is undertaken at the climatological station at the Bord na Móna Energy Works in Derrygreenagh (6-7 miles away). This station records the precipitation, temperature, wind force and direction, evaporation, humidity and atmospheric pressure with the results being manually recorded on a regular basis.

(1) Precipitation

Annual rates of precipitation for the Clonbullogue area from 2001 to 2004 are given in table 3.9/1 below. Over the four years of data presented below the annual rainfall figures have averaged at approximately 848.5 mm with the months of January, February, May and October receiving the greatest monthly rates. Winter rainfall is commonly associated with Atlantic frontal depressions whereas during the summer months high rainfall amounts will tend to be associated with intense thunder showers which may be localised in rainfall intensity.

Table 3.9/1 Precipitation Rates at Derrygreenagh Climatological Stations (mm).

Period	J	F	M	A	M	J	J	A	S	O	N	D	Ann
2001	41.2	56.8	68.4	68.3	28.1	58.7	49.7	84.1	47.5	126.3	41.2	24.5	694.8
2002	102.9	149.9	42.1	70.9	102.1	88.9	55.5	44.5	18.7	151.4	161.9	95.9	1084.7
2003	50.1	48.2	36.5	46.8	107.9	80.1	90.6	7.2	49.4	51.8	63.6	71.7	703.9
2004	111.2	29.7	55.5	54.3	53.7	61.6	52.8	161.4	55.5	138.7	65.1	71.1	910.6

(2) Air Temperature

The pattern of monthly temperatures at Derrygreenagh for 2001to 2004 are shown in Table 3.9/2 below.

Table 3.9/2 Monthly Air Temperature at Derrygreenagh, Co. Offaly (2001-2004).

		J	F	M	A	M	J	J	A	S	O	N	D
2001	Mean maximum	6.2	8.2	8.9	11.9	17.7	17.8	19.6	19.7	17.5	14.7	10.8	7.8
2001	Min maximum	-0.7	0.6	1.2	3.2	6.1	8.5	10.9	10.4	8.6	7.8	4.4	-1.4
2002	Mean maximum	9.7	9.5	11.6	13.0	15.3	16.8	18.3	19.3	17.8	13.0	11.3	7.8
2002	Min maximum	3.0	2.7	3.0	4.0	6.4	9.0	10.7	11.2	8.2	5.2	5.1	3.7
2003	Mean maximum	7.6	8.2	12.8	14.4	15.3	18.7	20.1	21.8	18.2	13.2	11.2	8.3
2003	Min maximum	1.6	1.4	2.2	4.8	7.0	10.0	12.4	11.6	9.3	4.4	3.3	2.2
2004	Mean maximum	8.3	9.1	11.0	13.3	16.5	19.4	18.8	20.0	17.7	12.6	10.7	9.2
2004	Min maximum	1.4	1.0	2.4	4.6	6.2	10.6	10.3	12.1	10.2	4.7	5.5	3.1

(3) Wind

Wind field data was obtained from the Derrygreenagh weather station and the wind rose for the station is given in Attachment 8. These illustrate that the predominant wind direction for the area is west to south-westerly.

(4) Humidity & Atmospheric Pressure

The pattern of monthly humidity and atmospheric pressure records at Derrygreenagh from 2001 to 2004 records are shown in Table 2.9/3 below.

Table 3.9/3 Monthly humidity and atmospheric pressure at Derrygreenagh, Co. Offaly (2001-2004).

Year		J	F	M	A	M	J	J	A	S	O	N	D
2001	Humidity	95	94	90	89	81	84	87	90	92	92	91	88
2001	Pressure	993.3	1003	988	999	1007	1004	1001	1000	1003	993	1011	1024
2002	Humidity	89	85	83	79	81	83	83	84	84	89	90	90
2002	Pressure	1011	1005	1014	1014	1008	1012	1015	1017	1021	1010	999	1012
2003	Humidity	87	85	81	79	82	79	83	80	84	85	88	91
2003	Pressure	1002	1002	1007	1002	999	1000	1000	1007	1006	1003	994	1004
2004	Humidity	90	83	81	81	79	80	81	84	86	88	89	90
2004	Pressure	994	1009	1005	999	1005	1004	1003	996	1003	991	1010	1004

(5) Microclimate

The microclimate is defined as the climate within the immediate locality of the landfill site over an area, typically within 1-2km of the site. The microclimate can be characterised by low to intermediate lying ground (approximately 70m O.D) which is partly pasture land and partly drained bog area. During low wind speeds, especially during the winter months, mist or fog would be a common feature in this part of Offaly. The bog area would increase the relative humidity in the lower air layers contributing to poor visibility conditions.

3.9.2 ENVIRONMENTAL IMPACTS

No direct impacts on the climate (wind & rain patterns and ambient air temperatures) of the area are envisaged therefore no specific mitigation measures are proposed.

3.10 INTERACTIONS OF THE FOREGOING

All environmental factors are inter-related to some extent. As defined in the Environmental Protection Agency 'Draft Guidelines on the Information to be Contained in Environmental Impact Statements', a cumulative effect is defined as '*..the addition of many small impacts to create one larger, more significant impact*'. A synergistic impact occurs where *'the resultant impact is of greater significance than the sum of its constituents*'. Cumulative and synergistic effects are, therefore, those which result from the incremental effect of an action when added to other past, present, and reasonably foreseeable actions. The European Communities Environmental Impact Assessment (Amendment) Regulations, 1998, demand that an EIS describes the impacts and likely significant effects on the interaction between any of the following principal elements of the environment media :

- human beings
- Geology
- soil
- water
- air
- climate
- the landscape

Tables 2.1/1 and 2.1/2 on pages 7 and 8 highlight the impacts and effects on interactions between these media and identifies the sections of the EIS where the interactions are addressed.

3.10.1 WATER: HUMAN BEINGS/ECOLOGY

Contamination of nearby surface water bodies has the *potential* to impact on the water quality of the River Figile and River Barrow. This impact could *potentially* impact the biological quality of the water and has the *potential* of affecting the amenity value of the river, which would in turn affect human beings. *Potential* contamination of groundwater beneath the site would restrict any future use of the underlying strata for water supplies and would also have the *potential* to impact on the water quality on the local waterways. Mitigation measures to ameliorate these potential impacts are proposed in § 3.4.7

Hydrology for surface waters. In the case of groundwaters it is not envisaged that the quality of the underlying aquifers will be impacted.

3.10.2 HUMAN BEINGS: AIR/LANDSCAPE

Dust emissions and noise emissions from the ash repository site have the *potential* to impact on human beings in the vicinity of the site. Impacts from dust emissions have the potential of being the most significant impact of the proposed development. Mitigation measures to prevent the aforementioned impacts are given in § 3.6.4: Air.

The proposed development will be constructed and shall operate in accordance with the BATNEEC principle, thus reducing any *potential* impacts.

The visual impact of the facility has the potential to affect human beings, however the site is situated off the road and away from any residential housing therefore it is not envisaged to have an impact of the surrounding environment.

3.10.3 ECOLOGY: GEOLOGY/AIR

Minor impacts will be encountered by the flora and fauna due to the temporary loss of habitat within the proposed excavation of the cells. This habitat however, is not considered ecologically significant (refer to §3.2.2: Ecology/Baseline Ecological Study). In addition, restoration of the cells upon completion will enhance the flora and faunal biodiversity of the area by creating a new niche to the area.

The migration of dust emissions can have negative impacts on vegetation surrounding the site, however this impact is localised and the vegetation impacted on, is again of low ecological value. Mitigation measures proposed for the amelioration of this impact are outlined in § 3.6.4:Air.

TABLE 3.10/1: SUMMARY OF THE ENVIRONMENTAL IMPACTS OF THE ASH REPOSITORY, CLONCREEN BOG, CLONBULLOGUE, CO. OFFALY

	Human Beings	Ecology	Geology	Water	Air	Climate	The Landscape	Material Assets	Cultural Heritage
Human Beings	3.1	none	none	3.4 & 3.5	3.1 & 3.6	none	3.1 & 3.8	3.1	none
Ecology	none	3.2	none	3.2, 3.4 & 3.5	3.2 & 3.6	none	none	none	none
Geology	none	None	3.3	none	none	none	none	none	3.8
Water	3.1, 3.4, & 3.5	3.2, 3.4 & 3.5	none	3.4 & 3.5	none	none	none	none	none
Air	3.1 & 3.6	3.2 & 3.6	none	none	3.6	none	none	none	none
Climate	None	None	none	none	none	3.9	none	none	none
Landscape	3.5 & 3.7	None	none	none	none	none	3.8	none	none
Material Assets	3.1	None	None	None	None	None	None	3.1	none
Cultural Heritage	None	none	3.8	none	none	none	none	none	3.8

Any interactions which will not be impacted upon or affected by the facility are not described in the EIS.