10 GROUNDWATER / HYDROGEOLOGY

This application for the proposed amendments will have no impact on the hydrogeology of the site and its environs. The proposed amendments to the application now being submitted (as outlined in section 1.1), are for the same development, on the same site and a similar building footprint, which does not change the assessment already undertaken. The findings from the assessment already undertaken in 2005 and included in the EIS submitted in 2006 are detailed below with some minor updates to include more recent data where available.

10.1 INTRODUCTION

The information regarding the existing hydrogeological environment is based on investigations completed at the site in 2000 and 2001, geotechnical reports based on assessments completed in 2007 and 2008, a desk study and information from the Geological Survey of Ireland database.

10.2 OVERBURDEN HYDROGEOLOGY

The development site is underlain by a thick deposit of low permeability brown silty clays. Some discontinuous lenses of sandy horizons and gravels were also recorded. The vulnerability of the immediate area has been classified by the Geological Survey of Ireland (GSI) as Moderate (Figure 10.1).

The boulder clay varies in thickness across the site, ranging from approximately four metres towards the west of the site, to in excess of 10 metres towards the centre underneath the main building.

As described in Chapter 9 Soils & Geology, the base of the waste bunker when constructed will be below the surface of the bedrock. The site specific vulnerability rating in this area would therefore be considered extreme. Throughout the rest of the site, generally shallow excavations of overburden are required. The vulnerability in these areas is likely to be of moderate to high rating.

As described further below, the waste bunker has been designed for full containment. The bunker floor will have a basal thickness of 1.1m and a wall thickness underground of 800mm. The bunker will have a secondary containment system with fully sealed membrane and leak detection system to ensure that at the bunker remains water tight all times. Despite the vulnerability rating of this area the risk of contaminating the aquifer is very low.

10.3 BEDROCK AQUIFER

As detailed in Section 9, the limestones found beneath the development site are part of the Platin Formation. The grey limestone which was weathered at the surface was proven by borehole drilling at the site. The limestone is typical of the Lower Carboniferous shallow water limestones. These are typically pale thick-bedded with minor shales, possible dolomitised, with palaeokarstic features (GSI Sheet 16 and Meath Groundwater Protection Scheme). The Platin Formation has been classified by the GSI as; *regionally important, diffuse karst aquifer, good development potential (Rkd)* (Figure 10.2). This classification was determined by the GSI in 2004. This regionally important aquifer displays both karst and fracture flow features.

Since the implementation of the Water Framework Directive (WFD –Directive 2000/60/EC) various initiatives have been underway to lead to its implementation in Ireland. Characterisation of aquifers is one of the first key deliverables in the implementation of the WFD. Eight River Basin districts have been established in Ireland. The development is located in the Eastern River Basin District. The karstified aquifer upon which the site is located has been classified as of "poor" status. According to the ERBD report concentrations of orthophosphate exceed its water quality threshold in a number of streams which flow over the "Bettystown" groundwater body i.e. the karstified Platin Formation. The karstic nature and productivity of the Platin Formation are demonstrated at the nearby Platin Quarry where a significant dewatering operation is required to maintain dry working conditions at the quarry floor. The development site is located within the local groundwater regime which is now largely determined by the Platin Quarry dewatering programme.

10.4 Aquifer Vulnerability and Resource Protection

On the basis of site specific data, the GSI/EPA/DoEHLG Groundwater Protection Scheme Classification (see table below) ranks the site as having a high (H) to moderate (M) vulnerability due to the thickness and type of overburden cover present at the site.

Table 10.1 GSI Vulnerability Mapping Guidelines.

Vulnerability Rating	Hydrogeological Requirements (below the point of release of contaminants)				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Recharge Type
	high permeability (sand/gravel)	Moderate permeability (sandy till)	Low permeability (clayey till, clay, peat)	(sand & gravel aquifers only)	
Extreme	0-3.0m	0-3.0 m	0-3.0m	0-3.0m	point (<30 m radius)
High	>3.0	3.0-10.0m	3.0-5.0m	>3.0m	N/A
Moderate	N/A	>10m	5.0-10.0m	N/A	N/A
Low	N/A	N/A	>10.0m	N/A	N/A

Notes: i)N/A =not applicable

ii) Precise permeability values cannot be given at present

iii) Release point of contaminants is assumed to be 1-2 m below ground surface

(from Daly & Warren 1997)

Figures 9.2 and 9.3 (Section 9 Soils & Geology) present the location of the soil borings and trial pits across the site together with lines of cross section. The lines of cross section show schematically that the shallow geology across the site comprises boulder clays for the most part with some discontinuous lenses of silts and gravels. In addition, percolation testing was undertaken at the site which determined extremely low percolation rates due to the presence of these clays.

10.4.1 Assessment of Resource Protection Zonation

As the bedrock aquifer is considered Regionally important, and the soil cover varies in thickness from zero at the base of the waste bunker (post construction) to in excess of 10 metres in thickness in places, the site is assigned a rating of Regionally Important-Extreme to Regionally Important-Moderate (Rk/E to Rk/M) under the GSI classification system for designating resource protection zones.

Response levels have been developed for three polluting activities (septic tanks, landspreading and landfills) using this matrix of resource protection zones. Based on the risk involved in each of these potentially polluting activities, they are either acceptable, acceptable subject to conditions, not acceptable with some exemptions or not acceptable. There is no response level developed for waste-to-energy facilities, however stringent mitigation measures have been incorporated into the bunker design to provide adequate resource protection.

10.5 GROUNDWATER FLOW

Groundwater flow beneath the development site is determined by a cone of depression centred on the Platin excavation. Prior to the quarry development, the groundwater flow beneath the development site would have been towards the River Nanny and in a general south easterly direction.

Today, the groundwater flow beneath the development site has been reversed and is now northwards towards the nearby Platin quarry due to the lowering of the water table within the excavation. Current water levels are at approximately 10-15 mOD well below the level of any excavations for the development.

The groundwater abstracted from the excavation at Platin Quarry is piped directly to the River Nanny and so there is no loss of groundwater to this river. In fact there is a small increase due to the Platin excavation drawing some groundwater from the Boyne River catchment.

10.6 GROUNDWATER ABSTRACTIONS

Groundwater is extensively used by the local community as a source of water supply. A GSI well search in 2005 revealed 22 recorded wells within 3km of the site (see Table 10.3 for well data). It should be noted that the GSI database is not a complete data source for all private water wells.

Table 10.2 GSI Well search (3km radius around 306300, 270900)

DTB	DEPTH	GSI HOLENAME	TYPE	EASTING	NORTHING	TOWNLAND	USAGE	YIELD	YIELD CLASS	AVE DAILY ABSTRACT	WATER STRIKE	MAIN AQUIFER	ABSTR-ACTION
8.2	22.9	2925NWW070	Bored Well	30460	26835	DULEEK		109	Good			Limestone	
7.6	48.2	2925NWW071	Bored Well	30460	26830	DULEEK	Agri/ domestic use	101	Good			Limestone & Drift	
31.5	63.1	2925NWW072	Unknown well	30460	26825	DULEEK		12.5	Poor			Boulder Clay, Sand & Gravel, Limestone	
	18.9	2925NEW070	Bored Well	30855	26910	BEAUMONT		49	Moderate				
0	61	2927SEW047	Bored Well	30605	27150	PLATIN	Industrial	3600	Excellent	3600	41	Limestone with fissures.	137.5
	30	2927SEW048	Bored Well	30590	27135	PLATIN	Industrial	3600	Excellent	3600		Limestone	
	24.4	2925NWW060	Bored Well	30359	26852	DOWNESTOWN	Public supply		Poor	10			
	4.6	2925NEW058	Dug Well	30551	26899	BELLEWSTOWN	Public supply	3.3	Poor				
9.1	42.7	2927SEW036	Bored Well	30665	27210	PLATIN	Public supply	54.5	Moderate				
0	61	2927SEW037	Bored Well	30600	27150	PLATIN, DULEEK	Industrial		Unknown		2.5		
15.2	47.2	2927SEW038	Bored Well	30665	27190	PLATIN	Industrial	872.7	Excellent		28.9		51.12
11.3	34.1	2927SEW039	Bored Well	30665	27185	PLATIN	Industrial	164	Good		14.6		
	21.9	2927SEW041	Bored Well	30630	27335	DROGHEDA		28	Poor				
		2927SEW035	Bored Well	30665	27205	PLATIN			Unknown				
	6.7	2927SEW001	Dug Well	30745	27211	BEYMORE			Unknown				
		2927SEW003	Dug Well	30500	27200	DONORE			Unknown				
	6.1	2927SEW106	Dug Well	30387	27362	OLDBRIDGE							
9.8	10.3	2927SEW107	Dug Well	30380	27363	OLDBRIDGE							

Table 10.2 GSI Well search (3km radius around 306300, 270900) Contd.

DTB	DEPTH	GSI HOLENAME	TYPE	EASTING	NORTHING	TOWNLAND	USAGE	YIELD	YIELD CLASS	AVE DAILY ABSTRACT	WATER STRIKE	MAIN AQUIFER	ABSTR-ACTION
5.1	5.1	2927SEW108	Dug Well	30372	27364	DOWTH							
1.8	1.8	2927SEW109	Dug Well	30367	27365	DOWTH							
0	76.2	2927SEW110	Bored Well	30601	27258	DONORE	Agri/ domestic use	21.8	Poor				
0	42.7	2827SEW111	Bored Well	30602	27251	DONORE	Agri/ domestic use	1091	Excellent		36.5		

Historical Ref.	DW1	DW6	DW12	DW14	DW15	DW39
Well Depth (m)	2.75	4	42	>20	33	73
Date of Well Assessment	Water Level (Metres below ground level (mbgl))					
14-Feb-05	1.10	1.20	11.56	11.15	17.63	21.70
02-Sep-05	1.80	1.49	15.10	13.70	20.65	29.30
02-Dec-05	1.00	1.25	13.99	14.74	19.50	27.18

Table 10.3: Existing Well Data Available within 1.5km of the development

Table 10.3 above gives summary details of domestic wells in the vicinity of the development site and those available on public records managed by Meath County Council. The wells above fall within the cone of depression associated with Platin Quarry and have been monitored over many years as part of the quarry's planning permission.

10.6.1 On Site Groundwater Abstraction

Trial wells have been drilled on the site and one of the trial wells, TW1, was tested to assess the available sustainable yield. The pumping test indicated that a yield in the order of 300m³/d could be sustainably abstracted from a well at the site. Quality results for TW1 are presented in Appendix 10.1.

A production well is presently being installed from which the water requirements of the site will be supplied. A yield in excess of 300m^3/d is expected which will comfortably meet the water requirements for the site. The location of the trial well is presented on Figure 9.2 (Soils & Geology)

10.7 POTENTIAL IMPACTS

The main potential impacts relate to the abstraction of groundwater from the proposed supply well to be located on the development site and for groundwater contamination relating to the storage of chemicals on the site and the percolation of treated waste water.

10.7.1 Construction Phase

Potential impacts during the construction phase would be associated with accidental spillage of potentially polluting substances including oils, paints and liquid wastes and any additional substances associated with the construction activities.

All potentially polluting chemicals will be securely stored during the construction phase and refuelling of earth moving machinery will be carried out according to an appropriate Method Statement. Waste water generated during the construction phase will be removed from the development site for disposal in an approved waste water treatment plant.

10.7.2 Operational Phase

The potential impacts during the operation phase would include;

- Impact on groundwater levels and quality in private wells
- Impact on regional groundwater quality

The development site lies within the groundwater regime now established by the Platin dewatering programme. The quarry abstracts sufficient groundwater to maintain the water table just below the working quarry floor. This operation has resulted in a cone of depression in the water table that is centred on the deep excavation.

The proposed groundwater abstraction at the development site will be located within the Platin cone of depression. The proposed abstraction will not alter the extent of the Platin cone of depression as the planned abstraction is minor in comparison to the Platin extraction.

Also, as the amount Platin abstracts is varied to maintain the water table level at or just below the quarry floor the proposed abstraction will not materially add to the total amount of groundwater abstracted from the aquifer. Rather, the planned abstraction at the development site will probably result in a small net reduction in the amount of groundwater abstracted from beneath the nearby quarry excavation with the total being abstracted from the aquifer remaining largely unchanged.

However, if the planned abstraction on the development site were to impact on the groundwater levels in nearby private wells, the Company would remedy the situation by deepening the impacted well(s).

In the event that Platin Quarry should cease dewatering, it will take a considerable amount of time for the water table to recover to their pre-quarrying levels. When the water levels have recovered, it is acknowledged that the groundwater flow direction beneath the site will revert to flow in the direction of the River Nanny.

Given the containment measures incorporated into the design of the facility and the bunker, the risk of leakage from the proposed development entering the groundwater system is virtually nil. Therefore even in the event of the dewatering operation ceasing at Platin, there will be no impact on the groundwater quality regime as a result of the groundwater flow direction reverting to its pre dewatering orientation.

The planned disposal of treated waste water to the ground has the potential to impact on groundwater quality immediately below the percolation area. However in order to ensure adequate protection of the aquifer, the design of the treatment plant and secondary/tertiary treatment system is in accordance with the EPAs requirements as per the EPA Waste Water Treatment Manual for Small Communities, Business, Leisure Centres and Hotels (1999).

In the event of an unmitigated accidental discharge any resulting plume would move in the direction of the Platin excavation and potentially result in the deterioration of the groundwater being pumped from the quarry. Mitigation measures to prevent such an eventuality are described under 10.8 mitigation measures below.

10.8 MITIGATION MEASURES

10.8.1 Construction Phase

All oils, chemicals, paints or other potentially polluting substances used during construction will be stored in designated storage areas which will be bunded to a volume of 110% capacity of the largest tank/container within the bunded area(s).

Filling and draw-off points will be fully located within the bunded area(s).

Drainage for the bunded area(s) will be diverted for collection and safe disposal.

All domestic effluent generated on site will be discharged to temporary sewage containment facilities prior to transport and treatment off site.

10.8.2 Operational Phase

Since the production of the 2006 EIS, an assessment of the groundwater monitoring wells present at the site, was completed by WYG on 26th June 2008. Monitoring wells MW1, MW2 MW3 were found intact. MW4 was located but had been damaged and was no longer functioning. All monitoring wells at the site were dry and no samples could be obtained.

It is anticipated that the reduction in water levels recorded in the monitoring wells is directly related to dewatering at the adjoining Platin Quarry site. As part of this application and in accordance with the monitoring requirements of the waste licence for the facility, it is proposed to drill replacement monitoring wells to a suitable deeper level in order to allow current groundwater quality and future trends to be assessed. The design and location of these monitoring wells will be agreed in advance with Meath County Council and the Environmental Protection Agency. These wells will be sampled in advance of the facility being commissioned and then sampled frequently to ensure continuation of the base line conditions. If there is a deterioration in groundwater beneath the development site the cause of the contamination will be identified and removed. In the event of an incident, the company will consult with Irish Cement to ensure that the quality of the groundwater being pumped to the River Nanny is not compromised as a result of any discharge or leakage from the development site.

All substances that would have the potential to cause a negative impact on groundwater will be stored in appropriate containers and/or placed within bunded areas. Raw materials for the process will be stored in containers/silos within the process building. Residues will be stored in a bunker and silos within the process building.

All waste entering the facility will be stored in fully contained structures therefore there will be no potential for leakage to soils. This waste storage area will be chemically and mechanically resistant to the waste. It will be impermeable and have a secondary containment system with an inspection chamber to check for leakage.

All concrete underground storage structures whether for waste or liquid (as there is a possibility that firewater run-off may enter any of the tanks) will be constructed as watertight structures in accordance with the requirements of relevant Codes of practice such as BS 8007 British Standard for design and Construction of Aqueous Liquid Retaining Structures. Typically these structures will be reinforced concrete with minimum wall and base thicknesses of 250 mm or greater depending on the structural requirements. Details for the construction of these tanks will follow good building practice, the guidelines in the Code of Practice and details used successfully in other similar structures. The structures will be integrity tested in accordance with the guidelines given in the Code of Practice for leakage to confirm that they are watertight. This will be demonstrated to the satisfaction of the Local Authority following installation and prior to use for storage. In addition, the waste bunker which will have a base thickness of 1.1m and a wall thickness underground of 800mm, will have a secondary containment system with

fully sealed membrane and leak detection system to ensure that at all times the bunker remains water tight. This is detailed in Section 11 also.

In the case of the storm water attenuation pond it is proposed that this will be excavated down to formation level of approximately 27.15 m OD. A protective sand layer or similar material will then be laid in preparation for the sealing membrane. The sealing membrane will be welded HDPE membrane which is commonly used for forming secondary containment liners in effluent tanks. The attenuation pond will be tested and demonstrated to be watertight to the satisfaction of the local Authority. The tank will be approximately 2.6m deep and will be surrounded by a 2.4m high chainlink fence. A minimum permanent water level of approximately 300mm will be maintained in the tank at all times. A minimum freeboard of 300mm will be maintained for any storm occurrence less than 1:100 years.

All underground piping will be maintained and regularly inspected for integrity.

All domestic effluent will be treated by an appropriate system prior to its discharge to the percolation area. The Puraflo system proposed will achieve an effluent treatment standard of B.O.D. (Biochemical Oxygen Demand) 20 mg/l and T.S.S. (Total Suspended Solids) 30 mg/l.

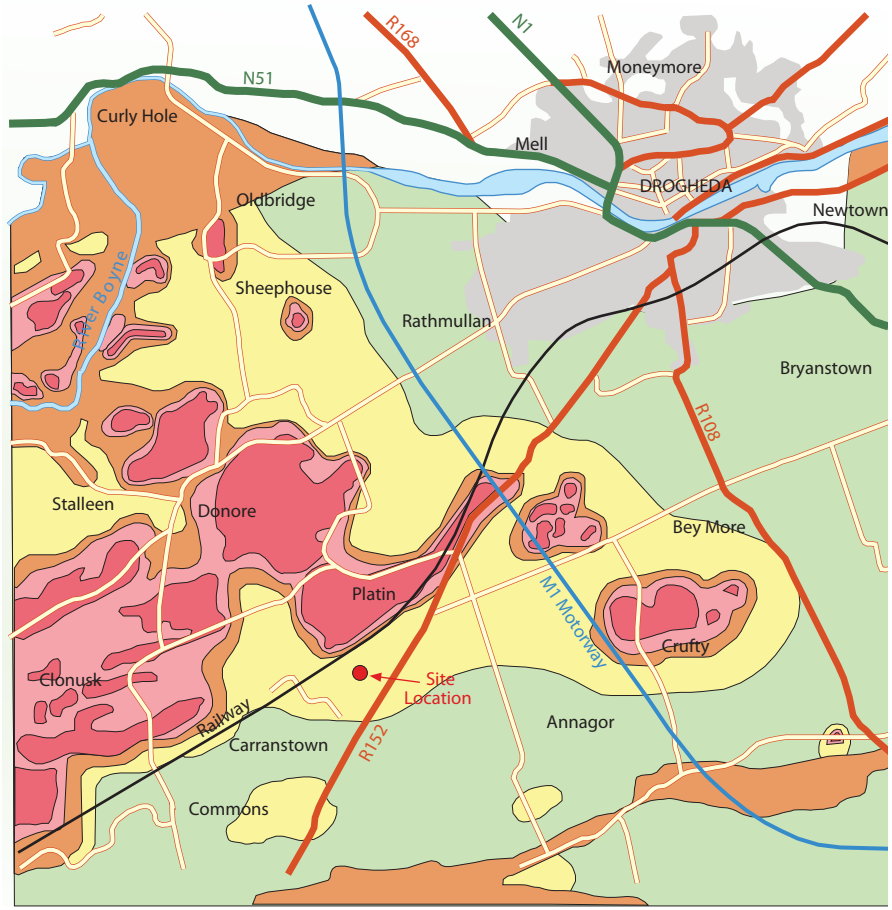
All underground piping will be maintained and regularly inspected for integrity.

A petrol interceptor will be in place on the surface water drainage outfall line from hardstanding areas to contain any leakages from vehicles on site. Full details of the proposed on site drainage network are presented in Section 11.

In the event that Platin might cease dewatering or pumping in the future, it is likely that it would take a considerable length of time for the water table to recover to pre quarrying levels. When the water levels recover it is acknowledged that the groundwater flow direction beneath the site will revert to towards the River Nanny. The only discharge from the site is from the treatment of foul effluent in a Puraflo system and disposal via a Percolation area. The required site tests have been undertaken and a system has been designed in accordance with the EPA requirements. Given the containment measures incorporated into the design of the facility (and in particular the waste bunker) the risk of leakage to groundwater is virtually nil. The facility will be operated in accordance with an EPA waste licence which will require regular monitoring to detect any potential contamination issues. Therefore even in the event that Platin ceases dewatering, there will be no impact on the groundwater quality regime as a result of the groundwater levels and flow returning to pre dewatering conditions.

10.9 RESIDUAL IMPACTS

The proposed amendments to the facility will not have a significant impact on the hydrogeology of the development site or beneath the surrounding lands.



Source: www.gsi.ie

0 1.6
KILOMETRES

LEGEND

- E (Rock near Surface or Karst)
- E - Extreme
- H - High
- M - Moderate
- L - Low

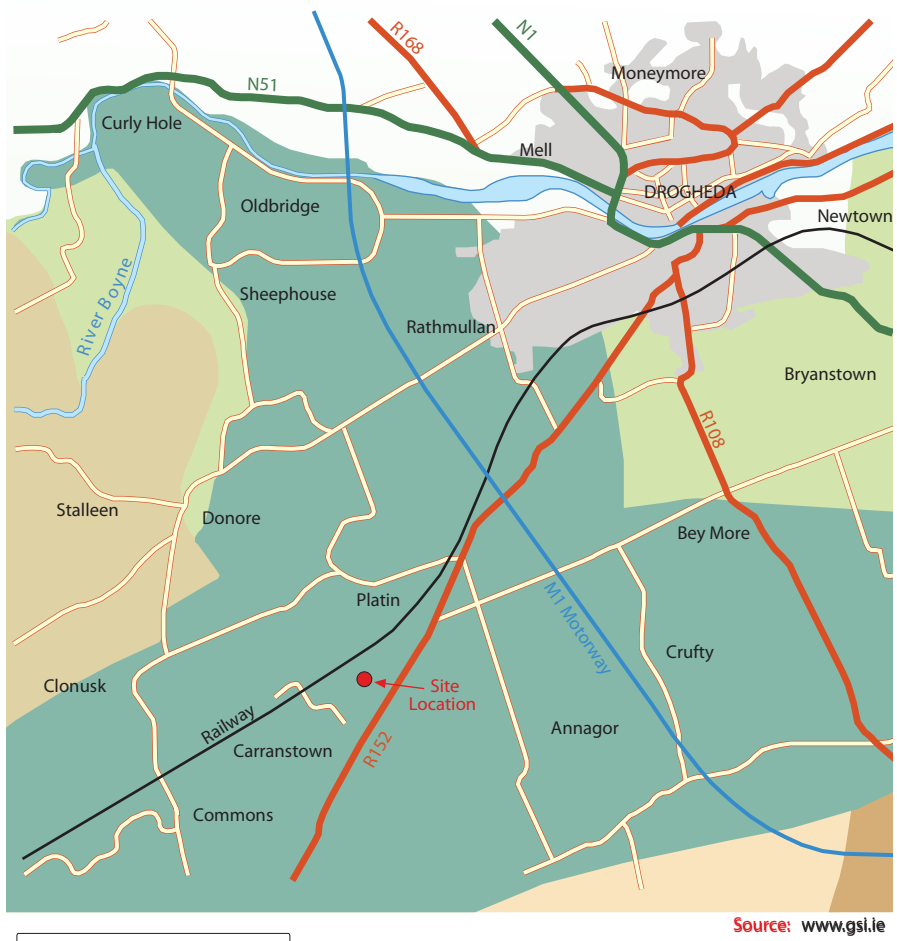
NOTE: Drawing is for diagrammatic purposes only. No measurements to be taken.

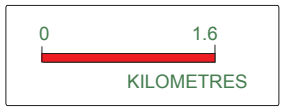
Indaver
Regional Vulnerability

Figure No. 10.1

Job No. CE07624	**Date.** Aug. 2009
Finalised By - DMcD	**Office** - 1404
Drawn By: J Farrar - CS2,Illustrator	

WYG Ireland





LEGEND

- Rkd - Regionally important, diffuse karst aquifer, good development potential
- Lm - Locally important, generally moderately productive
- Ll - Locally important , generally moderate productive in local zones
- Lg - Locally important, sand/gravel aquifers
- Pl - Poor aquifer, generally unproductive except in local zones
- Pu - Poor aquifer, bedrock which is generally unproductive

NOTE: Drawing is for diagrammatic purposes only. No measurements to be taken.

Indaver
Regional Aquifers

Figure No. 10.2

Job No. CE07624	**Date.** Aug. 2009
Finalised By - DMcD	**Office** - 1404
Drawn By: J Farrar - CS2,Illustrator	

WYG Ireland

Appendix 10.1

Trial Well Quality Results 2000-2008

Trial Well Water Quality

PARAMETER	UNIT		TW1	TW1
Date		**SI 278 OF 2007**	**18/05/2000**	**24/06/2008**
Ph	p H units	>6.5<9.5	7.70	7.16
Colour	hazen units	N-A-C	<5	0
Turbidity	NTU	N-A-C	<0.1	0.30
Conductivity	uS/cm	2500	552	715
Total Hardness	CaCO3 mg/l	-	366	409
Total Alkalinity	CaCO3 mg/l	-	239	290
Non carbonate hardness	CaCO3 mg/l	-	127	119
Calcium (Ca)	Ca mg/l	-	130	131
Magnesium (Mg)	Mg mg/l	-	10.00	19.99
Potassium (K)	K mg/l	-	1.3	11.9
Sodium (Na)	Na mg/l	200	13.0	11.9
Iron (fe)	Fe mg/l	0.2	<0.01	0.03
Manganese (Mn)	Mn mg/l	0.05	<0.01	0.00
Copper	Cu mg/l	2	<0.01	<0.001
Aluminium	Al mg/l	0.2	0.08	0.00
Nitrate	NO3 mg/l	50	62.0	42.5
Nitrite	NO2 mg/l	0.5	<0.01	0.08
Chloride (Cl)	Cl mg/l	250	30	39
Sulphate (soluble) (SO4)	SO4 mg/l	250	40	15
Total Ammonia	mg/l	0.3	<0.05	0.07
NPOC/Total organic carbon	mg/l	N-A-C	<0.5	<2
Bacteriological Parameters				
Plate Count (@22C)	tcc/ml	N-A-C	42.00	-
Plate Count (@37C)	tcc/ml	-	0.00	-
Coliforms	count/100ml	0	Nil	-
E.Coli	count/100ml	0	Nil	-
Faecal Streptococci	count/100ml	-	Nil	-

SI 278 of 2007= (European Drinking Water) Regulations 2007

Shading = Value has exceeded IGV

N-A-C= No abnormal change

Analysis conducted by Alcontrol Geochem Laboratories , Dublin

11 SURFACE WATER

An assessment of the Surface Water environment of the site was undertaken in 2005 and was included in the EIS submitted with the planning application in February 2006. Some minor revisions have been made to the application now being submitted. This chapter has therefore been revised to reflect the impact on surface water as a result of the proposed amendments to the existing permission.

11.1 DRAINAGE NETWORK

Regional

The development site lies in the River Nanny catchment (Figure 11.1). The River Nanny rises in the south-east of Co. Meath and flows through Duleek towards Laytown, where it discharges to the sea.

A hydrological station located on the River Nanny at Duleek has an estimated dry weather flow of 0.01 m^3/s and a 95 percentile flow of 0.06 m^3/s.

The River Nanny channel is located approximately 2 km south of the development site. Surface water in the vicinity of the site drains naturally towards the river.

Local

Surface water on and in the vicinity of the site drains through land drains and ditches towards the local streams that flow to the River Nanny. The drainage ditches are mostly dry in the summer months.

11.2 SURFACE WATER QUALITY

A limited amount of chemical and biological data for the River Nanny is available from the EPA. The EPA sampling stations are shown in Figure 1 of Appendix 11.1, and the available data is given in Appendix 11.1

11.2.1 River Water Quality

The biological records indicated that water quality has improved on the River Nanny at Station 4 i.e. Bridge downstream of Nanny Bridge from an average Q-value rating of 3-4 in 1998 – 2001 to a Q value of 4 in 2005 (EPA River Water Quality Report). Water quality of average Q-value 3-4 has remained the same over the same period at Station 5 “Bridge NE Bellewstown bridge”. (refer to Figure 1, Appendix 11.1)

11.3 PROPOSED DRAINAGE NETWORK

11.3.1 Foul Water/Sanitary Management

Construction

During the construction phase, domestic effluent generated on the site will discharge to temporary sewage containment facilities prior to its transport and treatment off site.

Operation

Domestic sewage from toilets, changing and kitchen areas will discharge via the foul drainage system into an on site effluent treatment system which will then pass through a percolation area to ground. The percolation area will be constructed in accordance with the guidelines in the EPA's Wastewater Treatment Manual. (See Section 9 and Appendix 9.4 for details of assessment of the site for the installation of a Puraflo^{TM} system and associated percolation testing). It is proposed that there will be two such percolation areas, one for the main process building facilities and one for the gatehouse.

The design and suitability of the puraflo units proposed to be used in these percolation areas are discussed in Section 9.3.

11.3.2 Industrial Effluent

Operation

Industrial effluent will be contained within the site and evaporated within the incineration process. There will be no discharge of process effluent to the drainage network. Due to the change of the wet tail end flue gas cleaning system to a dry lime injection, there will be no effluent at all from the flue gas treatment process. Some wash waters from cleaning operations will be directed to the spilled water storage tank and will be either evaporated in the spray reactor, or transported off-site for treatment or disposal to an appropriately permitted or licensed facility.

11.3.3 Storm Water Management

Construction

Storm water management during the construction stage will be addressed in accordance with the Environmental Management Plan agreed with the Local Authority. As is noted elsewhere in the EIS this plan will monitor such issues as dust generation, noise generation, traffic management and surface water run-off.

Run off during the construction will be directed towards temporary settlement tanks prior to its discharge to the local drainage ditch. A wheel wash has been installed for the construction phase. The discharge from the wheel wash will be directed to the settlement tanks or will be a sent off-site for treatment.

The settlement tanks will be regularly inspected and subsequently de-silted by the site contractor.

The final discharge from the settlement tanks will discharge to the existing drainage ditch network.

Operation

Process Building

All waters produced from wash down etc. within the waste processing building will be directed to a spill tank located to the east of the bunker building and underground. The spill tank will have a capacity of 100m^3. As described above, water from this spill tank will be used to supplement process water requirements or will be transported off-site for treatment or disposal to an appropriately permitted or licensed facility. There will be no process effluent from the facility.

During shutdowns there may be a need to drain the boiler which is filled with approximately 130m^3 of clean de-mineralised water. Some of this water will be pumped to the spilled water tank for re-use in the process and the remainder to the stormwater network where it will pass through two sets of TOC monitoring equipment prior to discharge.

Site Drainage

The site storm water drainage system has been designed in general accordance with Sustainable Drainage Systems (SuDS) principles and will collect rainwater from all roofs, hardstands, roads and grassed areas which fall naturally towards these areas. The design has altered since the 2006 application as a result of a detailed review of hardstanding/roof areas and in consultation with the Drainage Division of Meath County Council. There has been a large reduction in the overall attenuation volume from 4100m3 to 1600m3, the main reason being a significant decrease (5.46 Ha to 2.2 Ha) in the total contributing area used to calculate the volume. The following design has been agreed and is in accordance with the requirements of Meath County Council.

Sustainable drainage systems aim to mimic as closely as possible the natural drainage of a site in order to reduce the impact of flooding and water pollution. The subject site is essentially divided into two parts, firstly the northern 6.8 Ha. 'developed' part of the site, and secondly the southern 3.6 Ha. 'undeveloped part of the site. For the southern 'undeveloped' part of the site, the natural drainage is not being altered. Stormwater will continue to be collected by the existing system of field boundary ditches for ultimate outfall to the River Nanny. In areas where an existing intercepting ditch runs through the development area, the existing ditch will be culverted with "French drains" either side of the culvert pipe. Similarly infiltration trenches will be used to intercept overland stormwater flow from the undeveloped areas before reaching any of the proposed areas of roads and hardstanding. This intercepted flow will be directed to the original field ditch boundary drainage system. Due to the natural south to north slope of the ground, storm waters emanating from the development will not flow naturally to the undeveloped part of the site. It is proposed that these lands will be landscaped with selected trees and shrubs. This will have the beneficial effect of increasing the "residence time" of the storm flows thereby reducing downstream effects.

The design principle for the northern portion of the site is to largely manage runoff flows and pollutants on the site rather than directing them to the nearest receiving waters. This will be achieved by a combination of good housekeeping measures, retention and by monitoring (i.e. testing). Good housekeeping measures include reusing waste contaminated water in the process itself, as detailed

above. Waste contaminated water that is not required in the process will be diverted to the spilled water tank and sent for disposal or treatment at an appropriately licensed facility. It is therefore highly unlikely for such waste contaminated water to pollute any receiving waters.

In accordance with SuDS, consideration was given to surfacing roads and hard standings with pervious paving. However given the risk of spillage onto these areas from attending refuse lorries, with subsequent possible contaminated runoff, the designed surface water drainage system routes the surface water from roads and hardstanding to a monitoring station and from there to the firewater retention tank if contaminated, or to the natural watercourse via a petrol interceptor if uncontaminated.

In order to prevent flooding of the ditches downstream of the facility a discharge rate from the site based on the Dublin City Council Storm Water Management Policy and by agreement with Meath County Council of 36.2 litres/second has been incorporated into the drainage design. This discharge rate from the site will be controlled by pumping at an agreed discharge rate. Attenuation for a 1 in 30 year storm will be provided by means of a storm water attenuation pond which discharges via a pump to an external drainage ditch. Attenuation of 1 in 100 year storm occurrences will also be contained within the attenuation pond (see Appendix 11.2 for calculations). In the event of a greater than 1:100 year storm occurrence, the paving will be designed sloping away from the building meaning any flooding that may occur will flow away from the building towards proposed and existing land drains. The provision of the above system allows the maintenance of the current discharge characteristics to the ditches serving the site i.e. flows similar to that generated from agricultural land. This will prevent downstream flooding due to “flash flooding” from the site.

The drainage design allows for the monitoring of the storm water discharge at two locations in order to prevent any uncontrolled water discharges from oil leakages, spillages etc entering the watercourses. The parameters required and resultant level limits will be agreed with Meath County Council and the EPA. The first monitoring point will be located prior to the attenuation pond and can divert suspect flows to a watertight storage tank (300m^3) located to the north east of the surface water attenuation pond. The stored suspect water will be re-used in the process where possible while the remainder will be stored within the tank for off site treatment or disposal to a suitably licensed facility. Should this storage tank be filled the first monitoring chamber will go into overflow mode and allow water to pass into the attenuation pond (1600m^3) at the outfall of which it will be further sampled by a second monitoring chamber located prior to discharge from the site. Should suspect water be detected at this monitoring chamber, the discharge pumps from the attenuation pond will be shut down. In this instance the attenuation pond will be allowed to fill with no discharge.

All stormwater will pass through a petrol interceptor prior to entry into the retention tank or attenuation pond. The petrol interceptor will be a Class I by-pass interceptor and the separator will be in accordance with European Standard prEN 858 (installations for the separation of light liquids). See Figure 11.2 for a flow diagram of the proposed storm water management system.

11.4 POTENTIAL IMPACTS

Construction Phase

The construction phase will consist, in the main, of the construction of the landscaping bunds, excavation and the construction of the buildings, roads, hardstanding areas, car parks and other ancillary structures.

The main potential impacts arising out of these works will consist of the following:

- Run-off from bare earth surfaces will contain silt and clay particles. Excessive amounts of silt entering the surface water system could clog the stream beds.
- Hydrocarbon contaminated water entering the drainage network has the potential to contaminate the surface water.
- Sewage or canteen effluent entering the surface water system has the potential to contaminate the surface waters.

Operational Phase

The main potential impacts associated with the operational phase will comprise the following:

- Run-off from the site has the potential to impact on surface water quality.
- Fire water run-off generated by a fire occurring in any of the buildings causing uncontrolled flows to the storm water drainage system have the potential to impact on surface water quality.

11.5 MITIGATION MEASURES

Construction Phase

The following mitigation measures will be implemented during the construction phase:

Temporary settlement tanks and interceptors will be constructed as necessary during the early stages of construction mitigating against silt laden run off to the existing drainage network. Prior to commencement of development, written agreement will be sought from the planning authority for details of temporary settlement tanks/silt traps/oil interceptors to control discharges of site surface water run-off during the construction period in advance of the construction of the proposed permanent attenuation pond. The concentration of suspended solids (SS) of the surface water run-off from the site construction works, for discharge to surface waters, will not exceed 30 mg/litre.

It is proposed to seed and grass the perimeter/screening bunds at the earliest opportunity.

During the construction phase of the development, oil and fuel storage tanks, chemicals and all other materials that pose a risk to waters if spilled, will be stored in designated storage areas, which will be bunded to a volume of 110% of the capacity of the largest tank/container within the bunded area(s). Filling and draw-off points will be located entirely within the bunded area(s). Drainage from the bunded area(s) will be diverted for collection and safe disposal. Bunded pallets will be used for storage of drums.

During the construction phase all domestic effluent generated on site will discharge to temporary sewage containment facilities prior to transport and treatment off site.
During the construction stage a temporary wheel wash will be located along the access road to the facility. Site construction roads will be sprayed with water during dry periods to mitigate against the formation of dry dust particles and road sweepers will be operated as required to keep public roads clean.

Operational Phase

There will be no discharge of process effluent to the drainage network.

Fuels and oils used on site during the operational phase will be stored in tanks located in concrete containment bunds.

Domestic effluent will be treated by an appropriate system and discharged to the percolation area.
Chemicals or other potentially polluting substances will be stored within the main process building which is bunded.

Run-off from clean hard surfaces on site including the roofs of the buildings, site roads, car parks, hardstanding areas and ancillary buildings will be collected into the surface water drainage system as detailed in Section 11.2.2 above.

All drainage arrangements will comply with the requirements of the planning authority for such works and services.

All sludge from the drainage system, bunds, silt traps and oil interceptors will be regularly collected for safe disposal.

An adequate supply of containment booms and/or suitable absorbent material to control, contain and absorb any potential spillages will be maintained at the facility.

Firefighting and Firewater Retention

Fire suppression is provided by an on site water storage tank with an effective fire-fighting storage volume of 1,800m^3 which is supported by 2 diesel fire pumps connected to a fire main and hydrant

system throughout both the site and buildings. This will be further augmented by Local Fire Service capabilities. Of the total capacity (1,800m^3), 600m^3 is provided for process water requirements with 1,200m^3 fully reserved for fire fighting. However in the event of a fire, the process water requirement will not be needed and potentially all 1,800m^3 will be available for fire fighting. Staff will be trained in Emergency Response techniques in order to deal with emergencies including fire fighting. The fire safety objectives adopted in the design of the Meath waste-to-energy facility are:

- to achieve compliance with the Building Regulations with particular reference to Part B (Fire), so that a Fire Safety Certificate will be obtained prior to the commencement of construction; and
- to follow as far as practicable the recommendations in the Code of Practice for Fire Safety in Buildings – BS5588 which is referred to in Technical Guidance Document B (Fire) to the Building Regulations.

Indaver have received the first fire safety certificate for the bunker complex construction on the site.

The greatest potential for fire at the facility arises within the waste bunker where localised heating can occur due to decomposition of organic material. As detailed in Section 5, localised fires within the waste bunker are lifted using the grab crane, into the hoppers which transfer the waste directly to the furnace. Up to the level of the tipping hall, the bunker has a capacity of 6,615m^3 approximately. If a 50% voidage ratio is assumed for the waste, then there would be a retention capacity of 3,300m^3 within the waste bunker. With 1,800 m^3 of water available for fire fighting, this demonstrates that all of the water would be retained within the bunker even in the most extreme fire event.

The design of the waste bunker and underground pits will be in accordance with the requirements of BS8007 “Design of Aqueous Liquid retaining Concrete Structures i.e. as watertight structures, thus retaining any fire water generated within the bunker. Typically it is expected that these structures will have minimum thicknesses of 250mm or more. In addition it is proposed to provide a double containment system to the base of the waste bunker complete with an inspection chamber. This system will consist of a welded watertight high density polyethylene liner cast into the side walls of the bunker and run under the bunker to form a secondary containment line. This will allow any water that collects between the concrete and the liner to be tested for contamination and removed whilst providing an additional barrier to the possibility of contaminating water leaching to the ground.

With respect to fire occurring elsewhere in the process building or other buildings on site the run-off will drain either to the spilled water tank of 100m^3 or be contained by collection in the surface water drainage system. This in turn will drain to both the diverted water tank (300m^3 capacity) located to the north east of the retention pond and in turn by overflow (if the volumes exceed 300m^3) to the attenuation pond (1,600m^3) where the discharge pumps will be automatically shut down. This will be achieved by the provision of an actuated shut-off valve, controlled by the fire alarm/detection system, at the outfall to the attenuation pond and contaminated water will be diverted first to the diverted water tank. This water

will be stored for reuse in the flue gas cleaning process or removed from site for treatment or disposal to an appropriately licensed facility.

The revised firewater retention volume of 300m^3 (600m^3 in previous application) has been calculated using the German LÖRÜRL Methodology for the calculation of retention volume. The greatly reduced volume is as a result of a number of factors that are considered in the LÖRÜRL Methodology that aren't considered under EPA guidelines, for example evaporation, the layout of buildings, early detection and others. The LÖRÜRL Methodology is considered by the EPA as an appropriate methodology for calculating firewater retention volumes. The requirements of EPA Guidance note on the Requirements for Fire Water Retention Facilities has also been considered for the initial overall retention volume calculations.

Based on a two hour fire event with a 1 in 20 year storm occurrence for a total of 4 hours (230m^3), the overall storage volume provided (2,000 m^3) is adequate to contain the required volume of fire water (1,800m^3) and rainwater (200m^3). This approach is a compromise between the LÖRÜRL and EPA approaches, as the EPA approach requires retention of rainwater from a 1 in 20 year storm occurrence for a total of 24 hours (1,400m^3). The LÖRÜRL Methodology takes the position that a large storm occurring simultaneously with a fire is an unrealistic scenario and hence a conservative view is taken that the storm will occur for the duration of the fire plus another two hours after.

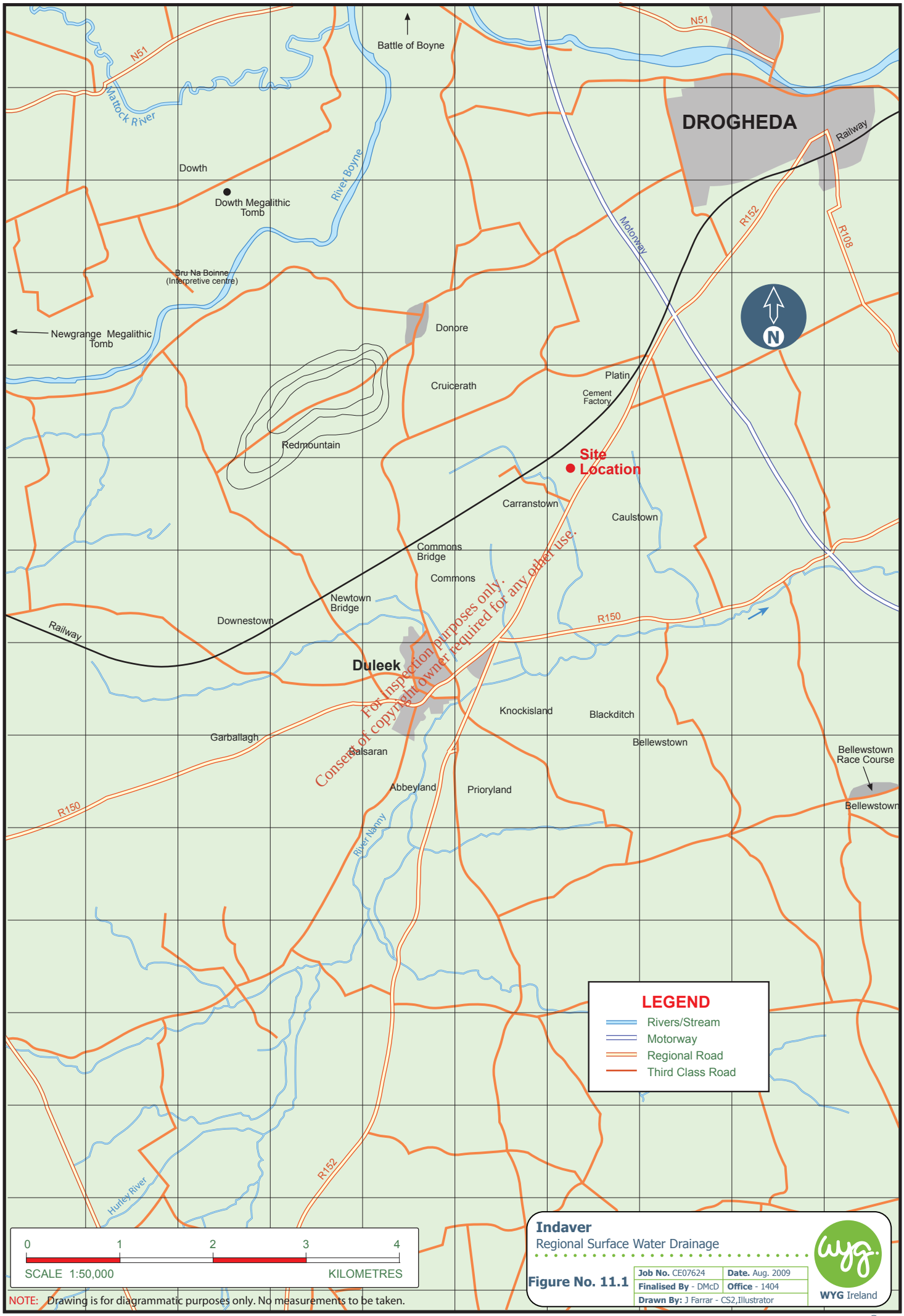
The largest potential fire event possible on the site would be a waste bunker fire. Even with the bunker full of waste, there is a retention capacity of 3,300m^3, which is far in excess of the amount of fire fighting water available on the site.

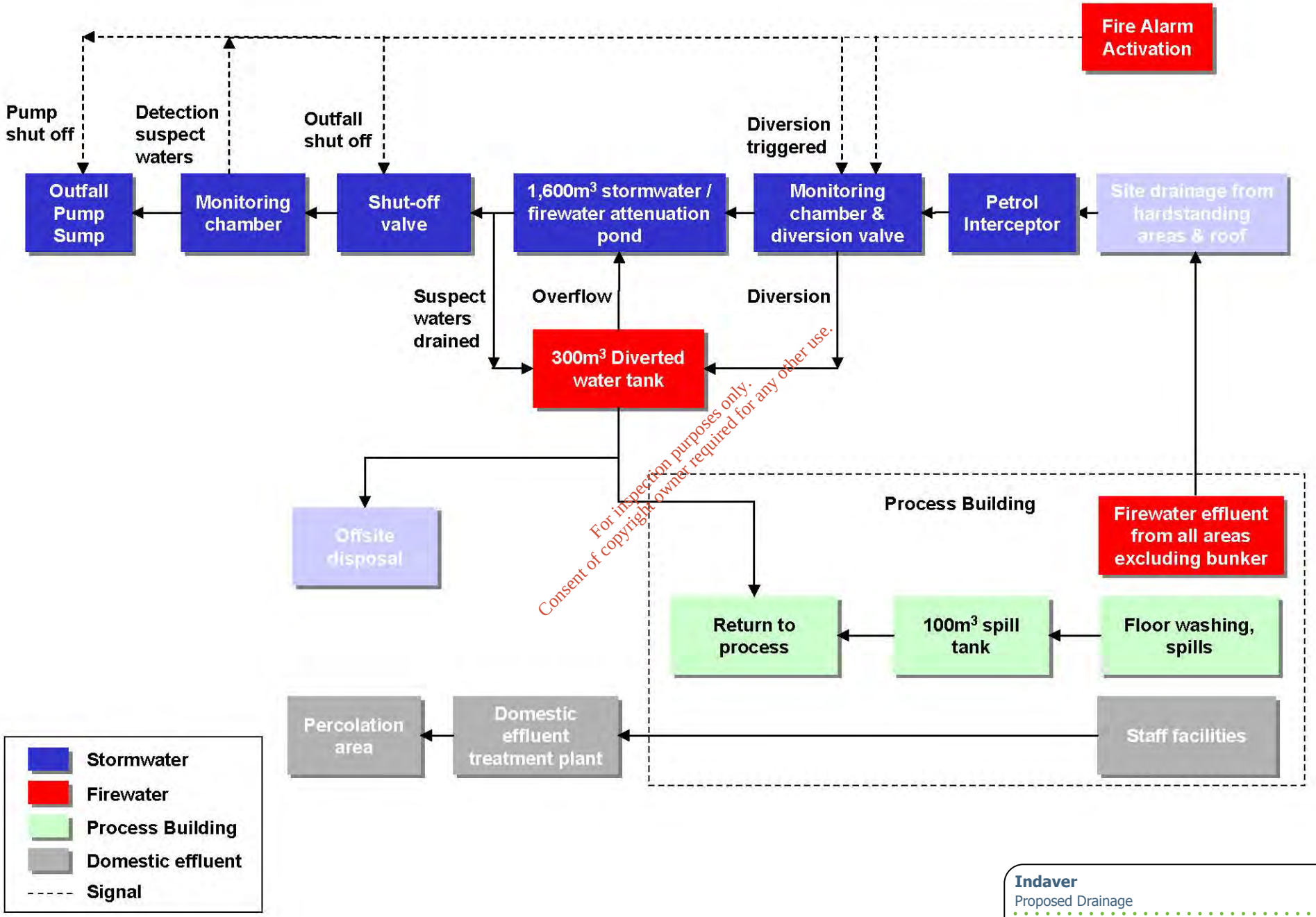
As part of the final design and in consultation with the EPA, a full Fire water retention study will be carried out.

A schematic of the effluent streams and their management is presented in Figure 11.2.

11.5.1 RESIDUAL IMPACTS

The proposed system will prevent uncontrolled discharges to the outfall ditch by the provision of two layers of monitoring and a controlled discharge system. As a result of the proposed amendments there will be no significant negative impacts on the existing surface water.





Indaver
Proposed Drainage

Figure No. 11.2

Job No. CE07629	**Date.** Aug. 2009
Finalised By - DMcD	**Office** - 1404
Drawn By: J Farrar - CS2,Illustrator	

WYG Ireland

JF(10)

Appendix 11.1

EPA SW QUALITY DATA RIVER NANNY (2005)

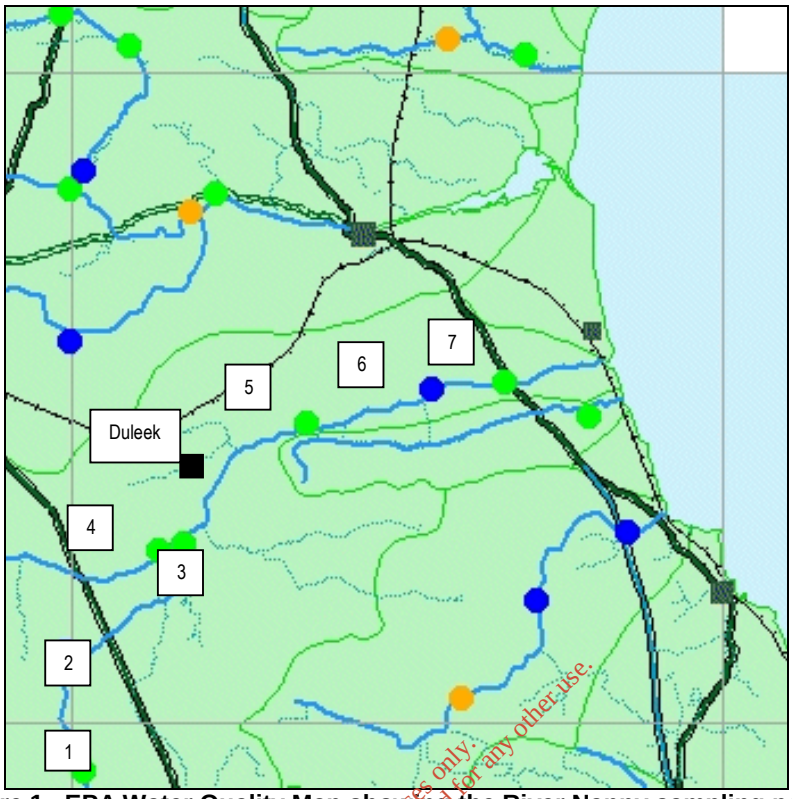


Figure 1. EPA Water Quality Map showing the River Nanny sampling points

EPA data sampling points.

1. Bridge at Painestown
2. Rathfeigh Old Bridge
3. Just upstream River Nanny Confluence
4. **Bridge downstream of Nanny Bridge**
5. **Bridge NE Bellewstown House**
6. Daristown Bridge
7. Bridge at Julianstown

1 Biological Quality

Current data for biological data show that this section of the river has a Q-value of 3-4, indicating slightly polluted (McGarrigle *et al*., 2004). The biological records showed that the water quality has improved in this section of the River Nanny from an average Q-value rating of 3 in 1988 - 1996 to a Q-rating of 3-4 in 1998 – 2001.

Comparable biological data are available for the years: 2001, 1998, 1996, 1991 and 1988. A direct comparison between years showed that in 1991 there was an improvement in water quality at the station downstream of Duleek. In other sampling years, there was no change recorded between stations upstream and downstream.

Table 1 Comparable Biological Data (2001, 1998, 1996, 1991 and 1988)

Year	Upstream	Downstream	Change
2001	3-4	3-4	No change
1998	3-4	3-4	No change
1996	3	3	No change
1991	3	3-4	Improvement
1988	3	3	No change

2 Chemical Quality

For the assessment of organic pollution, the more commonly measured parameters include BOC, DO, Phosphates, Oxidised Nitrogen and Ammonia (McGarrigle *et al*., 2002). The most recent chemical data available for the stations upstream and downstream of Duleek are given in Tables 2 and 3 respectively. There is an increase in median values downstream of Duleek for B.O.D., Ortho-Phosphate and Total Ammonia. Oxidised nitrogen values are higher upstream. D.O values are higher downstream.

EPA guidelines for maximum BOD values are < 3mg/l in unpolluted waters (< 5mg/l Freshwater Fish Regulations and ≤ 4 mg/l Water Quality Guidelines). Maximum values at both stations are in excess of this indicating a high BOD upstream and downstream. DO values in unpolluted waters should be between 80 -120%. Maximum values downstream are slightly in excess of this value. Recommended median values for Ortho-Phosphate are <0.030 mg/l P. Both stations are well in excess of this value. Oxidised Nitrogen and Total Ammonia at both stations are below the recommended maximum of 50mg/l and 0.3 mg/l (Drinking Water Standards).

BOD and Ortho-Phosphate values are higher than recommended values at both stations but there is no clear change in values between these points. This indicates that there is no obvious change in chemical water quality standards between these two stations.

Table 2 Chemical Data Upstream of Duleek (Location 4, Figure 1)

Station No: 0280 **Location:** Downstream Nanny Bridge **Date From:** 2001 **To:** 2005

Parameter	Parameter Units	Minimum	Median	Maximum	No of Samples	Source	Source Type
B.O.D	mg/l O^2		1.17	6.55	12	Meath Co Co	LA
Dissolved Oxygen	% Saturation	84.5		111.1	12	Meath Co Co	LA
Ortho-Phosphate	mg/l P		0.100	0.261	12	Meath Co Co	LA
Oxidised Nitrogen	mg/l N		4.889	5.975	12	Meath Co Co	LA
Total Ammonia	mg/l N		0.042	0.948	12	Meath Co Co	LA

Table 3 Chemical Data Downstream of Duleek (Location 5, Figure 1)

Station No: 0500 **Location**: Bridge NE Bellewstown House **Date From:** 2001 **To:** 2005

Parameter	Parameter Units	Minimum	Median	Maximum	No of Samples	Source	Source Type
B.O.D	mg/l O^2		1.68	5.73	12	Meath Co Co	LA
Dissolved Oxygen	% Saturation	92.2		122.4	12	Meath Co Co	LA
Ortho-Phosphate	mg/l P		0.120	0.235	12	Meath Co Co	LA
Oxidised Nitrogen	mg/l N		4.827	5.819	12	Meath Co Co	LA
Total Ammonia	mg/l N		0.093	0.541	12	Meath Co Co	LA

Appendix 11.2
Drainage Calculations

INDAVER

PM GROUP

MWH

Lab

B&W vølund

DRAINAGE DESIGN CALCULATIONS FOR PLANNING

MEATH WASTE MANAGEMENT FACILITY **(PL)**

REV	DATE	DESCRIPTION	ISSUED BY	ISSUED VISA	CHECKED / REVIEW BY	CHECKED / REVIEW VISA	APPROVED BY	APPROVED VISA
A	29/05/09	For Planning	WH		JD		AF	

PM File No.
011879.49.030

PM Document No:
011879-49-CA-0001

INDAVER	REV	PAGE	CLIENT DOC.NO.
	A	1/13	PMG-MEATH-CIV-CAL-000-0001

CONTENTS

OVERVIEW

This document consists of nine attachments as outlined on the Contents Page.

ATTACHMENT 1

INTRODUCTION

PM GROUP	Calculation		Sheet:	1	Of: 1	Rev. No.:	A
	Client:	Indaver Ireland	Date:	29-May-09			
	Project:	Meath Waste Management Facility	Orig:	Wayne Hyde			
	PM Project No.:	011879	Aut.Chk:	John Dwyer			
	Client Project No.:						

Part Of Document No. / Description	Preliminary/ Planning Drainage Design, Meath Waste Management Facility
Calculation No. / Description:	Surface Water Drainage / Attenuation Design, Foul Drainage

Introduction

Indaver are proposing amendments to the existing planning permission for a 70MW Waste to Energy facility at Carranstown, Duleek, Co. Meath. (Refer to Drawings PMG-MEATH-CIV-DWG-000-1706 to 1708 for Drainage Layout.)
The preliminary design is in accordance with the Greater Dublin Strategic Drainage Study and sustainable measures have been incorparated in the design where possible, for example existing drianage ditches will be maintained where possible before discharge to an adjacent drainage ditch in the Northwest of the site.

Assumption

1. The following calculations refer to drainage network shown on Services Drawings PMG-MEATH-CIV-DWG-000-1706 to 1708.
2. Surface Water pipe network has been designed with the Micro Drainage "WinDes" computer software using Modified Rational Method.
3. Met Eireann rainfall statistics for Duleek have been used.
4. Permissable Discharge is 59.6 l/s (6.2 l/s/ha), Applying the Factor Standard Error of 1.65 gives a permissable discharge of 36.2 l/s (3.73l/s/ha) agreed with Pat Kinsella MCC 29-5-09 (see Attachment 8)
5. The Foul Network has been designed with the Micro Drainage "WinDes" computer software using the appliance unit discharge method as stated in BSEN752 (Not included in this draft revision)

Pipe Network

1. The Stormwater network consists of one main network which takes runoff from roads, yard areas, carparks (permeable paving), roofs, some landscaped areas and other hardstand areas
2. The Pipe Network had been sized to accommodate a 1 in 2 year return period storm event in compliance with the requirements of EN 752.
3. A minimum proportional velocity of 0.75 m/s has been assumed to allow for self cleansing velocity in accordance with requirements of EN 752.
4. A pipe roughness co-efficient (k=0.6mm, storm k=1.5mm foul) has been assumed for concrete Class M Spigot and Socket pipes.

Surface Water Attenuation

1. It is proposed to attenuate the Surface Water runoff from the site within an attenuation pond located in the Northwest corner before discharge by pumping at a controlled rate to the adjacent drainage ditch.
2. The proposed network has been modelled within Micro Drainage "WinDes" computer software using the simulation Module.
3. Prior to entering the Attenuation pond all surface water will pass through a TOC monitoring chamber, any contaminated water will be diverted to a holding/ firewater retention tank. Contaminated flow will be sampled before disposal.
4. Prior to leaving the Site surface water will pass through a second TOC monitoring chamber, detection of contaminated water will deactivate pumping. Contaminated water will either be pumped to the building and burnt off in the process or tankered off site.

The Surface Water Sewer system has been simulated with the attenuation pond for different return periods up to and including a 1 in 100 year return period for surcharging and flooding.
The results were checked according to the following criteria.

1. No Surcharge in a 1 in 5 year return period event.
2. No Flooding in a 1 in 30 year return period event.
3. Flood water not to leave the site in a 1 in 100 year return period event.

The Micro Drainage reports are attached.

Petrol / Oil Interceptor (Pollution Control Measures)

A Class 1 Bypass oil/petrol interceptor will be provided prior to stormwater entering the attenuation pond
A full retention forecourt seperator will be provided for the diesel delivery area

ATTACHMENT 2

MAIN STORM NETWORK DESIGN

STORM NETWORK DESIGN

Global Variables

Region	FSR - Scotland & Ireland
Return Period (yrs)	5
M5-60 (mm)	15.300
Ratio R	0.270
Volumetric Runoff Coef	0.750
Profile Type	Summer
PIMP (%)	100
Areal Reduction Factor	1.000
Storm Duration (mins)	15
Hot Start (mins)	0
Hot Start Level (mm)	0
Manhole Headloss Coefficient	0.500
MADD Factor * 10m³/ha Storage	2.000
Foul Sewage/Hectare (l/s)	0.00
Additional Flow - % of Total Flow	0
Number of Input Hydrographs	0
Number of Time/Area Diagrams	0
Number of Bifurcations	0
Number of Overflows	0
Number of Off-Line Controls	0
Number of On-Line Controls	1

Starting Storm file name

M:\011838\MicroD\Planning.SWS

Freely Discharging Outfalls

Outfall Pipe Number	Outfall MH/No	C.Level (m)	I.Level (m)	D,L (mm)	B (mm)
1.012	Ditch	30.000	29.000	1500	1500

Network Details

* - Indicates pipe has been modified outside of WinDes's Storm/Foul & Schedules

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
1.000	42.50	0.800	53.1	0.207	4.00	1	0.600	o	225
1.001	50.50	0.500	101.0	0.081	0.00	1	0.600	o	225
1.002	52.50	0.350	150.0	0.088	0.00	1	0.600	o	300
1.003	8.80	0.080	110.0	0.000	0.00	1	0.600	o	300
1.004	59.60	1.580	37.7	0.053	0.00	1	0.600	o	300
1.005	42.00	0.200	210.0	0.082	0.00	1	0.600	o	375
1.006	53.60	0.200	268.0	0.040	0.00	1	0.600	o	375
2.000	50.00	0.315	158.7	0.111	4.00	1	0.600	o	225
2.001	46.00	0.270	170.4	0.124	0.00	1	0.600	o	225
2.002	8.00	0.050	160.0	0.052	0.00	1	0.600	o	300
2.003	77.00	0.285	270.2	0.097	0.00	1	0.600	o	300
3.000	42.60	0.480	88.8	0.025	4.00	1	0.600	o	225
4.000	31.20	0.300	104.0	0.031	4.00	1	0.600	o	225
3.001	16.50	0.250	66.0	0.000	0.00	1	0.600	o	225
2.004	40.00	0.165	242.4	0.115	0.00	1	0.600	o	375
2.005	29.00	0.135	214.8	0.081	0.00	1	0.600	o	375
1.007	10.00	0.025	400.0	0.056	0.00	1	0.600	o	600

PN	USMH No.	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl No.	US/MH (mm)
1.000	1	33.500	32.075	1.200	32.400	31.275	0.900		1200
1.001	2	32.400	31.275	0.900	32.030	30.775	1.030		1200
1.002	3	32.030	30.700	1.030	32.000	30.350	1.350		1200
1.003	4	32.000	30.350	1.350	32.000	30.270	1.430		1200
1.004	4	32.000	30.180	1.520	30.000	28.600	1.100		1200
1.005	5	30.000	28.525	1.100	29.500	28.325	0.800		1200
1.006	11	29.500	28.325	0.800	29.500	28.125	1.000		1200
2.000	8	30.300	29.495	0.580	30.300	29.180	0.895		1200
2.001	8	30.300	29.180	0.895	30.300	28.910	1.165		1200
2.002	8	30.300	28.835	1.165	30.300	28.785	1.215		1200
2.003	8	30.300	28.785	1.215	30.300	28.500	1.500		1200
3.000	8	30.360	29.305	0.830	30.800	28.825	1.750		1200
4.000	8	31.400	29.975	1.200	30.800	29.675	0.900		1200
3.001	8	30.800	28.825	1.750	30.300	28.575	1.500		1200
2.004	8	30.300	28.425	1.500	30.200	28.260	1.565		1200
2.005	8	30.200	28.260	1.565	29.500	28.125	1.000		1200
1.007	8	29.500	27.900	1.000	29.500	27.875	1.025		1500

Network Details

PN	Length (m)	Fall (m)	Slope (1:x)	Area (ha)	T.E. (mins)	Rain Pro	k (mm)	Hyd Sect	Dia (mm)
5.000	49.00	0.195	251.3	0.155	4.00	1	0.600	o	225
5.001	22.00	0.100	220.0	0.094	0.00	1	0.600	o	300
6.000	40.00	0.170	235.3	0.169	4.00	1	0.600	o	225
5.002	22.50	0.100	225.0	0.027	0.00	1	0.600	o	300
5.003	5.60	0.050	112.0	0.027	0.00	1	0.600	o	375
5.004	29.00	0.100	290.0	0.082	0.00	1	0.600	o	375
7.000	8.00	0.050	160.0	0.062	4.00	1	0.600	o	225
7.001	28.00	0.165	169.7	0.039	0.00	1	0.600	o	225
7.002	21.00	0.125	168.0	0.030	0.00	1	0.600	o	225
5.005	9.50	0.050	190.0	0.058	0.00	1	0.600	o	375
5.006	43.00	0.150	286.7	0.066	0.00	1	0.600	o	375
5.007	15.00	0.080	187.5	0.025	0.00	1	0.600	o	375
1.008	8.03	0.020	401.3	0.030	0.00	1	0.600	o	600
1.009	9.11	0.025	364.3	0.000	0.00	1	0.600	o	600
1.010	10.05	0.050	201.0	0.000	0.00	1	0.600	o	600
1.011	5.99	-1.320	-4.5	0.080	0.00	1	0.600	o	600
1.012	6.05	0.025	241.8	0.000	0.00	1	0.600	o	450

PN	USMH No.	US/CL (m)	US/IL (m)	US C.Depth (m)	DS/CL (m)	DS/IL (m)	DS C.Depth (m)	Ctrl No.	US/MH (mm)
5.000	39	30.300	29.060	1.015	30.300	28.865	1.210		1200
5.001	39	30.300	28.790	1.210	30.300	28.690	1.310		1200
6.000	39	30.300	28.925	1.150	30.300	28.755	1.320		1200
5.002	39	30.300	28.680	1.320	30.300	28.580	1.420		1200
5.003	39	30.300	28.505	1.420	30.300	28.455	1.470		1200
5.004	39	30.300	28.455	1.470	30.300	28.355	1.570		1200
7.000	39	30.300	28.845	1.230	30.300	28.795	1.280		1200
7.001	39	30.300	28.795	1.280	30.300	28.630	1.445		1200
7.002	39	30.300	28.630	1.445	30.300	28.505	1.570		1200
5.005	39	30.300	28.355	1.570	30.300	28.305	1.620		1200
5.006	39	30.300	28.305	1.620	30.300	28.155	1.770		1200
5.007	39	30.300	28.155	1.770	29.500	28.075	1.050		1200
1.008	39	29.500	27.850	1.050	29.500	27.830	1.070		1500
1.009	38	29.500	27.780	1.120	29.500	27.755	1.145		1500
1.010	38	29.500	27.755	1.145	29.500	27.705	1.195		1500
1.011	38	29.500	27.705	1.195	29.760	29.025	0.135	5	1500
1.012	38	29.760	29.025	0.285	30.000	29.000	0.550		1500

PIPELINE SCHEDULES

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	o	225	1	33.500	32.075	1.200	1200
1.001	o	225	2	32.400	31.275	0.900	1200
1.002	o	300	3	32.030	30.700	1.030	1200
1.003	o	300	4	32.000	30.350	1.350	1200
1.004	o	300	4	32.000	30.180	1.520	1200
1.005	o	375	5	30.000	28.525	1.100	1200
1.006	o	375	11	29.500	28.325	0.800	1200
2.000	o	225	8	30.300	29.495	0.580	1200
2.001	o	225	8	30.300	29.180	0.895	1200
2.002	o	300	8	30.300	28.835	1.165	1200
2.003	o	300	8	30.300	28.785	1.215	1200
3.000	o	225	8	30.360	29.305	0.830	1200
4.000	o	225	8	31.400	29.975	1.200	1200
3.001	o	225	8	30.800	28.825	1.750	1200
2.004	o	375	8	30.300	28.425	1.500	1200
2.005	o	375	8	30.200	28.260	1.565	1200
1.007	o	600	8	29.500	27.900	1.000	1500

Downstream Manhole

PN	Length (m)	Slope (1:x)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
1.000	42.50	53.1	2	32.400	31.275	0.900	1200
1.001	50.50	101.0	3	32.030	30.775	1.030	1200
1.002	52.50	150.0	4	32.000	30.350	1.350	1200
1.003	8.80	110.0	4	32.000	30.270	1.430	1200
1.004	59.60	37.7	5	30.000	28.600	1.100	1200
1.005	42.00	210.0	11	29.500	28.325	0.800	1200
1.006	53.60	268.0	8	29.500	28.125	1.000	1500
2.000	50.00	158.7	8	30.300	29.180	0.895	1200
2.001	46.00	170.4	8	30.300	28.910	1.165	1200
2.002	8.00	160.0	8	30.300	28.785	1.215	1200
2.003	77.00	270.2	8	30.300	28.500	1.500	1200
3.000	42.60	88.8	8	30.800	28.825	1.750	1200
4.000	31.20	104.0	8	30.800	29.675	0.900	1200
3.001	16.50	66.0	8	30.300	28.575	1.500	1200
2.004	40.00	242.4	8	30.200	28.260	1.565	1200
2.005	29.00	214.8	8	29.500	28.125	1.000	1500
1.007	10.00	400.0	39	29.500	27.875	1.025	1500

PIPELINE SCHEDULES

Upstream Manhole

PN	Hyd Sect	Diam (mm)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
5.000	o	225	39	30.300	29.060	1.015	1200
5.001	o	300	39	30.300	28.790	1.210	1200
6.000	o	225	39	30.300	28.925	1.150	1200
5.002	o	300	39	30.300	28.680	1.320	1200
5.003	o	375	39	30.300	28.505	1.420	1200
5.004	o	375	39	30.300	28.455	1.470	1200
7.000	o	225	39	30.300	28.845	1.230	1200
7.001	o	225	39	30.300	28.795	1.280	1200
7.002	o	225	39	30.300	28.630	1.445	1200
5.005	o	375	39	30.300	28.355	1.570	1200
5.006	o	375	39	30.300	28.305	1.620	1200
5.007	o	375	39	30.300	28.155	1.770	1200
1.008	o	600	39	29.500	27.850	1.050	1500
1.009	o	600	38	29.500	27.780	1.120	1500
1.010	o	600	38	29.500	27.755	1.145	1500
1.011	o	600	38	29.500	27.705	1.195	1500
1.012	o	450	38	29.760	29.025	0.285	1500

Downstream Manhole

PN	Length (m)	Slope (1:x)	MH No.	C.Level (m)	I.Level (m)	C.Depth (m)	MH DIAM., L*W (mm)
5.000	49.00	251.3	39	30.300	28.865	1.210	1200
5.001	22.00	220.0	39	30.300	28.690	1.310	1200
6.000	40.00	235.3	39	30.300	28.755	1.320	1200
5.002	22.50	225.0	39	30.300	28.580	1.420	1200
5.003	5.60	112.0	39	30.300	28.455	1.470	1200
5.004	29.00	290.0	39	30.300	28.355	1.570	1200
7.000	8.00	160.0	39	30.300	28.795	1.280	1200
7.001	28.00	169.7	39	30.300	28.630	1.445	1200
7.002	21.00	168.0	39	30.300	28.505	1.570	1200
5.005	9.50	190.0	39	30.300	28.305	1.620	1200
5.006	43.00	286.7	39	30.300	28.155	1.770	1200
5.007	15.00	187.5	39	29.500	28.075	1.050	1500
1.008	8.03	401.3	38	29.500	27.830	1.070	1500
1.009	9.11	364.3	38	29.500	27.755	1.145	1500
1.010	10.05	201.0	38	29.500	27.705	1.195	1500
1.011	5.99	-4.5	38	29.760	29.025	0.135	1500
1.012	6.05	241.8	Ditch	30.000	29.000	0.550	1500 x 1500

MANHOLE SCHEDULES

M/Hole Number	Cover Level (m)	M/Hole Depth (m)	M/Hole Diam.,L*W (mm)	Pipes Out PN	Pipes Out IL.(m)	Pipes Out D (mm)	Pipes In PN	Pipes In IL.(m)	Pipes In D (mm)
1	33.500	1.425	1200	1.000	32.075	225			
2	32.400	1.125	1200	1.001	31.275	225	1.000	31.275	225
3	32.030	1.330	1200	1.002	30.700	300	1.001	30.775	225
4	32.000	1.650	1200	1.003	30.350	300	1.002	30.350	300
4	32.000	1.820	1200	1.004	30.180	300	1.003	30.270	300
5	30.000	1.475	1200	1.005	28.525	375	1.004	28.600	300
11	29.500	1.175	1200	1.006	28.325	375	1.005	28.325	375
8	30.300	0.805	1200	2.000	29.495	225			
8	30.300	1.120	1200	2.001	29.180	225	2.000	29.180	225
8	30.300	1.465	1200	2.002	28.835	300	2.001	28.910	225
8	30.300	1.515	1200	2.003	28.785	300	2.002	28.785	300
8	30.360	1.055	1200	3.000	29.305	225			
8	31.400	1.425	1200	4.000	29.975	225			
8	30.800	1.975	1200	3.001	28.825	225	3.000 4.000	28.825 29.675	225 225
8	30.300	1.875	1200	2.004	28.425	375	2.003 3.001	28.500 28.575	300 225
8	30.200	1.940	1200	2.005	28.260	375	2.004	28.260	375
8	29.500	1.600	1500	1.007	27.900	600	1.006 2.005	28.125 28.125	375 375
39	30.300	1.240	1200	5.000	29.060	225			
39	30.300	1.510	1200	5.001	28.790	300	5.000	28.865	225
39	30.300	1.375	1200	6.000	28.925	225			
39	30.300	1.620	1200	5.002	28.680	300	5.001 6.000	28.690 28.755	300 225
39	30.300	1.795	1200	5.003	28.505	375	5.002	28.580	300
39	30.300	1.845	1200	5.004	28.455	375	5.003	28.455	375
39	30.300	1.455	1200	7.000	28.845	225			
39	30.300	1.505	1200	7.001	28.795	225	7.000	28.795	225
39	30.300	1.670	1200	7.002	28.630	225	7.001	28.630	225

MANHOLE SCHEDULES

M/Hole Number	Cover Level (m)	M/Hole Depth (m)	M/Hole Diam.,L*W (mm)	Pipes Out PN	Pipes Out IL. (m)	Pipes Out D (mm)	Pipes In PN	Pipes In IL. (m)	Pipes In D (mm)
39	30.300	1.945	1200	5.005	28.355	375	5.004	28.355	375
							7.002	28.505	225
39	30.300	1.995	1200	5.006	28.305	375	5.005	28.305	375
39	30.300	2.145	1200	5.007	28.155	375	5.006	28.155	375
39	29.500	1.650	1500	1.008	27.850	600	1.007	27.875	600
							5.007	28.075	375
38	29.500	1.720	1500	1.009	27.780	600	1.008	27.830	600
38	29.500	1.745	1500	1.010	27.755	600	1.009	27.755	600
38	29.500	1.795	1500	1.011	27.705	600	1.010	27.705	600
38	29.760	0.735	1500	1.012	29.025	450	1.011	29.025	600
Ditch	30.000	1.000	1500 x 1500		OUTFALL		1.012	29.000	450

ATTACHMENT 3

STORM NETWORK 5 YEAR SIMULATION

STORMWATER NETWORK 5 YR SIMULATION

Summary Wizard of "CRITICAL"(Rank 1 by Max Level)
Results for Design Storms

Margin for Flood Risk warning (mm)	300
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF
Analysis Time Step	Fine

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	5
Climate Change (%)	10

PN	Storm	Return Period	Climate Change	Rank	First X Surcharge	First Y Flood	First Z Overflow	O/F Act
1.000	15 Summer	5	10%	1				
1.001	15 Winter	5	10%	1				
1.002	15 Winter	5	10%	1				
1.003	15 Winter	5	10%	1				
1.004	15 Winter	5	10%	1				
1.005	15 Winter	5	10%	1				
1.006	15 Winter	5	10%	1				
2.000	15 Summer	5	10%	1				
2.001	15 Winter	5	10%	1				
2.002	15 Winter	5	10%	1				
2.003	15 Winter	5	10%	1				
3.000	15 Summer	5	10%	1				
4.000	15 Summer	5	10%	1				
3.001	15 Summer	5	10%	1				
2.004	15 Winter	5	10%	1				
2.005	15 Winter	5	10%	1				
1.007	15 Winter	5	10%	1				

Lvl Ex.	PN	Water Lvl. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
	1.000	32.195	-0.105	0.000	0.56	0.0	37.8	O K
	1.001	31.458	-0.042	0.000	0.98	0.0	48.6	O K
	1.002	30.887	-0.113	0.000	0.69	0.0	59.3	O K
	1.003	30.561	-0.089	0.000	0.84	0.0	59.6	O K
	1.004	30.309	-0.171	0.000	0.38	0.0	65.7	O K
	1.005	28.737	-0.163	0.000	0.60	0.0	75.4	O K
	1.006	28.565	-0.135	0.000	0.67	0.0	76.2	O K
	2.000	29.610	-0.110	0.000	0.49	0.0	19.2	O K
	2.001	29.358	-0.047	0.000	0.95	0.0	36.1	O K
	2.002	29.028	-0.107	0.000	0.70	0.0	43.2	O K
	2.003	29.003	-0.082	0.000	0.82	0.0	53.1	O K
	3.000	29.350	-0.180	0.000	0.09	0.0	4.5	O K
	4.000	30.026	-0.174	0.000	0.12	0.0	5.7	O K
	3.001	28.889	-0.161	0.000	0.18	0.0	10.2	O K
	2.004	28.643	-0.157	0.000	0.63	0.0	73.5	O K
	2.005	28.531	-0.104	0.000	0.65	0.0	78.4	O K
	1.007	28.472	-0.028	0.000	0.85	0.0	159.0	O K

Summary Wizard of "CRITICAL"(Rank 1 by Max Level)
Results for Design Storms

PN	Storm	Return Period	Climate Change	Rank	First X Surcharge	First Y Flood	First Z Overflow	O/F Act
5.000	15 Summer	5	10%	1				
5.001	15 Winter	5	10%	1				
6.000	15 Summer	5	10%	1				
5.002	15 Winter	5	10%	1				
5.003	15 Winter	5	10%	1				
5.004	15 Winter	5	10%	1				
7.000	15 Summer	5	10%	1				
7.001	15 Winter	5	10%	1				
7.002	15 Winter	5	10%	1				
5.005	15 Winter	5	10%	1				
5.006	15 Winter	5	10%	1				
5.007	15 Winter	5	10%	1				
1.008	15 Summer	5	10%	1				
1.009	15 Summer	5	10%	1				
1.010	15 Winter	5	10%	1				
1.011	120 Winter	5	10%	1				
1.012	15 Summer	5	10%	1				

Lvl Ex.	PN	Water Lvl. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
	5.000	29.228	-0.057	0.000	0.85	0.0	26.5	O K
	5.001	28.999	-0.091	0.000	0.58	0.0	38.3	O K
	6.000	29.101	-0.049	0.000	0.91	0.0	29.2	O K
	5.002	28.961	-0.019	0.000	1.00	0.0	65.2	O K
	5.003	28.760	-0.120	0.000	0.63	0.0	67.3	O K
	5.004	28.743	-0.087	0.000	0.75	0.0	77.0	O K
	7.000	28.939	-0.131	0.000	0.36	0.0	11.4	O K
	7.001	28.903	-0.117	0.000	0.45	0.0	16.7	O K
	7.002	28.753	-0.102	0.000	0.58	0.0	21.0	O K
	5.005	28.691	-0.039	0.000	0.95	0.0	100.4	O K
	5.006	28.650	-0.030	0.000	0.97	0.0	104.8	O K
	5.007	28.517	-0.013	0.000	0.95	0.0	105.4	O K
	1.008	28.450	0.000	0.000	1.41	0.0	244.5	O K
	1.009	28.380	0.000	0.000	1.23	0.0	245.4	O K
	1.010	28.192	-0.163	0.000	0.88	0.0	268.2	O K
	1.011	28.001	-0.304	0.000	0.17	0.0	36.2	O K
	1.012	29.190	-0.285	0.000	0.29	0.0	36.2	O K

ATTACHMENT 4

STORM NETWORK 30 YEAR SIMULATION

STORMWATER NETWORK 30YR SIMULATION

Summary Wizard of "CRITICAL" (Rank 1 by Max Level)
Results for Design Storms

Margin for Flood Risk warning (mm)	300
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF
Analysis Time Step	Fine

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	30
Climate Change (%)	10

PN	Storm	Return Period	Climate Change	Rank	First X Surcharge	First Y Flood	First Z Overflow	O/F Act
1.000	15 Winter	30	10%	1				
1.001	15 Winter	30	10%	1	30/15 Summer			
1.002	15 Winter	30	10%	1				
1.003	15 Winter	30	10%	1	30/15 Summer			
1.004	15 Winter	30	10%	1				
1.005	15 Winter	30	10%	1				
1.006	15 Winter	30	10%	1				
2.000	15 Winter	30	10%	1	30/15 Winter			
2.001	15 Winter	30	10%	1	30/15 Summer			
2.002	15 Winter	30	10%	1	30/15 Summer			
2.003	15 Winter	30	10%	1	30/15 Summer			
3.000	15 Summer	30	10%	1				
4.000	15 Summer	30	10%	1				
3.001	15 Winter	30	10%	1				
2.004	15 Winter	30	10%	1				
2.005	15 Winter	30	10%	1	30/15 Winter			
1.007	15 Winter	30	10%	1	30/15 Summer			

Lvl Ex.	PN	Water Lvl. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
	1.000	32.300	0.000	0.000	0.77	0.0	52.2	O K
	1.001	31.893	0.393	0.000	1.33	0.0	65.9	SURCH'ED
	1.002	30.978	-0.022	0.000	0.95	0.0	81.1	O K
	1.003	30.660	0.010	0.000	1.14	0.0	81.0	SURCH'ED
	1.004	30.334	-0.146	0.000	0.51	0.0	88.1	O K
	1.005	28.815	-0.085	0.000	0.80	0.0	100.7	O K
	1.006	28.699	-0.001	0.000	0.89	0.0	100.2	O K
	2.000	29.748	0.028	0.000	0.66	0.0	26.1	SURCH'ED
	2.001	29.646	0.241	0.000	1.25	0.0	47.4	SURCH'ED
	2.002	29.210	0.075	0.000	0.96	0.0	58.7	SURCH'ED
	2.003	29.175	0.090	0.000	1.12	0.0	72.2	SURCH'ED
	3.000	29.358	-0.172	0.000	0.13	0.0	6.6	O K
	4.000	30.038	-0.162	0.000	0.18	0.0	8.4	O K
	3.001	28.904	-0.146	0.000	0.26	0.0	15.0	O K
	2.004	28.747	-0.053	0.000	0.85	0.0	98.7	O K
	2.005	28.641	0.006	0.000	0.91	0.0	109.0	SURCH'ED
	1.007	28.542	0.042	0.000	1.14	0.0	213.1	SURCH'ED

Summary Wizard of "CRITICAL"(Rank 1 by Max Level)
Results for Design Storms

PN	Storm	Return Period	Climate Change	Rank	First X Surcharge	First Y Flood	First Z Overflow	O/F Act
5.000	15 Winter	30	10%	1	30/15 Summer			
5.001	15 Winter	30	10%	1	30/15 Summer			
6.000	15 Winter	30	10%	1	30/15 Summer			
5.002	15 Winter	30	10%	1	30/15 Summer			
5.003	15 Winter	30	10%	1	30/15 Summer			
5.004	15 Winter	30	10%	1	30/15 Summer			
7.000	15 Winter	30	10%	1				
7.001	15 Winter	30	10%	1	30/15 Winter			
7.002	15 Winter	30	10%	1	30/15 Summer			
5.005	15 Winter	30	10%	1	30/15 Summer			
5.006	15 Winter	30	10%	1	30/15 Summer			
5.007	15 Winter	30	10%	1	30/15 Summer			
1.008	15 Winter	30	10%	1	30/15 Summer			
1.009	15 Winter	30	10%	1	30/15 Summer			
1.010	15 Summer	30	10%	1				
1.011	120 Winter	30	10%	1				
1.012	15 Summer	30	10%	1				

Lvl Ex.	PN	Water Lvl. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
	5.000	29.454	0.169	0.000	1.15	0.0	35.8	SURCH'ED
	5.001	29.302	0.212	0.000	0.70	0.0	46.2	SURCH'ED
	6.000	29.401	0.251	0.000	1.20	0.0	38.4	SURCH'ED
	5.002	29.253	0.273	0.000	1.28	0.0	83.5	SURCH'ED
	5.003	29.097	0.217	0.000	0.81	0.0	86.9	SURCH'ED
	5.004	29.071	0.241	0.000	0.95	0.0	98.0	SURCH'ED
	7.000	29.064	-0.008	0.000	0.53	0.0	16.6	O K
	7.001	29.053	0.033	0.000	0.72	0.0	26.5	SURCH'ED
	7.002	29.017	0.162	0.000	0.74	0.0	27.1	SURCH'ED
	5.005	28.977	0.247	0.000	1.21	0.0	127.9	SURCH'ED
	5.006	28.870	0.190	0.000	1.26	0.0	135.7	SURCH'ED
	5.007	28.636	0.106	0.000	1.24	0.0	137.4	SURCH'ED
	1.008	28.514	0.064	0.000	2.00	0.0	347.1	SURCH'ED
	1.009	28.418	0.038	0.000	1.74	0.0	347.1	SURCH'ED
	1.010	28.355	0.000	0.000	1.10	0.0	335.9	O K
	1.011	28.195	-0.110	0.000	0.17	0.0	36.2	O K
	1.012	29.190	-0.285	0.000	0.29	0.0	36.2	O K

ATTACHMENT 5

STORM NETWORK 100 YEAR SIMULATION

STORMWATER NETWORK - 100 YR SIMULATION

Project Management Group		Page 1
Killakee House Belgard Square, Tallaght Dublin 24, Ireland		Micro Drainage
Date 29 May 2009 15:51 File PLANNING100YR.SUM	Designed By hydew Checked By	
Micro Drainage	Simulation W.11.2	

Summary Wizard of "CRITICAL"(Rank 1 by Max Level)
Results for Design Storms

Margin for Flood Risk warning (mm)	300
DTS Status	ON
DVD Status	OFF
Inertia Status	OFF
Analysis Time Step	Fine

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 240, 360, 480, 960, 1440, 2160, 2880, 4320, 5760, 7200, 8640, 10080
Return Period(s) (years)	100
Climate Change (%)	10

PN	Storm	Return Period	Climate Change	Rank	First X Surcharge	First Y Flood	First Z Overflow	O/F Act
1.000	15 Winter	100	10%	1	100/15 Summer			
1.001	15 Winter	100	10%	1	100/15 Summer			
1.002	15 Winter	100	10%	1	100/15 Summer			
1.003	15 Winter	100	10%	1	100/15 Summer			
1.004	15 Winter	100	10%	1				
1.005	15 Winter	100	10%	1	100/15 Summer			
1.006	15 Winter	100	10%	1	100/15 Summer			
2.000	15 Winter	100	10%	1	100/15 Summer			
2.001	15 Winter	100	10%	1	100/15 Summer			
2.002	15 Winter	100	10%	1	100/15 Summer			
2.003	15 Winter	100	10%	1	100/15 Summer			
3.000	15 Summer	100	10%	1				
4.000	15 Summer	100	10%	1				
3.001	15 Winter	100	10%	1				
2.004	15 Winter	100	10%	1	100/15 Summer			
2.005	30 Winter	100	10%	1	100/15 Summer			
1.007	15 Winter	100	10%	1	100/15 Summer			

Lvl Ex.	PN	Water Lvl. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
	1.000	32.765	0.465	0.000	0.83	0.0	56.5	SURCH'ED
	1.001	32.238	0.738	0.000	1.48	0.0	73.6	FLD RISK
	1.002	31.112	0.112	0.000	1.09	0.0	92.9	SURCH'ED
	1.003	30.692	0.042	0.000	1.31	0.0	92.7	SURCH'ED
	1.004	30.349	-0.131	0.000	0.59	0.0	102.5	O K
	1.005	29.149	0.249	0.000	0.90	0.0	112.6	SURCH'ED
	1.006	28.991	0.291	0.000	1.02	0.0	115.3	SURCH'ED
	2.000	30.147	0.427	0.000	0.69	0.0	27.3	FLD RISK
	2.001	30.022	0.617	0.000	1.41	0.0	53.6	FLD RISK
	2.002	29.506	0.371	0.000	1.05	0.0	64.2	SURCH'ED
	2.003	29.445	0.360	0.000	1.27	0.0	82.3	SURCH'ED
	3.000	29.366	-0.164	0.000	0.16	0.0	8.6	O K
	4.000	30.047	-0.153	0.000	0.23	0.0	10.8	O K
	3.001	29.039	-0.011	0.000	0.34	0.0	19.4	O K
	2.004	29.025	0.225	0.000	0.89	0.0	103.5	SURCH'ED
	2.005	28.897	0.262	0.000	0.94	0.0	112.9	SURCH'ED
	1.007	28.775	0.275	0.000	1.25	0.0	232.4	SURCH'ED

Summary Wizard of "CRITICAL"(Rank 1 by Max Level)
Results for Design Storms

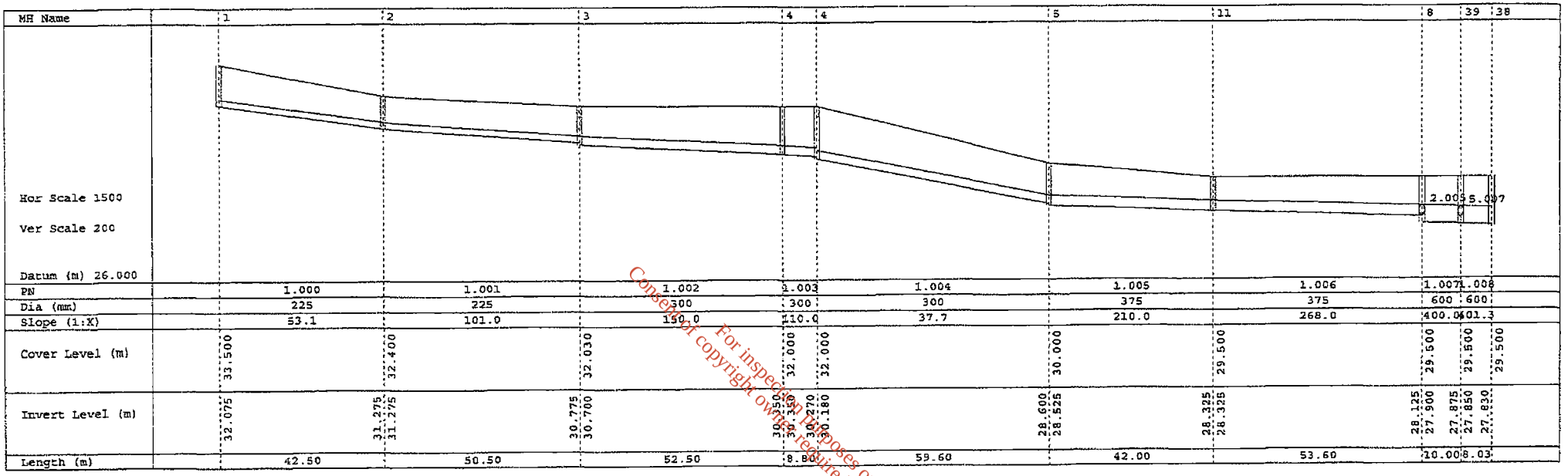
PN	Storm	Return Period	Climate Change	Rank	First X Surcharge	First Y Flood	First Z Overflow	O/F Act
5.000	15 Winter	100	10%	1	100/15 Summer			
5.001	15 Winter	100	10%	1	100/15 Summer			
6.000	15 Winter	100	10%	1	100/15 Summer			
5.002	15 Winter	100	10%	1	100/15 Summer			
5.003	15 Winter	100	10%	1	100/15 Summer			
5.004	15 Winter	100	10%	1	100/15 Summer			
7.000	15 Winter	100	10%	1	100/15 Summer			
7.001	15 Winter	100	10%	1	100/15 Summer			
7.002	15 Winter	100	10%	1	100/15 Summer			
5.005	15 Winter	100	10%	1	100/15 Summer			
5.006	15 Winter	100	10%	1	100/15 Summer			
5.007	15 Winter	100	10%	1	100/15 Summer			
1.008	15 Winter	100	10%	1	100/15 Summer			
1.009	15 Winter	100	10%	1	100/15 Summer			
1.010	15 Winter	100	10%	1	100/15 Summer			
1.011	240 Winter	100	10%	1	100/60 Winter			
1.012	15 Summer	100	10%	1				

Lvl Ex.	PN	Water Lvl. (m)	Surcharged Depth (m)	Flooded Vol (m³)	Flow/ Capacity	Overflow (l/s)	Pipe Flow (l/s)	Status
	5.000	30.002	0.717	0.000	1.25	0.0	39.2	FLD RISK
	5.001	29.811	0.721	0.000	0.84	0.0	55.6	SURCH'ED
	6.000	29.941	0.791	0.000	1.35	0.0	43.2	SURCH'ED
	5.002	29.750	0.770	0.000	1.49	0.0	97.1	SURCH'ED
	5.003	29.548	0.668	0.000	0.94	0.0	100.6	SURCH'ED
	5.004	29.514	0.684	0.000	1.12	0.0	115.6	SURCH'ED
	7.000	29.489	0.419	0.000	0.62	0.0	19.5	SURCH'ED
	7.001	29.476	0.456	0.000	0.79	0.0	29.3	SURCH'ED
	7.002	29.435	0.580	0.000	0.78	0.0	28.4	SURCH'ED
	5.005	29.389	0.659	0.000	1.41	0.0	148.6	SURCH'ED
	5.006	29.246	0.566	0.000	1.48	0.0	159.0	SURCH'ED
	5.007	28.913	0.383	0.000	1.47	0.0	162.7	SURCH'ED
	1.008	28.744	0.294	0.000	2.27	0.0	394.6	SURCH'ED
	1.009	28.587	0.207	0.000	1.98	0.0	395.1	SURCH'ED
	1.010	28.431	0.076	0.000	1.29	0.0	395.3	SURCH'ED
	1.011	28.390	0.085	0.000	0.17	0.0	36.2	SURCH'ED
	1.012	29.190	-0.285	0.000	0.29	0.0	36.2	O K

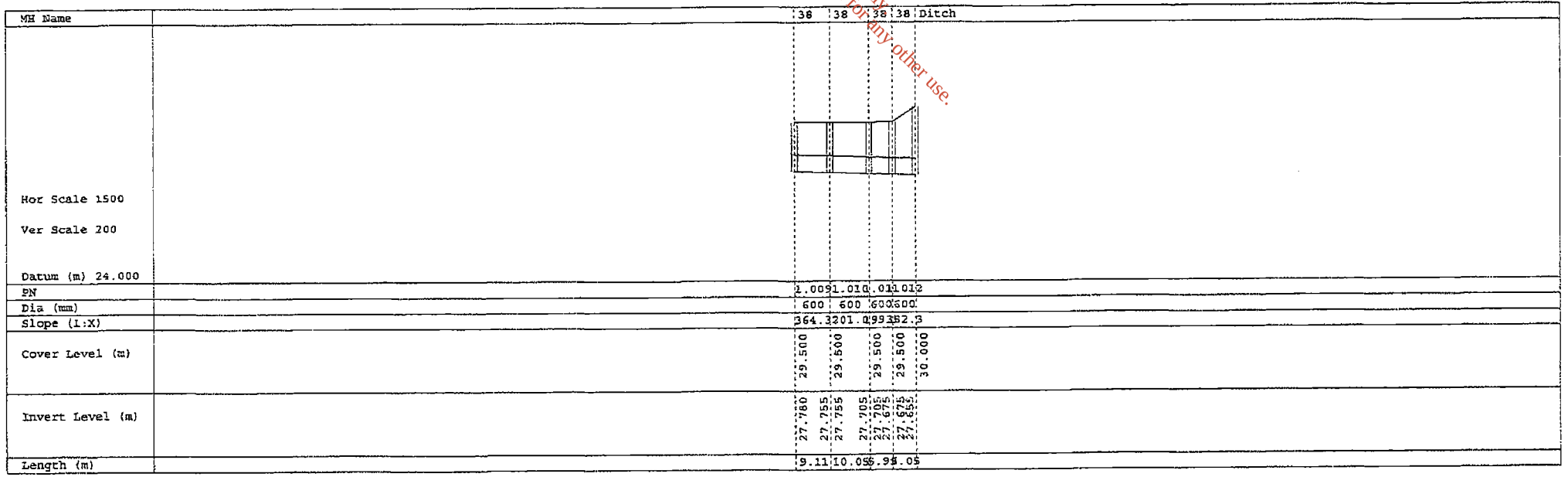
ATTACHMENT 6

STORM NETWORK LONGSECTIONS

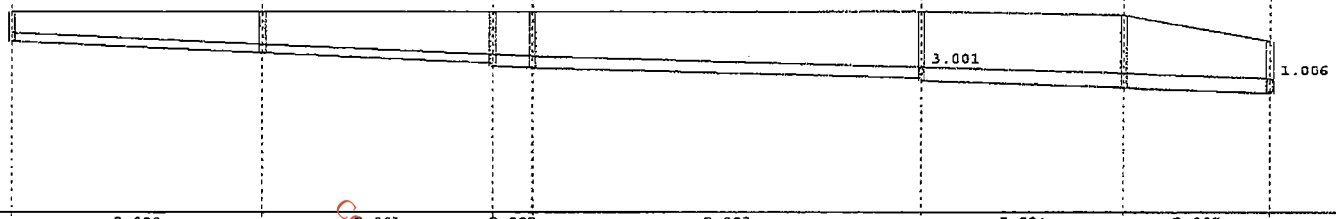
Project Management Group	
Killakee House	
Belgard Square, Tallaght	
Dublin 24, Ireland	
Date 29 May 2009 16:10	Designed By hydew
File PLANNING.SWS	Checked By
Micro Drainage	System1 W.11.2

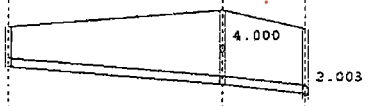


MH Name	1	2	3	4	4	5	11	8	39	38
Hor Scale 1500 / Ver Scale 200 / Datum (m) 26.000								2.000	5.000	
PN	1.000	1.001	1.002	1.003	1.004	1.005	1.006	1.007	1.008	
Dia (mm)	225	225	300	300	300	375	375	600	600	
Slope (1:X)	53.1	101.0	150.0	110.0	37.7	210.0	268.0	400.0	401.3	
Cover Level (m)	33.500	32.400	32.030	32.000	32.000	30.000	29.500	29.500	29.500	29.500
Invert Level (m)	32.075	31.275 31.275	30.775 30.700	30.350 30.350	30.270 30.180	28.600 28.525	28.325 28.325	28.125 27.900	27.875 27.850	27.830
Length (m)	42.50	50.50	52.50	8.80	59.60	42.00	53.60	10.00	8.03	



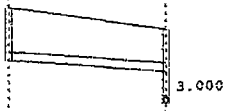
MH Name	38	38	38	38	Ditch
Hor Scale 1500 / Ver Scale 200 / Datum (m) 24.000					
PN	1.009	1.010	1.011	1.012	
Dia (mm)	600	600	600	600	
Slope (1:X)	364.3	201.0	199.3	82.3	
Cover Level (m)	29.500	29.500	29.500	29.500	30.000
Invert Level (m)	27.780	27.755 27.755	27.705 27.705	27.675 27.655	
Length (m)	9.11	10.05	6.95	4.05	

MH Name	8	8	8	8	8	8	8
Hor Scale 1500 Ver Scale 200 Datum (m) 25.000							
PN		2.000	2.001	2.002	2.003	2.004	2.005
Dia (mm)		225	225	300	300	375	375
Slope (1:X)		158.7	170.8	160.0	270.2	242.4	214.8
Cover Level (m)	30.300	30.300	30.300	30.300	30.300	30.200	29.600
Invert Level (m)	29.495	29.180 29.180	28.910 28.825	28.785 28.700	28.500 28.425	28.260 28.260	28.125
Length (m)		50.00	46.00	8.00	77.00	40.00	29.00

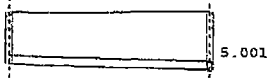
MH Name	8	8	8
Hor Scale 1500 Ver Scale 200 Datum (m) 25.000			
PN		3.000	3.001
Dia (mm)		225	225
Slope (1:X)		88.7	66.0
Cover Level (m)	30.360	30.800	30.300
Invert Level (m)	29.305	28.825 28.825	28.575
Length (m)		42.60	16.50

Project Management Group
Killakee House
Belgard Square, Tallaght
Dublin 24, Ireland
Date 29 May 2009 16:10
File PLANNING.SWS
Micro Drainage

Designed By hydew
Checked By
System1 W.11.2

MH Name		8	8
Hor Scale 1500 Ver Scale 200 Datum (m) 26.000			
PN		4.000	
Dia (mm)		225	
Slope (1:X)		104.0	
Cover Level (m)		31.400	30.860
Invert Level (m)		29.675	29.675
Length (m)		33.20	

MH Name	39	39	39	39	39	39	39	39	39
Hor Scale 1500 Ver Scale 200 Datum (m) 25.000									
PN	5.000	5.001	5.002	5.003	5.004	5.005	5.006	5.007	
Dia (mm)	225	300	300	375	375	375	375	375	
Slope (1:X)	251.3	220.0	225.0	112.0	290.0	190.0	286.7	187.5	
Cover Level (m)	30.300	30.300	30.300	30.300	30.300	30.300	30.300	30.300	29.500
Invert Level (m)	29.060	28.865 28.790	28.690 28.680	28.580 28.505 28.455		28.355 28.355	28.305 28.305	28.155 28.155	28.075
Length (m)	49.00	22.00	22.50	5.60	29.00	9.50	43.00	15.00	

MH Name	39	39
Hor Scale 1500 Ver Scale 200 Datum (m) 25.000		
PN	6.000	
Dia (mm)	225	
Slope (1:X)	235.3	
Cover Level (m)	30.300	30.300
Invert Level (m)	28.795	28.795
Length (m)	40.00	

MH Name	39	39	39	39
Hor Scale 1500 Ver Scale 200 Datum (m) 25.000				
PN	7.000	7.001	7.002	
Dia (mm)	225	225	225	
Slope (1:X)	160.0	169.7	168.0	
Cover Level (m)	30.300	30.300	30.300	30.300
Invert Level (m)	28.845	28.795	28.630	28.505
Length (m)	8.00	28.00	21.00	

ATTACHMENT 7

MET ÉIREANN RAINFALL DATA

Return Period Rainfall Depths for sliding Durations
Location: Duleek, Co. Meath Easting: 303896 Northing: 271067
Average Annual Rainfall(1961-1990) for Duleek: 805mm

DURATION	6months	1year	2	3	4	5	10	20	30	50	75	100	150	200	250	500
5 mins	2.5	3.5	4	4.8	5.3	5.7	7	8.5	9.5	10.9	12.1	13.1	14.5	15.6	16.6	N/A
10 mins	3.5	4.8	5.6	6.6	7.4	7.9	9.8	11.9	13.3	15.2	16.9	18.2	20.2	21.8	23.1	N/A
15 mins	4.1	5.7	6.5	7.8	8.7	9.3	11.5	14	15.6	17.9	19.9	21.4	23.8	25.6	27.2	N/A
30 mins	5.4	7.4	8.5	10.1	11.1	11.9	14.6	17.6	19.5	22.2	24.6	26.5	29.3	31.5	33.3	N/A
1 hours	7.1	9.6	11	12.9	14.3	15.3	18.5	22.1	24.4	27.7	30.5	32.7	36.1	38.6	40.7	N/A
2 hours	9.4	12.6	14.2	16.7	18.3	19.5	23.5	27.8	30.6	34.5	37.9	40.5	44.4	47.4	49.9	N/A
3 hours	11.1	14.7	16.6	19.3	21.1	22.5	27	31.8	34.9	39.2	43	45.8	50.1	53.5	56.2	N/A
4 hours	12.4	16.4	18.5	21.5	23.4	24.9	29.7	35	38.3	42.9	47	50	54.7	58.2	61.1	N/A
6 hours	14.6	19.2	21.5	24.9	27.1	28.8	34.2	40	43.7	48.8	53.3	56.6	61.7	65.6	68.8	N/A
9 hours	17.2	22.4	25	28.9	31.3	33.2	39.3	45.7	49.9	55.5	60.4	64.1	69.7	74	77.4	N/A
12 hours	19.3	25	27.9	32	34.8	36.8	43.3	50.3	54.8	60.8	66.1	70	76	80.5	84.2	N/A
18 hours	22.7	29.2	32.5	37.1	40.2	42.5	49.8	57.5	62.4	69.1	74.9	79.3	85.8	90.8	94.8	N/A
24 hours	25.5	32.6	36.2	41.3	44.6	47.1	54.9	63.3	68.6	75.7	81.9	86.6	93.6	98.8	103.1	117.7
2 days	31.8	40	44.1	49.9	53.7	56.5	65.3	74.6	80.5	88.4	95.2	100.2	107.8	113.6	118.2	133.8
3 days	37	46.2	50.7	57.1	61.2	64.3	74	84.1	90.5	99	106.3	111.7	119.9	126	130.9	147.6
4 days	41.6	51.6	56.5	63.5	67.9	71.3	81.6	92.5	99.3	108.4	116.1	121.9	130.5	137	142.2	159.8
6 days	49.8	61.2	66.8	74.7	79.7	83.5	95.1	107.2	114.8	124.8	133.4	139.8	149.3	156.4	162.1	181.3
8 days	57.1	69.8	76	84.7	90.2	94.4	107.1	120.3	128.5	139.5	148.7	155.6	165.9	173.5	179.7	200.3
10 days	63.9	77.8	84.5	93.9	99.9	104.4	118.1	132.3	141.1	152.8	162.7	170.1	181	189.2	195.8	217.6
12 days	70.3	85.2	92.5	102.6	109	113.7	128.4	143.5	152.9	165.3	175.8	183.6	195.2	203.8	210.8	233.8
16 days	82.4	99.2	107.4	118.7	125.8	131.2	147.5	164.3	174.7	188.5	200	208.6	221.3	230.8	238.4	263.6
20 days	93.6	112.3	121.2	133.7	141.5	147.4	165.2	183.6	194.9	209.8	222.4	231.7	245.4	255.6	263.8	291
25 days	107	127.7	137.6	151.3	160	166.4	186	206.1	218.5	234.8	248.4	258.6	273.5	284.6	293.5	322.9

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For frequencies less that two years Average Recurrence Intervals(ARI) are used
For details refer to:
'Fitzgerald D. L. (2007) Estimates of Point Rainfall Frequencies Technical Note No. 61 Met Eireann Dublin'
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

M5 60 15.3 M5 2d 56.5 Ratio R 0.27

ATTACHMENT 8

PERMISSIBLE DISCHARGE CALCULATION

STORAGE POND VOLUME

PERMISSABLE DISCHARGE

Project Management Group		Page 1
Killakee House Belgard Square, Tallaght Dublin 24, Ireland		Micro Drainage
Date 29 May 2009 16:06 File	Designed By hydew Checked By	
Micro Drainage	Source Control W.11.2	

IH 124 Mean Annual Flood

Input

Return Period (years)	30
Area (Ha)	9.700
SAAR (mm)	802.000
Soil	0.450
Urban	0.000
Region Number	15 (Greater Dublin)

Results	l/s
QBAR Rural	59.8
QBAR Urban	59.8
Q 30 years	127.1
Q 1 year	50.9
Q 2 years	55.1
Q 5 years	82.0
Q 10 years	99.9
Q 20 years	117.2
Q 25 years	122.7
Q 30 years	127.1
Q 50 years	139.4
Q 100 years	156.2
Q 200 years	172.9
Q 250 years	n/a
Q 1000 years	n/a

WARNING: Irish growth curves are not defined above 200 years.

* QBAR = 59.8 l/s

FSE (FACTOR STANDARD ERROR IH 124) DICTATES THAT PERMISSABLE DISCHARGE BE DIVIDED BY 1.65

∴ PERMISSABLE DISCHARGE = 36.2 l/s

STORAGE POND VOLUME

Storage Pond at pipe 1.011 USMH 38

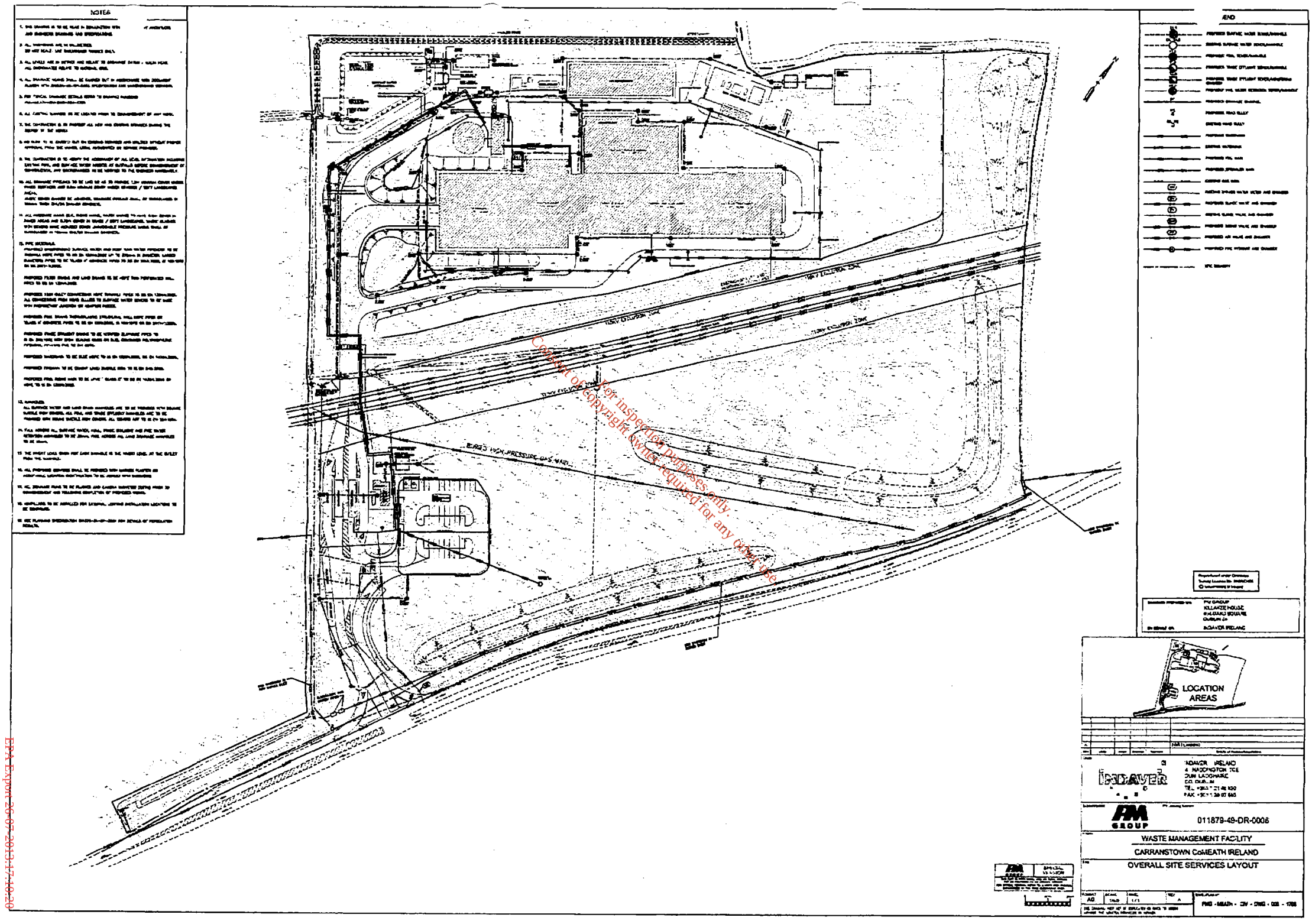
Storage Pond Invert Level (m) 27.705

Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.0	800.0	0.6	800.0	1.2	800.0	1.8	800.0	2.4	0.0
0.1	800.0	0.7	800.0	1.3	800.0	1.9	800.0	2.5	0.0
0.2	800.0	0.8	800.0	1.4	800.0	2.0	800.0		
0.3	800.0	0.9	800.0	1.5	800.0	2.1	0.0		
0.4	800.0	1.0	800.0	1.6	800.0	2.2	0.0		
0.5	800.0	1.1	800.0	1.7	800.0	2.3	0.0		

ATTACHMENT 9

SITE SERVICES OVERALL PLAN LAYOUT

DRAWING 011879-49-DR-1706



12 ECOLOGY

12.1 INTRODUCTION

This application for the proposed amendments will have no impact on Ecology. The proposed amendments to the application now being submitted (as outlined in section 1.1), is for the same development, on the same site, but on a slightly reduced building footprint. The ecological assessment already undertaken in 2005 has comprehensively addressed the potential impacts of the proposed development on the flora and fauna of the site and its environs.

Since the production of the 2006 EIS, Ecological Solutions Ltd carried out a Bat and Vertebrate Faunal survey in April and May 2008. Subsequently a number of mitigation measures for bats were implemented on site in September 2008. A copy of these reports are presented in Appendix 12.1 and 12.2. A summary of the Assessment completed in 2005 along with the findings from the more recent surveys are presented in this Chapter.

12.2 NATURE CONSERVATION DESIGNATIONS

A review of the National Parks and Wildlife Service datasets (www.npws.ie) indicates that there are no parts of the site or the immediate surroundings covered by a scientific or conservation designation or proposed designation as recognised by the NPWS. Four designated pNHAs and one cSAC occur within approximately 5km of the site and are detailed below (see Figure 12.1).

Table.12.1. Designated sites within approximately 5 km of the study area.

Site	Designation	Site Code	Description	Approx. distance to study area
01578	Duleek Commons	pNHA	Calcareous marsh and fen system	2 km
01593	Thomastown Bog	pNHA	Raised bog surrounded by wet woodland and wet grassland	5 km
01862	Boyne River Islands	pNHA	Alluvial wet woodland	5 km
01861	Dowth Wetland	pNHA	floodplain marsh with an associated area of deciduous woodland	4 km
002299	River Boyne & River Blackwater	cSAC	Fresh water river with alkaline fen and alluvial woodlands	3km

12.3 CONSULTATION

As part of the ecological assessment completed in 2005, consultation was undertaken with the Department of Environment, Heritage and Local Government (DOEHLG) and the Eastern Regional Fisheries Board (ERFB).

The DOEHLG considered the area to be largely intensive agricultural land use and had no ecological issues with the proposed development. The ERFB highlighted the populations of brown trout in the Nanny. The Environmental Officer stated that it was imperative that preventative measures were taken to ensure non negative impact to water courses.

12.4 FIELD INSPECTIONS

Comprehensive flora, mammal and bird assessments were conducted at the proposed site as part of the EIS submitted with the planning application in 2006. No designated habitats of international or national value were recorded on or adjacent to the site. All the habitats recorded on site are widespread within the landscape and of moderate to low species-richness. A summary of the habitats present on site at the time of the original study in 2005 is provided in Figure 12.2. However since then some of these habitats i.e. H1, H3, H4 and H5 habitats were removed during the site clearance works.

12.4.1 Flora

All the habitats recorded on site are widespread within the landscape and of moderate to low species-richness. The dominant habitats on site are arable crops and improved agricultural grassland, which are highly modified habitats. They are of low scientific interest and represent a low contribution to local biodiversity.

12.4.1.1 Flora Mitigation Measures

There are no habitats on site of high ecological importance that warrant conservation. Hedgerows and treelines will be incorporated where possible and enhanced to improve the biodiversity value of these features. The development provides good potential to increase the biodiversity value of the site with appropriate landscaping. Best practices methods should ensure that there is no impact on surrounding watercourses and subsequently the River Nanny. By undertaking, these measures it is envisaged that there will be no negative impact on the ecology of the area and there will be a net gain in biodiversity value of the site.

A review of the Heritage Division datasets indicates that no part of the site or the immediate surroundings is covered by a scientific or conservation designation or proposed designation as recognized by the National Parks and Wildlife Service (NPWS). Four designated sites occur within the vicinity of the site; the nearest Duleek Commons proposed Natural Heritage Area c. 2km to the south west of the development. The surrounding habitats consist largely of arable land and improved agricultural grassland bunded by hedgerow of similar composition and structure as those described on the site. In addition no rare, threatened or legally protected plant species, as listed in the Irish Red Data Book (Curtis & McGough, 1988), were found throughout the site nor have been known to occur in the general area in the past. The species are widespread within the landscape and are typical of the habitats in which they were found.

The air quality assessment shows that the nearest conservation designation is outside the range of the air emission plume. The other designated sites; the Boyne River Islands candidate Special Areas of Conservation; Dowth Wetlands proposed Natural Heritage Area and Thomastown Bog are c.4-5km from the site and also outside the range of the air emission plume.

The studies carried out by AWN showed that the entire maximum predicted ground level concentrations of emissions were found to be below the limits specified in the Council Directive 2000/76/EC air quality standard limits and WHO guideline values. The cumulative emissions of the waste to energy plant and the other developments in the vicinity did not cause the maximum predicted ground level of emissions to reach air quality standard limit values and guidelines. As the projected emissions will be within European Limits, it is considered that there would be no significant impacts by air emissions on the flora and fauna within the surrounding area or on designated sites for conservation in the region.

12.4.1.2 Flora Conclusion

A number of the mitigation measures have now been implemented as part of the initial stages of the development of the site. Existing treelines and hedgerows have been retained where possible, it is therefore envisaged that there will be no negative impact on the ecology of the area and there may be a net gain in biodiversity value of the site.

12.4.2 Fauna

The site has a very low representation of Irish fauna, due to the intensive agricultural practice (most of the site is composed of arable land) and therefore a limited range of habitats on site. The vegetated boundaries are of low species diversity and poor structure. There is an almost total lack of ponds, and there are no rivers or streams. There are very limited areas of scrub or other habitat types.

12.4.2.1 Fauna Mitigation Measures

The proposed scheme will entail loss of arable lands, improved pasture and boundaries of low ecological interest. No species of ecological importance were noted on the site. No signs of current active use of the site by badgers were found. Bats were considered likely to utilise the area for feeding, summer and winter roosts may be present in mature trees or within ivy covered trees on site. Bat foraging and roosting areas may be affected. No significant impacts are expected on other species known or expected on site.

Since the completion of the EIS in 2006 and subsequent grant of planning for the site in 2007 a number of mitigation measures have been implemented, namely;

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- Bat and Vertebrate Faunal Survey
- Erection of Bat Boxes
- Supervised felling of Potential Bat Roosts

Bat and Vertebrate Faunal Study

A bat survey was completed at the site on the 28th of April 2008 and 1st May 2008. A vertebrate faunal survey, with a focus on badgers was undertaken on the 10th April 2008. Both surveys were undertaken at suitable times of the year for the species assessed though it is noted that there are no seasonal constraints in relation to badgers. In summary it was identified that Bats utilise the area for feeding, commuting and roosting. Mitigation measures in the form of bat boxes and supervised felling of trees were recommended to ensure minimum impact to bat species as a result of the proposed development. Impacts on the other vertebrate fauna that were the main focus of the assessment were found to be insignificant/neutral or minor negative.

Erection of Bat Boxes

In order to mitigate against the potential loss of bat foraging/roosting sites identified for bat species, six bat boxes have been erected at the site. The main function of bat boxes is to provide alternative safe roosting sites for groups of bats where natural sites become unavailable. Boxes were installed by Ecological Solutions Ltd on 29th September 2008 in accordance with best practice at suitable locations. Details of the Bat Box scheme have been forwarded to Bat Conservation Ireland to be included in their database for monitoring purposes. The scheme will be monitored for a period of over 2 years in order to ensure best placement and effectiveness of the boxes.

Supervised Felling of Trees marked as Potential Bat Roosts (PBR)

In order to ensure felling of trees with potential to be bat roosts is undertaken sensitively, felling of trees was undertaken in accordance with NRA Guidelines: Guidelines for the treatment of Bats during the construction of National Road Schemes (Tree felling and Hedgerow Removal). This requires large mature trees to be felled carefully by gradually dismantling the tree by a qualified tree surgeon under supervision of a bat specialist. One PBR tree was felled on September 22nd 2008 under the supervision of the bat specialist. No bat droppings or other evidence of bat usage was recorded in the tree felled. Three other trees identified as PBR trees were located at the site boundary and have been retained.

12.4.2.2 Fauna Conclusion

No species of ecological importance were noted on the site. No signs of current active use of the site by badgers were found. As bats are thought likely to use the site for feeding, a number of mitigation measures for bats have now been implemented at the site. This will ensure that impacts on fauna in the locality are negligible.

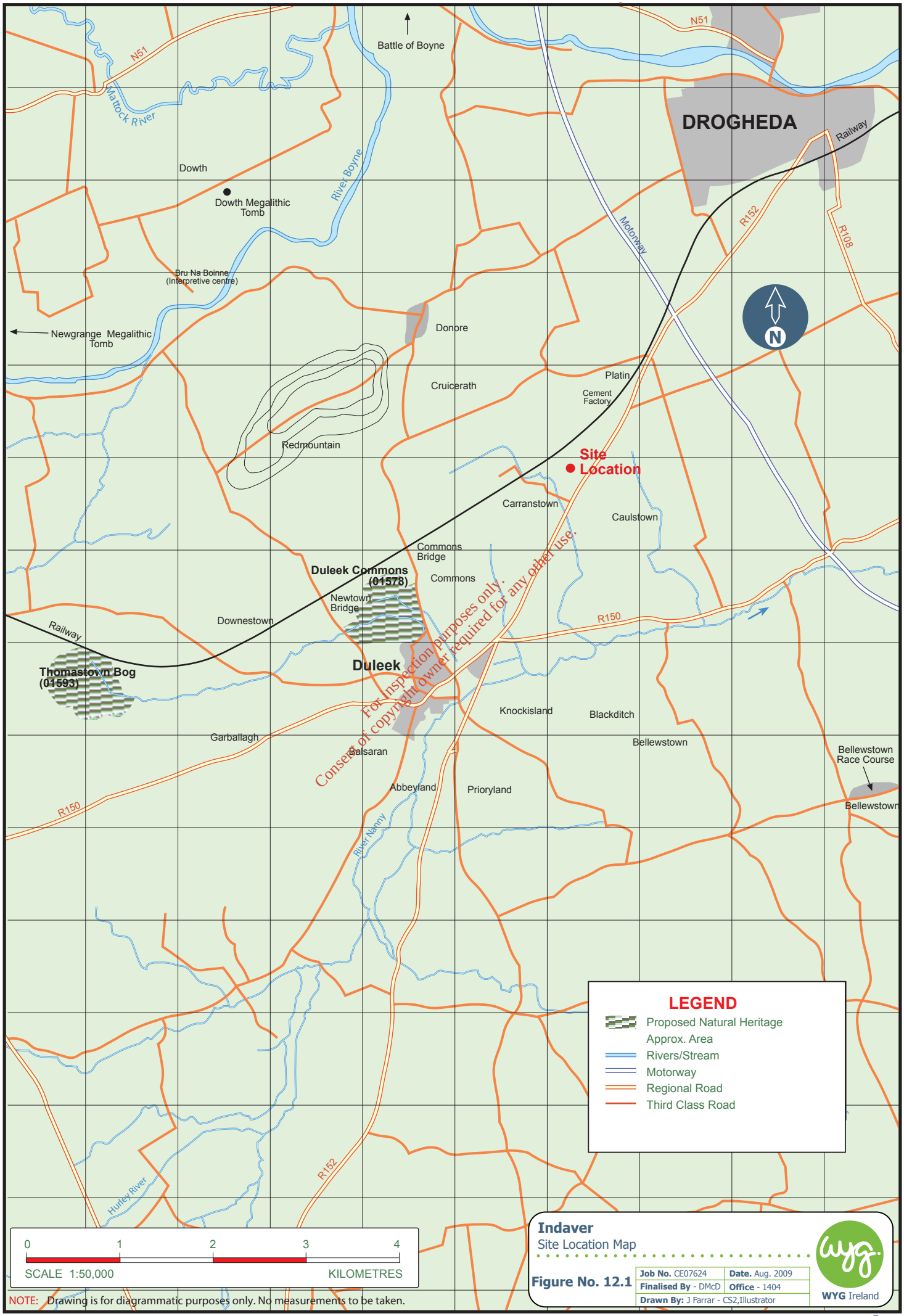
12.4.3 Birds

The bird species recorded breeding in the survey area are typical of agricultural habitats in eastern Ireland. The presence of a nesting pair of peregrines in the locality is of note as this species is listed in Annex I of the EU Birds Directive. However, the peregrine is not a species of high conservation concern in Ireland, and a national survey in 2002 indicated a stable population with significant increases in the use of artificial sites, such as quarries and buildings.

The maturing trees and shrubs within the site will support all of those species which already occur and it is likely that a higher diversity of species will occur than at present due to the diversity of trees and shrubs that will be planted as part of the landscaping plan for the site.

12.5 CONCLUSIONS

The amendments to the proposed development will have no significant impact on the ecology of the site. A number of mitigation measures have now been completed and should ensure that any potential impacts to flora, fauna and birds are minimised.



LEGEND

- Site Boundary
- Improved agricultural grassland
- Arable crops
- Spoil & bare ground
- Hedgerow (intact)
- Hedgerow (gappy)
- Treeline
- Drainage ditch

0 50 100 150
METRES

N

NOTE: Drawing is for diagrammatic purposes only. No measurements to be taken.

Indaver
Habitat Map

Figure No. 12.2

Job No. CE07624	**Date.** Aug. 2009
Finalised By - DMcD	**Office** - 1404
Drawn By: J Farrar - CS2,Illustrator	

WYG Ireland

Appendix 12.1

Bat and Vertebrate Faunal Survey

APPROVED WASTE MANAGEMENT FACILITY (WASTE INCINERATOR) AT CARRANSTOWN, CO. MEATH

PRE-CONSTRUCTION STUDIES

BAT AND BADGER SURVEY

FINAL Report prepared for

INDAVER

by

Dr. Tina Aughney B.Sc. Ph.D.
Mr. Ger Stanton B.Sc.
&
Dr. Chris Smal B.Sc. Ph.D. MIEEM

26th June 2008

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APPROVED WASTE MANAGEMENT FACILITY (WASTE INCINERATOR) AT CARRANSTOWN, CO. MEATH

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PRE-CONSTRUCTION BAT AND BADGER SURVEY

1. Introduction

Indaver Ireland Ltd have received planning permission from Meath County Council for the construction of a waste management facility at Carranstown, in the form of a non-hazardous waste incinerator. The facility will service the North-East Region and has a capacity to treat 30% of the waste generated in the region, leaving 70% available for other technologies including recycling and composting.

Ecological Solutions were requested to conduct pre-construction bat and badger surveys, and such surveys are the subject of this report. These pre-construction surveys were a requirement of the mitigation measures of the EIS.

Present landuse is primarily of arable farmland, with one field of permanent improved grassland pasture. Surrounding landuse is also agricultural, with some nearby residential buildings. A large cement factory is sited not far from the site, to the north-east.

1.1 Site location and access

The site is located in north-east Co. Meath in the townland of Carranstown, c. 3km north-west of Duleek town, and c. 4.7km south-east of Drogheda. The site can be accessed from the Regional road R152.

The study area, c. 25 acres in size, falls within 1 km square O 0670 of the National Grid (Discovery Series Sheet no. 43).

2. Bat and fauna survey

This report presents the results of a bat survey undertaken on the 28th April and 1st May 2008. The bat fauna occurring on the site are described, and the likely impacts of the proposed development on the fauna discussed, with recommendations for mitigation or remedial measures.

The vertebrate faunal study, with focused emphasis on badgers, was undertaken on the 10th of April 2008. The results are discussed and mitigation measures considered. This fauna study did not include birds (refer to EIS for bird assessment and mitigation measures).

The general format of this report is in accordance with guidelines recommended by the EPA - *Guidelines on the Information to be contained in Environmental Impact Statements* (2002) and Advice notes on current practice (2003) Recommendations and evaluation techniques utilised are in general accordance with *Guidelines for Baseline Ecological Assessment* (Institute of Environmental Assessment, UK, 1995), *Wildlife Impact: the treatment of nature conservation in environmental assessment* (RSPB, 1995) and *Guidelines for ecological evaluation and impact assessment* (Regini, M. 2000).

2.1 Survey methodology

Daytime field survey (of bats) was conducted by Dr. Tina Aughney on 28th April 2008 in good weather conditions: dry, clear skies, warm and breezy. This was followed by a night-time bat detector survey on the same date. Weather conditions became progressively cooler as the night proceeded with persistent rain showers. As a result, a second night-time visit was undertaken on 1st May 2008 during milder and drier weather conditions.

The bat survey was conducted by search of potential roosting sites in daytime and by use of bat detectors at night.

One building located adjacent to the survey area, a farm cottage (in derelict condition), was surveyed. Daytime survey for bats included search of this building and examination of mature trees within the survey area. The presence of bats is indicated principally by their signs, such as staining, feeding signs or droppings - though direct observations are also made. Mature trees were also assessed as 'Potential Bat Roosts' (PBRs) and those trees with tree holes, crevices, split limbs, and dead wood were recorded.

A night-time detector survey was carried out using Pettersson D240 Time/Expansion Heterodyne detector, and Tranquillity Time Expansion detectors. The Pettersson D240 detector was used during walkabout survey while the Transect Tranquility time expansion detector was located at the cottage to record any bat activity on a continuous basis during night-time survey period (Recording from 9.00 pm to 10.30 p.m. on the first night and 9.00 pm to 11.30 p.m. on the second night).

Bat activity is mainly bi-modal, with bats taking advantage of increased insect numbers on the wing in the periods after dusk and before dawn – and, therefore, there is usually a lull in activity in the middle of the night. This is true of 'hawking' species - bats which capture prey in the open air. However, 'gleaning' species such as brown long-eared *Plecotus auritus*, Natterer's bats *Myotis nattereri* and whiskered bats *Myotis mystacinus* remain active throughout the night, as prey is available on foliage for longer periods. The prime periods for detecting, therefore, are two hours after dusk and again for a shorter period before dawn.

Field survey (of badgers and other vertebrate fauna, excluding birds) was conducted by Mr. Ger Stanton on the 10th April 2005 in good weather conditions: dry, clear, warm and with a slight breeze.

Survey of fauna was carried out by means of a thorough search within the site. Presence of mammals is indicated principally by their signs, such as dwellings, feeding signs or droppings - though direct observations are also occasionally made.

Both sides of internal boundaries were searched. Some of the adjoining lands to the south were search also. Only one side of the external boundary to the north and west was searched.

The nature and type of habitats present are also indicative of the species likely to be present.

2.1.1 Survey constraints

The timing of the survey for bats was ideal, as bat activity is high during the summer months (at the time of this survey) due to the high insect activity and warm air temperatures. Summer roost sites are occupied at this time of year so that species likely to occur in the area are likely to have been present at the time of survey. Therefore, there were no survey constraints in relation to bat detector survey.

There were no seasonal constraints in regard to badger survey at this time of year. Badger surveys are best conducted from December to April, when vegetation cover is low.

Note that the EIS survey for badgers was conducted in June, well outside of preferred season of survey as vegetational cover makes badger survey impracticable.

3. General description of area

The site is located in generally flat agricultural landscape between the towns of Drogheda and Duleek. Elevation drops gently from the east to the west, rising again at the extreme west. The elevation of the site is between 30 and 40m asl. The site is within an agricultural area of good soils.

A railway line is present a short distance from the site to the west. The site is immediately adjacent to the R152.

All but one of the several fields on site have been recently ploughed.

The principal habitats present in the area were mapped by Dr. Chris Smal (refer EIS 2005) in previous faunal survey for EIS and that was used as the basis for the present bat survey.

3.1 Designated conservation areas in the vicinity

There are no designated conservation areas in the immediate locality. Duleek Commons (pNHA no. 01578) is situated c. 2km to the south-west. Thomastown Bog (pNHA no. 01593) is situated c. 6 km to the south-west also. The Boyne River valley cSAC is situated c. 4km to the north-west. The River Nanny reaches the Irish Sea at Laystown, where the estuary is a pNHA and an pSAC (site code: 000554, Laytown Dunes/Nanny Estuary).

4. Results of bat survey

4.1 Detector survey

The bat detector survey recorded three bat species, with additional records for *Myotis* species, roosting, commuting and/or foraging within the survey site.

Common pipistrelles *Pipistrellus pipistrellus* and soprano pipistrelle *Pipistrellus pygmeaus* were recorded emerging from the farm cottage adjacent to the proposed development (7 common pipistrelles) and also from an additional house adjacent to the proposed development site (8 soprano pipistrelles). These bats were observed commuting along hedgerows within the proposed development site (Figure 1) towards the general vicinity of the railway tract. No bats were recorded emerging from PBR (Potential Bat Roosts) trees located within the proposed development site.

Common pipistrelle bat activity was high and this species was recorded throughout the survey area commuting and foraging along hedgerows and scrub areas. It was the most commonly recorded species during this bat survey.

Soprano pipistrelle *Pipistrellus pygmeaus* bat activity was also relatively high and this species was recorded throughout the survey area commuting and foraging along hedgerows and scrub areas. It was the second most commonly recorded species during this bat survey.

An additional species of bat Leisler's bat *Nyctalus leisleri*) were recorded foraging and commuting within the survey area.

Two *Myotis* species individuals were recorded commuting along hedgerows towards the railway line.

4.2 Building survey

No bat droppings were recorded on external walls or windows of the derelict farm cottage located just outside the proposed development site.

4.2.1 Other species

Other species which might be expected in the area include the Natterer's bat *Myotis nattereri*, which is a widespread woodland species (high potential that the *Myotis* species individuals detected was this species), and Nathusius' pipistrelle *Pipistrellus nathusii*.

These species would be expected to occur more frequently at the west of the site where there are areas of woodland (railway line) and more extensive scrub habitats.

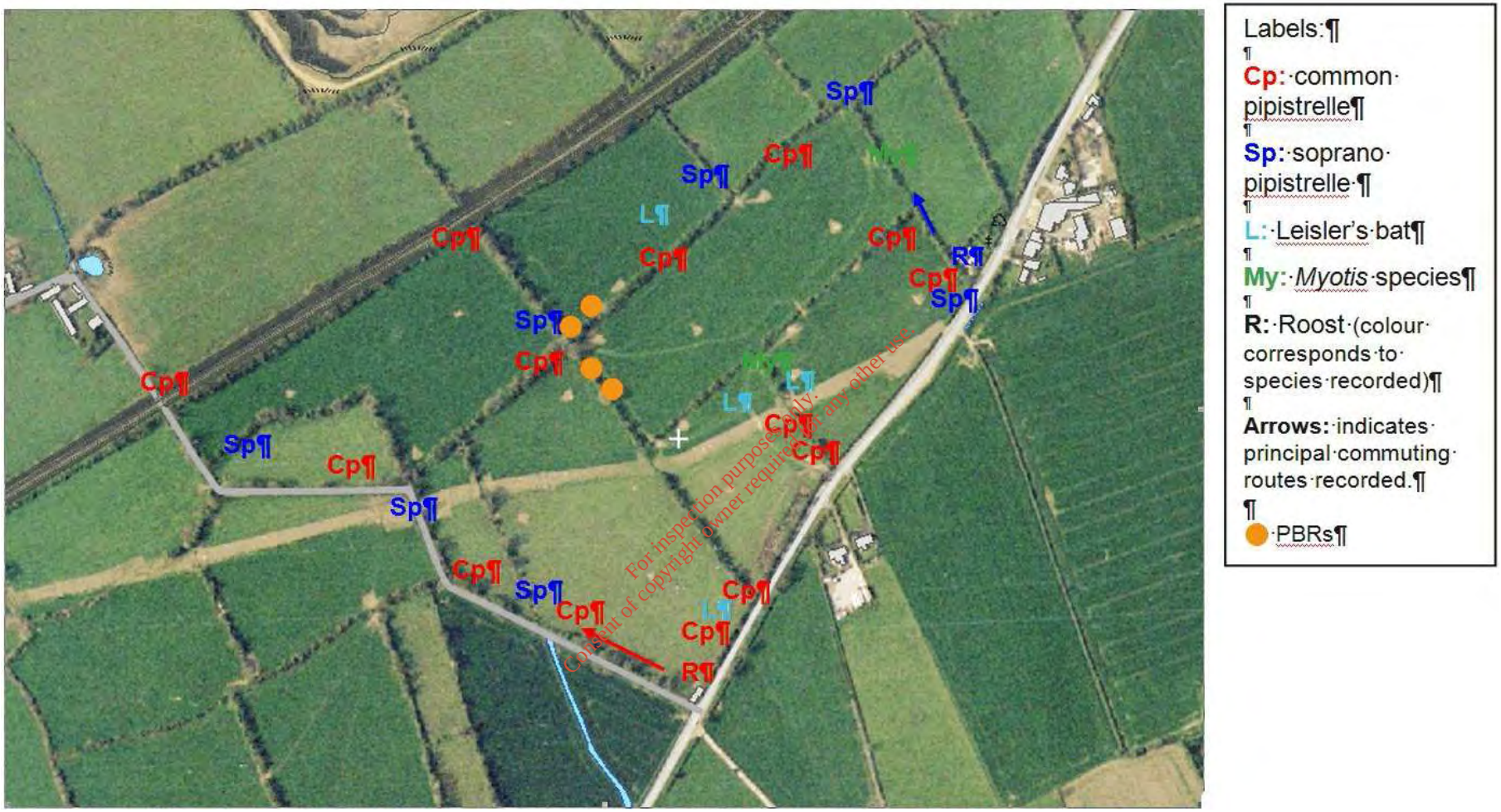

Figure 1. Results of daytime field survey and night-time bat detector survey. [PBR = potential bat roost in tree].

4.3 Tree and hedgerow survey

No definite tree bat roost was identified during the survey.

However, a small number of the trees within the site show potential features for use as bat roosts. Present were crevices or raised bark in which bats may secrete themselves; some trees had dead or broken branches, and others had dense ivy growth beneath which bats may roost.

Table 1: Mature trees identified as Potential Bat Roosts (PBRs)

tree	Species	PBR Value
1	Ash	B – tree holes, dead wood, split limbs and ivy
2	Ash	C – split limbs and dead wood
3	Ash	C – split limbs and dead wood
4	Ash	C – split limbs and dead wood

Recommended mitigation measures, to ensure that any animals resting on or within them are not harmed, are listed later.

Hedgerows on site provide suitable foraging areas for bats. There is a high degree of connectivity between mature hedgerows, which increases the commuting value for bats commuting to the proposed development site.

5. Badger/fauna survey results

Signs of faunal species of interest (and others) are shown on Figure 2 below.

5.1 Badger signs

No badger *Meles meles* setts were found to be present on site. This accords with the findings of the EIS, whilst seasonal constraints were high at the time of that survey.

However, badger prints and badger hair were found at several locations on site in this survey. This result shows that badgers do occur on site but that they have no active setts on site.

The fauna survey for the EIS was conducted in June, outside of the optimum survey season for badgers, as high vegetational cover makes search for badger setts and their signs very difficult indeed. Hence the recommendation in the EIS for an additional badger survey at pre-construction stage. The present study has been more successful in finding badger signs on site; it seems clear that there are no badger setts on site however.

There is considered to be one badger social group in the area, but with no setts on the site itself. Badgers are common in the Irish countryside and some presence of badgers is expected in most lowland areas of Ireland. A badger group's territory is variable but has a mean of c. 80 ha (varying from c. 15 ha to over 150 ha or more). Thus, the lands in question would constitute a portion of the foraging area of a badger social group.

5.2 Other mammalian species and amphibians

Fox *Vulpes vulpes* signs were located at two locations within site. A fox print was located in soft mud near the center of site. A fox scat was found near the rail track to the west of site. No fox dens were found.

Rabbit *Oryctolagus cuniculus* burrows with fresh droppings at the entrances were found below the railway embankment at the western end of the site. Several rabbits were also observed in this area.

One Irish hare *Lepus timidus hibernicus* print was identified just beyond the southern end of the site in soft mud. This species was noted as present on site previously.

An Irish Stoat *Mustela erminea hibernica* print was observed just beyond the southern end of the site. This species had not been observed in the EIS but potential presence had been noted in the EIS.

No otter *Lutra lutra* signs were observed on site, nor is this species expected on site due to lack of waterbodies or watercourses. This accords with the EIS findings.

No amphibians and reptiles were observed on site. This accords with EIS findings.

6. Overall assessment of scientific interest of site for fauna

i the main portion of the site is comprised of arable farmland, with a portion of improved agricultural grassland at the west. The arable land may be considered as of Negligible ecological value for foraging bats. These areas provide limited foraging opportunities for badgers and are less favoured by badgers than grassland areas.

ii the boundaries on site are of varied species composition and structure. They do provide wildlife corridors and foraging areas for common bat species and there is a high degree of connectivity between mature hedgerows and treelines. Therefore, they may be considered as of medium ecological value for bat species. These habitats are also commuting and foraging areas for badgers and other common faunal species.

iii Roosting sites for bats were recorded in the farm cottage house and second dwelling located adjacent to the proposed development site. In addition, some occasional small roosts may be located in mature trees on-site.

iv Extensively grazed agricultural grassland is also a suitable foraging habitat for bat species such as the Leisler's bat. These habitats do provide foraging areas for badgers.

Descriptions of the bat species identified on or potential on site are given in the Appendices.

7. Legal status – species of interest

All Irish bat species are protected under the Wildlife Act (1976) and Wildlife Amendment Act (2000). Across Europe, they are further protected under the Convention on the Conservation of European Wildlife and Natural Habitats (Bern Convention 1982), which, in relation to bats, exists to conserve all species and their habitats. The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention 1979, enacted 1983) was instigated to protect migrant species across all European boundaries. The Irish government has ratified both these conventions. Also, the EC Directive on The Conservation of Natural habitats and of Wild Fauna and Flora (Habitats Directive 1992), seeks to protect rare species, including bats, and their habitats and requires that appropriate monitoring of populations be undertaken.

In relation to other vertebrates: common protected [Wildlife Act (1976) and Wildlife [Amendment] Act (2000)] species observed or expected on site include the Irish hare, pygmy shrew, Irish stoat, and hedgehog. These species are common and generally ubiquitous in Irish agricultural landscapes.

A number of mammalian species are protected under the Wildlife Act (1976) and Wildlife [Amendment] Act (2000)[1]. These include the badger (which is also a Red Data Book species). However, the badger is a relatively common species and ubiquitous through much of the Irish countryside (Smal, 1995).

It is standard best practice to make special provisions for badgers affected by development; whilst the species is common in much of the Irish landscape, badgers are notable for their practice of constructing large underground tunnel and chamber systems (setts). Provisions are made for their humane removal or for their conservation on site where feasible or practicable. No active (or disused) setts were found on site; the Wildlife [Amendment] Act (2000) protects all setts (as resting places).

[1] Note that the Wildlife Act (1976) and the Wildlife Amendment Act (2000) allow exemptions for certain types of development [page 32, 2000 Act: "it shall not be an offence for a person - …while constructing a road, or building operation or work of engineering construction, or while constructing or carrying on such other operation or work as may be prescribed, *unintentionally* to kill or injure such an animal or *unintentionally* to destroy or injure the breeding place or resting place of such an animal…"]

8. Potential impacts of proposed development on fauna

The proposed scheme involves works and construction of facilities over most of the site, with access to the site from the R152.

There will be almost complete loss of habitats that are currently present on site (except portions at the extreme west). These include arable lands, a portion of improved pasture grassland, and most hedgerows and treelines present.

Principal impacts on bat fauna may be summarised as follows:

The proposed development will result in the loss of agricultural grassland, hedgerows and scrub leading to the loss of foraging habitat. One of the main impacts on bats arises through the loss of hedgerows, which are widely used as commuting routes by all of the bat species recorded. The degree of impact varies greatly depending on the bat species recorded and the location along the hedgerow network.

In addition, lighting and potential noise pollution from the proposed development is likely to impact on foraging and commuting bats in the vicinity of the hedgerow network and roosting sites recorded. The degree of impact is likely to be higher on *Myotis* species compared to the other three bat species recorded within the proposed development site.

Impacts on bats are considered to be Minor Negative provided that external boundary habitats remain in place. However, the loss of external boundary habitats will have a greater impact on commuting bats especially for those individuals roosting in the buildings identified as roosts and impacts on bats would be considered to be Minor Negative to Moderate Negative in this regard.

It is considered that, if appropriate mitigation measures are taken, bats of each species should persist in the area and commuting routes should continue to be available to bats.

Principal impacts on other fauna (mammals, amphibians etc.; birds not included) may be summarised as follows:

There will be loss of foraging areas for the badger group present in the area. That group does not have setts on site but such may be present nearby, e.g. along the old railway line or other suitable habitats nearby. The loss of a portion of the badger group's foraging area will have a negative impact on that group, but it is considered that this will be a slight negative impact in the overall context of badger densities in the locality, county and nationally. Badgers are being culled in Ireland as part of a TB control programme, but are otherwise protected.

The larger mammalian species of interest will move away from construction works. However, site clearance will result in mortality of some protected species such as pygmy shrew and possibly hedgehog. There are no means that can be reasonably adopted to avoid such losses, but these are common species.

Landscaping measures and additional planting etc. will off-set these losses by

providing additional habitat of benefit to these species.

8.1 Potential impacts on adjoining areas

There is not expected to be any significant impact on bat fauna present in adjoining areas arising from this proposal once external boundary habitats remain in place.

There will be a slight negative impact on the badger group using the site as a foraging area. This group has a territory that includes adjoining areas. The net impact on adjoining areas will be Minor Negative or Negligible re. badgers.

The impacts on other fauna in adjoining areas is considered to be Negligible.

Impacts on non-designated areas in the locality are also considered to be Negligible.

8.2 Impacts on designated conservation areas in the general vicinity

No designated conservation areas are present in the immediate vicinity of the site. Several are present within c. 6km of the site. Drainage is towards the conservation area of the Nanny Estuary.

No impacts, arising from the proposal, are expected on any of these designated conservation areas.

9. Mitigation measures

9.1 Bats

Bats utilise the area for feeding, commuting and roosting while additional summer (and perhaps winter roosts) may be present in mature trees or within ivy-covered trees on-site.

9.1.1 felling of large trees

Trees, which are to be removed, should be felled during the spring months of March, April, May or autumn months of September, October or November (felling during the spring or autumn months avoids the periods when the bats are most active).

Any trees showing crevices, hollows etc., should be removed while a bat specialist is present to deal with any bats found. Large mature trees should be felled carefully, essentially by gradual dismantling by tree surgeons, under supervision of a bat specialist. Refer to Table below:

Table 1 (repeated): Mature trees identified as Potential Bat Roosts (PBRs)

tree	Species	PBR Value
See Figure 1		
1	Ash	B – tree holes, dead wood, split limbs and ivy
2	Ash	C – split limbs and dead wood
3	Ash	C – split limbs and dead wood
4	Ash	C – split limbs and dead wood

Care should be taken when removing branches as removal of loads may cause cracks or crevices to close, crushing any animals within. These cracks should be wedged open prior to load removal. The dead branches should be lowered to the ground using ropes to avoid impacts which may injure or kill bats within. Such animals should be retained in a box until dusk and released on-site.

9.1.2 felling of ivy-covered trees

Any ivy-covered trees (ash) on site – other than large trees (referred to above) which require felling should be left to lie for 24 hours after cutting to allow any bats beneath the cover to escape.

9.1.3 landscaping

It would be of benefit to bats if treelines and shrubs of native species were planted on-site, with native species providing more insect life than foreign varieties. Such planting should ensure that there is a continuous network of hedgerow/treelines to allow bats to commute safely along the external boundaries of the proposed development site. This recommendation has benefit for other faunal species also.

9.1.4 bat box scheme

A bat box scheme should be included in the area to offset the potential loss of roosts due to tree removal. It is recommended that c. 6 bat boxes would suffice; these should be placed upon existing mature trees to be retained at the extreme west of the site.

Note: this recommendation is in accord with the EIS.

Details of sourcing these boxes and erection can be supplied. 'Schwegler' woodcrete bat boxes are recommended (2FN design) but other designs are available – timber, concrete and concrete/sawdust). Consult the following publication: *Bat Boxes: A guide to the history, function, construction and use in the conservation of bats by R. E. Stebbings and S. T. Walsh (The Bat Conservation Trust, 1991).* Brown long-eared bats, Leisler's bats, common pipistrelles and soprano pipistrelle bats will frequently use bat boxes both as temporary and maternity roosts. Special hibernation bat boxes are also available. Suppliers of artificial bat roost units:

Refer Appendices for details of suppliers of bat boxes.

9.1.5 retention of hedgerows, treelines and landscaping

The proposed development will entail loss of many of the internal boundaries on site. Site boundary features - treelines and hedgerows - should be retained where possible to offer continuous corridors for bats and other wildlife.

This is especially important for external boundary hedgerows and treelines.

A number of mature trees are present along some internal boundaries. Where possible, such trees should be incorporated into the landscaping plans for the site plan.

The proposal involves removal of mature trees.

Additional planting is recommended. This should be of native species, such as oak, ash, hawthorn, and other deciduous species, according to local conditions and expert advice.

9.1.6 lighting

Lighting should be avoided where possible as it has been shown to deter some bat species from foraging. However, if lighting is to be used then it should be of Mercury vapour type lamps. This type of lamp has been shown to attract eight times the numbers of insects than their sodium alternatives (Blake *et al*, 1994).

If sodium lamps have to be used then the high-pressure type should be installed rather than the low-pressure lamps. High-pressure sodium lamps have been shown to attract far greater insect numbers than-low pressure alternatives (Rydell, 1992), which would help to counter the loss of bat prey due to the removal of trees, shrubs etc.

Lighting should be cowled to ensure that light does not spill out onto adjoining habitats. Cowled lights will ensure that lighting is directed onto the proposed development site only. The height of poles should also be restricted to reduce the possibility of light pollution onto adjoining habitats. The intensity/brightness of lighting should be limited to minimum requirements for lighting for such developments as stated by health and safety guidelines. Lighting should be avoided in vicinity of external boundaries and especially adjacent to the two identified roosts.

9.2 mitigation for badgers and other fauna (excluding birds)

The larger mammalian species of interest will move away from construction works. However, site clearance will result in mortality of some protected species such as pygmy shrew and possibly hedgehog. There are no means that can be reasonably adopted to avoid such losses, but these are common species. Landscaping measures and additional planting etc. will off-set these losses by providing additional habitat of benefit to them.

There are, therefore, no specific recommendations for badgers and other protected species on site, other than those habitat retention recommendations and other landscaping recommendations referred to in relation to bats and below re. works on site.

9.3 protection of birds

There are some treelines and hedgerows to be removed; these provide a feeding and nesting habitat for birds as well as other fauna.

Clearance of trees, or areas of tall scrub, where required, must take place outside of the bird nesting season, and must exclude the period March 1st to August 31st.

9.4 works on site: construction and operation phase

There are no especial constraints on areas suitable for storage, machinery depots, site offices or other uses, but all areas identified as of interest or for protection within the development area should be avoided.

Where mature trees and treelines are to be retained, these areas should be avoided and fenced off prior to construction traffic entering the site - in order to protect the trees and their root systems.

It is a general recommendation that, where mature trees are to be retained, no works should be conducted within c. 7m or more sp as to protect their root systems.

9.5 monitoring

Any faunal mitigation measures incorporated into the proposed plan should be monitored for effectiveness by means of occasional visits (at appropriate season) during the first two years of operation and additional mitigation measures taken as appropriate and as advised after each monitoring report has been concluded.

10. Predicted impact of the proposal

The proposed scheme will entail loss of arable land (mainly), grassland pasture, and also mature hedgerows and some scrub habitat.

Impacts (on bats) in relation to the loss of foraging and commuting routes may be considered as Minor Negative to potentially Moderate Negative.

However, given successful implementation of mitigation measures for bats, the overall impact of the proposal may be considered as Minor Negative in relation to bats.

Impacts on the other vertebrate fauna that were the main focus of this report may be considered as Insignificant/Neutral or Minor Negative. Impacts are expected to be Neutral or Minor Negative if the various recommendations for landscaping and retention of habitats where possible are implemented.

11. Required operations

We have made recommendations above as to protection of bats principally and also re. landscaping measures and similar.

Please contact us or other suitably qualified ecologists/bat/mammal/experts for assistance or advice as to the implementation of these measures – that need to be conducted in the near future.

Note seasonal constraints for felling of potential bat roosts in trees (see earlier) and in relation to protection of birds.

No wildlife licences are required for the required works as no badger setts nor confirmed bat roosts were identified on site.

12. References and bibliography

Barratt, E. M., Deauville, R., Burland, T. M., Bruford, M. W., Jones, G., Racey, P. A., & Wayne, R. K. 1997 DNA answers the call of pipistrelle bat species. *Nature* **387**: 138 - 139.

Corbett, G. B. and Harris, S. 1991 Handbook of British Mammals. 3rd Edition, Blackwell Scientific, Publications.

Cox, P.R. 1993 *Badgers on site: a guide for developers and planners.* Berkshire County Council.

English Nature. 2002 *Badgers and development.* English Nature, Peterborough, UK.

Environmental Protection Agency 2003 *Advice notes on current practice in the preparation of Environmental Impact Statements.* EPA, Wexford, Ireland.

Environmental Protection Agency 2002 G*uidelines on the information to be contained in Environmental Impact Statements.* EPA, Wexford, Ireland.

Fossitt, J. 2000. *A Guide to Habitats in Ireland*. The Heritage Council, Kilkenny.

Harris, S., Jeffries, D., Cheeseman, C. & Booty, C. 1994 *Problems with badgers?* 3rd edition. RSPCA, UK.

Hayden, T. & Harrington, R. 2000 *Exploring Irish mammals*. Duchas. Town House Dublin.

Institute of Environmental Assessment. 1995 *Guidelines for Baseline Ecological Assessment.* E&FN Spon, London.

Ní Lamnha, E. 1979 *Provisional distribution atlas of amphibians, reptiles and mammals in Ireland.* 2nd edition. An Foras Forbartha.

O'Sullivan, P. 1994. *Bats in Ireland.* Special supplement to the Irish Naturalists' Journal.

Regini, K. 2000 Guidelines for ecological evaluation and impact assessment. *In Practice*, Bulletin of the Institute of Ecology and Environmental Management no. 29: 1-7.

Richardson, P 2000 *Distribution atlas of bats in Britain and Ireland 1980 - 1999*. The Bat Conservation Trust, London, UK.

RSPB. 1995 *Wildlife impact: the treatment of nature conservation in environmental assessment.* The RSPB, Sandy, UK.

Smal, C.M. 1995 *The Badger & Habitat Survey of Ireland.* The Stationery Office, Dawson St. Dublin 2.

Stebbings, R. E. and Walsh, S. T. 1991 *Bat Boxes: A guide to the history, function, construction and use in the conservation of bats*. The Bat Conservation Trust.

Whilde, A. 1993 *Threatened mammals, birds, amphibians and fish in Ireland. Irish Red Data Book 2: Vertebrates.* Belfast: HMSO.

13. APPENDICES

13.1 Description of bat species known on site

Common pipistrelle Pipistrellus pipistrellus

This species was only recently separated from its sibling, the soprano or brown pipistrelle *Pipistrellus pygmaeus*, which is detailed below (Barratt, E. M., Deauville, R. Burland, T. M., Bruford, M. W., Jones, G., Racey, P. A. & Wayne, R. K., 1997). The common pipistrelle's echolocation calls peak at 45 kHz. The species forages along linear landscape features such as hedgerows and treelines as well as within woodland.

Soprano pipistrelle Pipistrellus pygmaeus

The soprano pipistrelle's echolocation calls peak at 55 kHz, which distinguishes it readily from the common pipistrelle. The pipistrelles are the smallest and most often seen of our bats, flying at head height and taking small prey such as midges and small moths. Summer roost sites are usually in buildings but tree holes and heavy ivy are also used. Roost numbers can exceed 1500 animals in mid-summer.

Both the above species are considered as *Internationally Important*.

Leisler's bat Nyctalus leisleri

This species is Ireland's largest bat, with a wingspan of up to 320mm; it is also the third most common bat, preferring to roost in buildings, although it is sometimes found in trees and bat boxes. It is the earliest bat to emerge in the evening, flying fast and high with occasional steep dives to ground level, feeding on moths, caddis-flies and beetles. The echolocation calls are sometimes audible to the human ear being around 15kHz at their lowest. The audible chatter from their roost on hot summer days is sometimes an aid to location. This species is uncommon in Europe and Ireland holds the largest national population.

The species is considered as *Internationally Important*.

13.2 Photographic record

N.B. Photos from 2005 (EIS report, Ecological Solutions).

Plate 1. Farm cottage just off site at extreme south, and tall treeline next to R152.

Plate 2. Treeline next to Regional Road R152. Note that ploughed area approaches close to the boundary, reducing its quality for wildlife.

Plate 3. Ploughed field and managed hawthorn hedge at north-east of site, next to R152.

Plate 4. View of northern portion of site, with cement factory in background.

Plate 5. Central portion of site; ploughed fields. Hedgerow boundaries are thin and almost entirely of hawthorn.

Plate 6. Mature boundary at extreme west of site. The field is of improved pasture grassland, grazed by cattle.

13.3 Suppliers of bat boxes

Suppliers of artificial bat roost units include the following:

1. Schwegler Bat Boxes, Jacobi, Jayne & Co., Hawthorn Cottage, Maypole Hoath, Cantebury, Kent CT3 4LW, England. Phone: 01227 860521.

2. Alana Ecology Ltd., The Old Primary School, Church Street, Bishop's Castle, Shropshire, SY9 5AE. www.alanaecology.com; Phone: 01588 630173.

3. Marshall Clay Products, Howley Park, Quarry Lane, Woodkirk, Dewsbury, West Yorkshire, WF12 7JJ. Phone: 01132 203555.

Appendix 12.2

Mitigation Report Bat Fauna

APPROVED WASTE MANAGEMENT FACILITY (WASTE INCINERATOR) AT CARRANSTOWN, CO. MEATH

MITIGATION MEASURES

BAT FAUNA

Report prepared for

INDAVER IRELAND LTD

Leisler's bats roosting in Schwegler Woodcrete Bat Boxes © Tina Aughney

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1. Introduction

Indaver Ireland Ltd has received planning permission from Meath County Council for the construction of a waste management facility at Carranstown, in the form of a non-hazardous waste incinerator. The facility will service the North-East Region, which generates 500,000 tonnes of waste per year. The incinerator has a capacity to treat 30% of the waste generated in the region, leaving 70% available for other technologies including recycling and composting.

Present landuse is primarily of arable farmland, with one field of permanent improved grassland pasture. Surrounding landuse is also agricultural, with some nearby residential buildings. A large cement factory is sited not far from the site, to the north-east.

Ecological Solutions were requested to carry out a pre-construction fauna survey of the. The field studies (bat fauna) were undertaken in on 28th April 2008 and on 1st May 2008. The findings of the bat surveys were reported earlier ("Approved Waste Management Facility, Carranstown, Co. Meath: pre-construction badger and bat fauna study", dated 28th May 2008).

That report detailed likely impacts and mitigation measures recommended for various species of ecological interest. These included bats.

This report presents particular mitigation measures undertaken for bats in 2008.

In summary, mitigation work entailed:

1 Erection of Bat Box Scheme.
2 Felling of trees marked as Potential Bat Roosts.

The bat works described in this report were conducted by bat specialist Dr Tina Aughney for *Ecological Solution*s.

A meeting was held on site – on 29th August 2008 - with Dr. Tina Aughney and Ms. Lynette Creamer of Indaver Ireland present to finalise the details of tree felling and bat box erection.

2. Background

For the pre-construction report, bat survey on the site was undertaken by Dr Aughney. The field studies (bat fauna) were undertaken in on 28th April 2008 and on 1st May 2008.

Trees within the development site were inspected while buildings adjacent to the site were surveyed.

The bat detector survey recorded three bat species, with additional records for *Myotis* species, roosting, commuting and/or foraging within the survey site. Common pipistrelles *Pipistrellus pipistrellus* and soprano pipistrelle *Pipistrellus pygmeaus* were recorded emerging from the farm cottage adjacent to the proposed development and also from an additional house adjacent to the proposed development site. Common pipistrelle bat activity was high and this species was recorded throughout the survey area commuting and foraging along hedgerows and scrub areas. Soprano pipistrelle *Pipistrellus pygmeaus* bat activity was also relatively high and this species was recorded throughout the survey area commuting and foraging along hedgerows and scrub areas. An additional species of bat Leisler's bat *Nyctalus leisleri*) were recorded foraging and commuting within the survey area. Two *Myotis* species individuals were recorded commuting along hedgerows towards the railway line.

A total of four trees were identified as Potential Bat Roosts.

Mitigation measures were recommended for all bat species likely to be impacted by the scheme.

A variety of mitigation measures were proposed for the loss (or potential loss) of roosts within trees.

3. Bat Mitigation Measures

3.1 Bat Box Scheme

The main function of bat boxes is to provide alternative safe roosting sites for groups of bats where natural sites become unavailable. The internal diameter of a bat box is required to be sufficient to allow bats to cluster together in numbers to retain body heat. It is important to understand the life cycle of bats and their tendency to use an array of roosting sites through the year.

In summary, bats require different roost conditions for hibernation, during the sensitive time of rearing their young (maternity roost), night roosts for resting stops during night feeding and satellite roosts in between the main hibernation and maternity season. Roosting conditions also vary with each species.

In general, hibernation boxes require greater insulation (wall thickness of 100mm timber) to provide a constant temperature for bats throughout the winter to prevent bats from freezing. All other boxes, typically called summer boxes, are designed to provide secure and dry sheltered conditions. These boxes have relatively thin walls (about 20-30mm timber) and are used by bats outside the hibernation period. These requirements mean that any Bat Box Schemes should provide suitable bat boxes to cover the general requirements of different bat species all year around.

'Woodcrete' boxes are made of a mixture of concrete, sawdust and clay moulded into to shape. They have the advantage of allowing natural respiration, stable temperature and durability. 'Woodcrete' boxes last for 25 years and more.

To ensure that bats use the bat boxes, it is very important to site them carefully. Some general points to follow include:

1. Straight limb trees with no crowding branches or other obstructions for at least 3 metres above and below position of bat box.
2. Diameter of tree should be wide and strong enough to hold the required number of boxes.
3. Locate bat boxes in areas where bats are known to forage or adjacent to suitable foraging areas. Locations should be sheltered from prevailing winds.
4. Bat boxes should be erected at a height of 3-5 metres to reduce the potential of vandalism and predation of resident bats.
5. It is recommended to erect a number of bat boxes on one tree at an array of aspects. South facing boxes will receive the warmth of the sun, which is necessary for maternity colonies. In large bat box scheme it is generally recommended to have three bat boxes arranged at the same height facing North, South-east and South-west. This ensues a range of temperatures are available all day. If the South-facing boxes become to warm, bats can safely remove to the cooler North-facing box.

Bat Boxes (of the designs quoted below) were purchased by Indaver Ireland Ltd. and transported to the site by Dr Aughney. Six Schwegler Woodcrete Bat Boxes were required. Design codes quoted in the table above are taken from the Alana Ecology website (www.alanaecology.com).

Bats boxes were erected on 29th September 2008. All bat boxes were erected according to schedule listed in Table 1. The bat boxes were erected on three trees identified as PBRs (potential bat roost trees) in the pre-construction study. These three trees are to be retained in an existing boundary hedgerow/treeline (see Table 2 further below). See Figure 1 also.

Bat boxes were erected using a ladder with assistance from Indaver Ireland Ltd. and under supervision of a Health & Safety Officer.

Details of the Bat Box scheme will be submitted to Bat Conservation Ireland database for monitoring purposes.

Table 1: Location of compensatory bat box schemes along proposed route

Bat Box Scheme	Tree	Bat Box Designs
Bat Box I (Plate 1)	Ash	2FN (1 unit) 1FD (1 unit)
Bat Box II (Plate 2)	Ash	2FN (1 unit) 1FD (1 unit)
Bat Box III (Plate 3)	Ash	1FS (1 unit) 1FD (1 unit)

3.2 Tree felling of PBRs

Tree Felling Mitigation Measures as stated in the pre-construction report:

> "The felling of trees must be carried out in a sensitive and appropriate manner in accordance with NRA Guidelines: Guidelines for the Treatment of Bats during the construction of National Road Schemes (Tree felling and Hedgerow Removal - Timing & Procedures). As a mitigation measure, felling of trees in these areas should be supervised by a bat specialist in accordance with NRA Guidelines: Guidelines for the Treatment of Bats during the construction of National Road Schemes (Tree felling and Hedgerow Removal).
>
> Large mature trees should be felled carefully, essentially by gradual dismantling by qualified tree surgeons, under supervision of a bat specialist. Care should be taken when removing branches as removal of loads may cause cracks or crevices to close, crushing any animals within. These cracks should be wedged open prior to load removal. The dead branches should be lowered to the ground using ropes to avoid impacts which may injure or kill bats within. Any ivy covered trees which require felling should be left to lie for 24 hours after cutting to allow any bats beneath the cover to escape."

Tree felling of one PBR was completed on 22nd September 2008. All other PBR trees are located outside the fence perimeter of the development site and therefore are retained. The tree identified as no. 4 in the Table below was felled under supervision.

No bat droppings or other bat usage evidence was recorded in the tree felled.

Table 2: *Mature trees identified as Potential Bat Roosts (PBRs)*

Tree	Species	PBR Value
See Figure 1		
1	Ash	B – tree holes, dead wood, split limbs and ivy
2	Ash	C – split limbs and dead wood
3	Ash	C – split limbs and dead wood
4	Ash	C – split limbs and dead wood

3.3 Future Monitoring

3.3.1 Monitoring of bat box success

Acceptance of boxes by bats is less predictable than those for birds. Therefore, it is essential to monitor their use over a period of time. Those boxes that remain unused within two years of date of erection should be re-located.

> NB: Bats use boxes intermittently and the chance of finding a bat in a box at the time of inspection is considered to be 1 in 10.

Bat boxes should also be checked in autumn/wintertime for general wear and tear and to remove droppings from the previous summer use. Inspection of boxes should be carried out by a licensed bat-handler and to increase the scientific usage of information, it is essential to record numbers and species. Bats should be sexed and measurements (e.g. wing length, weight etc) taken where possible.

If, during inspection no bats are residing within the box, other signs of occupation may be present - e.g. droppings. It may be useful collect and store droppings to aid identification of species residing in bat box if this is unknown.

It is recommended that the bat box boxes erected for this scheme be inspected and monitored for a period of 2 years. An inspection of the boxes should take place once per year, with the next inspection to take place in August of 2009.

Safety is also essential during monitoring of bat boxes. Monitoring should be undertaking in pairs and use of hard hats, a strong aluminium ladder with safety strap for trees, and use of gloves (if handling bats) are recommended.

3.3.2 Registration of bat box scheme

Registering the bat box scheme with the national bat conservation group Bat Conservation Ireland will add information to databases on bat species distribution and useful information on suitability of bat box designs for different species.

4. Concluding remarks

The bat mitigation operations described in this report were completed in fulfilment of the grant of planning permission for the energy facility at Carranstown.

The bat box scheme needs to be monitored over a period of 2 years to ensure best placement and effectiveness of the boxes as roosting sites for bats. Annual inspections should suffice.

5. REFERENCES AND BIBLIOGRAPHY

Altringham, J. D. 1996 *Bats: Biology and Behaviour*. Oxford University Press.

Altringham, J. D. 2003 *British Bats*. HarperCollins Publishers.

Barratt, E. M., Deauville, R., Burland, T. M., Bruford, M. W., Jones, G., Racey, P. A., & Wayne, R. K. 1997 DNA answers the call of pipistrelle bat species. *Nature* **387**: 138 - 139.

Billington, G. E. & Norman, G. M. 1997 *The conservation of bats in bridges project: a report on the survey and conservation of bat roosts in bridges in Cumbria.* Kendal, English Nature.

Blake, D., Hutson, A. M., Racey, P. A., Rydell, J. & Speakman, J. R., 1994 *Use of lamplit roads by foraging bats in Southern England*. J. Zool. Lond. **234**: 453 - 462.

Boyd, I. & Stebbings, R. E. 1989 *Population changes in brown long-eared bats (*Plecotus auritus*) in bat boxes at Thetford Forest.* J. Appl. Ecol. **26**: 101 - 112.

Corbet, G.B. & Harris, S. 1991 *The handbook of British Mammals*. 3rd edition. Blackwell Scientific Publications, Oxford.

Environmental Protection Agency 1995 *Advice notes on current practice in the preparation of Environmental Impact Statements.* EPA, Wexford, Ireland.

Environmental Protection Agency 1997 *Draft guidelines on the information to be contained in Environmental Impact Statements.* EPA, Wexford, Ireland.

Environmental Protection Agency 2002 *Guidelines on the information to be contained in Environmental Impact Statements.* EPA, Wexford, Ireland.

Hayden, T. & Harrington, R. 2000 *Exploring Irish mammals*. Dúchas. Town House Dublin.

Hopkirk, A. and Russ, J. 2004 *Per-hibernal and hibernal activity and dispersal patterns of Leisler's bat, Nyctalus leisleri, in Northern Ireland.* Hopkirk and Russ bat Ecology.

Institute of Environmental Assessment. 1995 *Guidelines for Baseline Ecological Assessment.* E&FN Spon, London.

Limpens, H.J.G.A., Twist, P. and Veenbaas, G. 2005 *Bats and road construction.* (Brochure about bats and the ways in which practical measures can be taken to observe the legal duty of care for bats in planning, constructing, reconstructing, and managing roads.) Rijkwaterstaat, Dienst Weg-en Waterbouwkunde, Delft, the Netherlands and the Vereniging voor Zoogdierkunde en Zoogdierbescherming, Arnhem, the Netherlands, 24 pages. DWW-2005-033.

National Roads Authority [2004] *Guidelines for assessment of ecological impacts of National road schemes.* NRA, Dublin.

National Roads Authority 2006a *Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes*. National Roads Authority. www.nra.ie

National Roads Authority 2006b *Guidelines for the Treatment of Bats During the Construction of National Road Schemes.* National Roads Authority. www.nra.ie

Ní Lamnha, E. 1979 *Provisional distribution atlas of amphibians, reptiles, and mammals in Ireland.* 2nd edition. An Foras Forbartha.

O'Sullivan, P. 1994. *Bats in Ireland.* Special supplement to the Irish Naturalists' Journal.

Regini, K. 2000 Guidelines for ecological evaluation and impact assessment. *In Practice*, Bulletin of the Institute of Ecology and Environmental Management no. 29: 1-7.

Richardson, P. 2000 *Distribution atlas of bats in Britain and Ireland 1980 - 1999*. The Bat Conservation Trust, London, UK.

RSPB. 1995 *Wildlife impact: the treatment of nature conservation in environmental assessment.* The RSPB, Sandy, UK.

Rydell, J. 1992 Exploitation of insects around street lamps by bats in Sweden. *Functional Ecol.* 6: 744 - 750.

Stebbings, R. E. and Walsh, S. T. 1991 *Bat Boxes: A guide to the history, function, construction, and use in the conservation of bats*. The Bat Conservation Trust

6. PHOTOGRAPHIC RECORD AND FIGURES

Plates 1, 2, & 3: Bat box designs erected as part of the Bat Box Scheme.

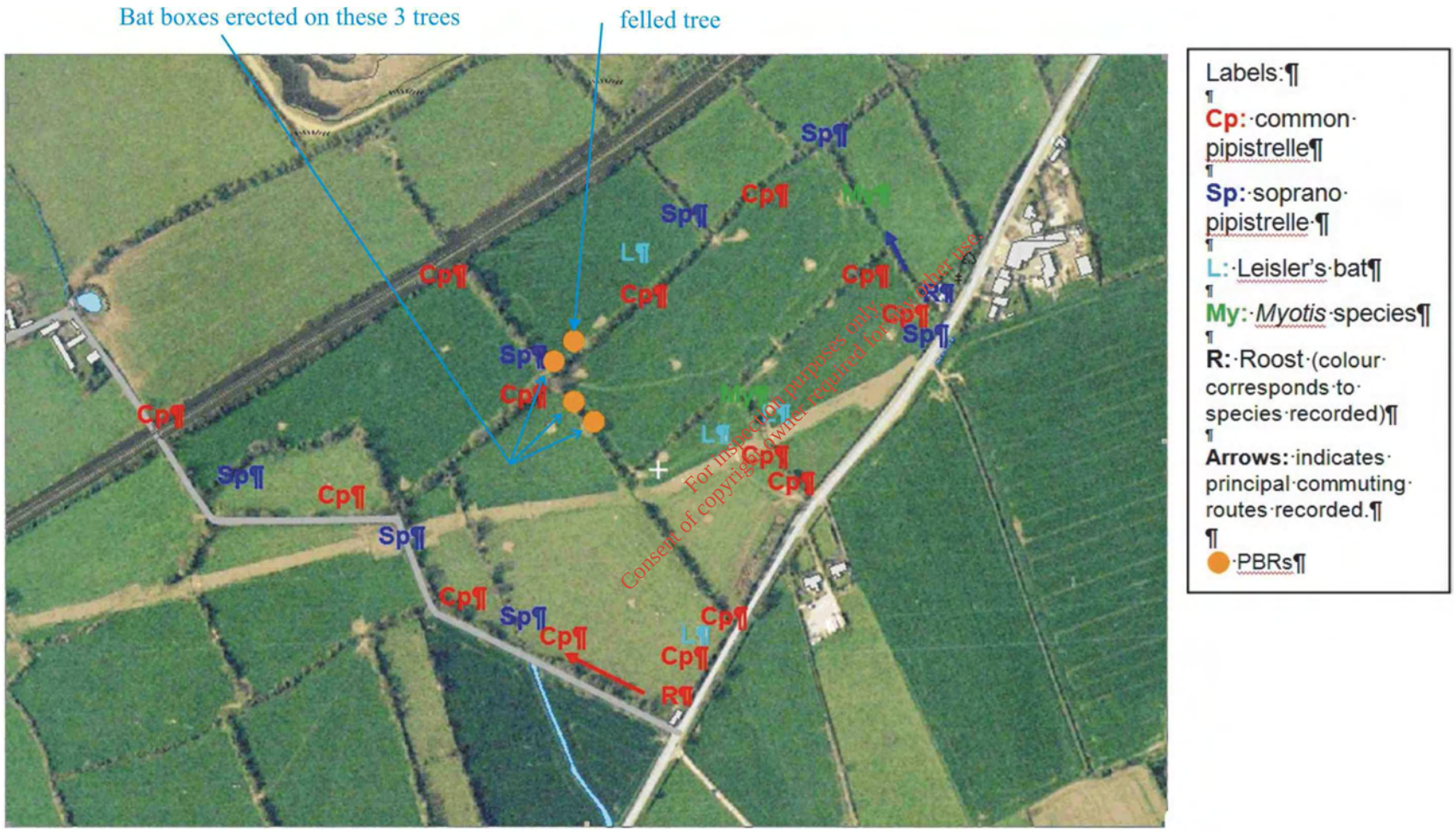

Figure 1. Results from pre-construction study. The tree felled under supervision is marked on the figure. Bat boxes were erected on the remaining three PBR trees (potential bat roosts).

13. TRAFFIC

13.1 INTRODUCTION

The proposed amendments to the existing permission will have no impact on traffic as outlined in the 2006 EIS as there are no changes to the type and quantity of construction traffic, the number of staff during the operation of the facility and traffic generated as a result of processing 200,000 tonnes per annum of Municipal Solid Waste.

Construction Traffic

The majority of construction workers will still arrive before 7am which is outside the am peak and numbers on site will be limited to 300. The construction period is still estimated at 24 months. The total construction traffic generated is shown in Table 13.1 below which is identical to that outlined in the 2006 EIS.

Time Period	HGV Movements		Workforce Traffic		General Site Traffic		Total Traffic Generation		
	In	Out	In	Out	In	Out	In	Out	Total
0600-0700	7	7	208	0	10	10	225	17	242
0700-0800	7	7	52	0	10	10	69	17	86
0800-0900	7	7	0	0	10	10	17	17	34
0900-1000	7	7	0	0	10	10	17	17	34
1000-1100	7	7	0	0	10	10	17	17	34
1100-1200	7	7	0	0	10	10	17	17	34
1200-1300	7	7	0	0	10	10	17	17	34
1300-1400	7	7	52	52	10	10	69	69	138
1400-1500	7	7	0	0	10	10	17	17	34
1500-1600	7	7	0	0	10	10	17	17	34
1600-1700	7	7	0	0	10	10	17	17	34
1700-1800	7	7	0	52	10	10	17	69	86
1800-1900	7	7	0	165	10	10	17	182	199
1900-2000	7	7	0	52	10	10	17	69	86

Table 13.1 Construction Traffic Generation

Operational Traffic

The number of staff working during the operational phase remains the same at a maximum of 50. The traffic generation associated with the acceptance of waste at the facility remains unchanged as the total maximum annual throughput remains at 200,000 tonnes per annum. Because there have been changes proposed for the raw materials to be used in the flue gas cleaning process, the predicted traffic volumes generated for both raw materials and residues produced from the permitted facility (2006 EIS) and traffic generated from the proposed amendments (2009 EIS) are both compared in Table 13.2.

As seen in the table there are no changes to the predicted traffic volumes associated with the residues produced, but overall volumes have decreased slightly for raw materials and residues. As detailed in Table 13.2 there are some minor changes to truck movements associated with individual raw materials. Some materials previously allowed for in traffic calculations i.e. NaOH, Na_3PO_4, urea and cokes are no longer required. Lesser quantities of hydrated lime $Ca(OH)_2$ are also now required. However quantities of quicklime, ammonia, activated carbon and expanded clay not previously provided for will now be required. Having engaged in discussions with a number of suppliers of raw materials, tonnages per truck have been updated to include the anticipated volumes that will be actually delivered in each individual load. In overall traffic terms, the truck movements associated with raw materials and residues are similar and as a result have a neutral effect on the overall traffic volumes.

As there are no changes to traffic generated from the proposed amendments and all other traffic volumes have remained the same, there is therefore no requirement to undertake a traffic impact assessment.

A comprehensive Traffic Impact Assessment (TIA) of the development was undertaken as part of the Environmental Impact Statement prepared for the planning application for the development in 2006. This TIA was prepared in general accordance with the 'guidelines for Traffic Impact Assessment' as published by the UK Institution of Highways and Transportation.

A summary of the findings of the TIA as presented in the EIS submitted in 2006 are detailed in this chapter with updates where appropriate.

13.2 EXISTING TRAFFIC ENVIRONMENT

13.2.1 Site Location & Road Network

The site of the development is located on the R152 Regional Road linking Drogheda and Duleek. In the vicinity of the site, the R152 is a single carriageway road with a general width of 7.0m. At the site of the development, a speed limit of 80kph applies.

As required by the planning conditions of the permission granted in 2006, the R152 has been widened (in accordance with the requirements of the Road Design Section of Meath County Council) to allow for a right turning lane and a deceleration lane for traffic turning left into the site.

Truck Movements	2006 EIS						2009 EIS					
	consumption/production				Trucks per		consumption/production				Trucks per	
	kg/hour	kg/week	kg/yr	ton/truck	week	year	kg/hour	kg/week	kg/yr	ton/truck	week	year
NaOH (De-min)	3.45	496	25,875	6	0.1	4.3	3.45	496	25,875	5	0.1	5.2
HCl	3.81	548	28,575	6	0.1	4.8	3.81	548	28,575	5	0.1	5.7
NH_4OH	3.81	548	28,575	6	0.1	4.8	0.00	0	0	0	0.0	0.0
Na_3PO_4	0.76	109	5,700	6	0.0	1.0	0.00	0	0	0	0.0	0.0
Hydrated Lime $Ca(OH)_2$	262.00	37,685	1,965,000	20	1.9	98.3	13.35	1,923	100,000	22	0.1	4.5
Caustic (Wet Scrubbing)	62.50	8,990	468,750	20	0.4	23.4	0.00	0	0	0	0.0	0.0
Quicklime CaO	0.00	0	0	0	0.0	0.0	307.16	44,231	2,300,000	25	1.8	92.0
Urea (De-NOx)	71.50	10,284	536,250	20	0.5	26.8	0.00	0	0	0	0.0	0.0
Ammonia (De-NOx)	0.00	0	0	0	0.0	0.0	133.55	19,231	1,000,000	25	0.8	40.0
Cokes	51.12	7,353	383,400	20	0.4	19.2	0.00	0	0	0	0.0	0.0
Activated Carbon	0.00	0	0	0	0.0	0.0	13.35	1,923	100,000	20	0.1	5.0
Expanded Clay	0.00	0	0	0	0.0	0.0	26.71	3,846	200,000	20	0.2	10.0
Fuel	36.94	5,313	277,050	20	0.3	13.9	36.94	5,313	277,050	20	0.3	13.9
Bottom Ash	6,505.00	935,651	48,787,500	20	46.8	2439.4	6,505.00	935,651	48,787,500	20	46.8	2439.4
Boiler & Fly Ash	324.00	46,603	2,430,000	20	2.3	121.5	324.00	46,603	2,430,000	20	2.3	121.5
Flue Gas Cleaning Residue	1,325.00	190,582	9,937,500	20	9.5	496.9	1,325.00	190,582	9,937,500	20	9.5	496.9
Scrap Metal	533.00	76,664	3,997,500	4	19.2	999.4	533.00	76,664	3,997,500	4	19.2	999.4
TOTALS					81.6	4253.4					81.2	4233.4

Table 13.2 -2006 / 2009 EIS Truck Movements

To the east of the site, the R152 connects to the M1 Motorway via the Drogheda South Interchange with a pair of roundabouts at the slip ramps. To the west of the site, the R152 forms a priority-controlled junction with the R150 to the east of Duleek.

13.3 TRAFFIC IMPACT ASSESSMENT METHODOLOGY (EIS 2006)

In order to assess the impact of the traffic generated by the development on the surrounding road network, the capacities of the development access junction with the R152 and of various other junctions along the haul routes were assessed.

The junctions were analysed using the Transport Research Laboratory (TRL) software Priority Intersection CApacity DelaY (PICADY) and Assessment of Roundabout Capacity And DelaY (ARCADY). The junction capacity assessments were carried out on the traffic in the base year 2006. Future traffic conditions were also assessed in so far as possible for a 20 year time horizon, Under the National Spatial Strategy and the Regional Planning Guidelines for the Greater Dublin Area the towns of Drogheda and Navan are expected to grow considerably in the future, and it is therefore expected that traffic flows between the two towns will increase accordingly.

The traffic data used in the assessment was the predicted 2005 traffic flows, based on traffic counts carried out in November 2005 and January 2006. The traffic counts show that the peak hour traffic period is 07:45 to 08:00. The counts show that during the morning peak, the two way flow is 1,108 vehicles.

The traffic assessment concluded that the development will generate a total of 58 truck movements during the peak period (08:00-09:00). The directional split is roughly even from the R152/M1 junction and the R152/R150 junction.

Indaver intend to prohibit traffic from using the R150 between Kentstown and the N2 by notifying all hauliers of alternative routes to be used to access the site. Instead, trucks serving the facility will be required to stay on the R153 to the N2/R153 junction then travel up the N2 to the N2/R152 junction.

13.4 PREDICTED IMPACTS

The amendments to the development will not result in any additional predicted impacts over and above those as described in the 2006 TIA. They were as follows;

- The development will result in additional turning movements on the R152 at the entrance to the proposed facility
- The two way traffic flows on the R152 will increase from 1,108 vehicles to 1,142 vehicles during the peak hour. This equates to an increase of 3% during the peak hour. This is a small increase which would not have an impact on the operation of the road.

- The additional traffic generated by the facility will increase the highest Reference Flow Capacity at the highest approach to the R150/R152 junction from 0.678 to 0.718. This compares favourably to a desirable maximum of 0.85.
- The additional traffic generated by the facility will increase the flows at the M1/R152 by a negligible amount. The roundabouts currently operate well without any queuing.
- The additional traffic generated by the facility will increase the flows at the N2/R150, N2/R153 and N2/R152 junctions by a negligible amount.
- The construction traffic generated by the facility will have a similar impact on capacity as the operational phase generated traffic.

13.5 PROPOSED MITIGATION

As required by the planning permission granted in 2006 the existing R152 has been widened to provide a ghost island junction, allowing through traffic to safely pass stationary vehicles waiting to turn right into the facility. A deceleration lane for traffic turning left into the site has been installed. (Photomontage Views 1-3 of Chapter 14 Landscape and Visual shows the current layout of the access junction and approaches to the access from Duleek and Drogheda directions respectively). As the proposed amendments are not increasing the traffic volumes associated with the development no further mitigation measures are proposed.

13.6 CONCLUSIONS

The conclusions of the 2006 TIA are as follows;

- The proposed amendments will not result in any additional impacts above those identified in the TIA prepared in 2006. No additional mitigation measures will be required.
- The facility will be accessed from the existing R152 by means of a priority controlled junction.
- As defined by the NRA, the R152 currently operates with a Level of Service (LOS) E. With the development generated traffic, the road will continue to operate with a LOS E.
- The proposed priority controlled junction will operate well within capacity under the expected traffic conditions as a result of the development. In 2006 it was predicted that traffic flow at this junction will reach capacity in the year 2013. The construction of the planned Duleek by-pass will improve the traffic flows in and around the village of Duleek, particularly the R150/R152 junction. Furthermore with the changed economic conditions it is now less likely that the junction will be operating at maximum capacity in 2013.
- The M1/R152 junction will operate well within capacity under the expected traffic conditions with no significant loss in spare capacity as a result of the traffic generated by the development.
- Truck traffic on the western haul route through Kentstown will be requested not to use the section of the R150 past Kentstown Primary School.
- Traffic impacts at the 3 junctions on the N2 at Brien's cross, at Balrath and Kilmoon west of the site will be very low and there will be no operational problems as a result of the development.

- The construction traffic will be similar to operational traffic during the Peak Hour. The R152 has sufficient capacity to cater for the anticipated construction traffic.