SAMPLING POINTS

PT_CODE	PT_TYPE	MON_TYPE	EASTING	NORTHING	VERIFIED
MP1	Sampling point for primary discharge	Sampling	245292	208253	Y
aSW1u	Upstream sampling location	Sampling	246356	209287	N
aSW1d	Downstream sampling location	Sampling	245245	208019	N

WWDL E3 - MOUNTMELLICK SAMPLING POINTS

StationName	SampleDate	(NH3)	BOD	COD	Conductivity	Nitrates	Ortho-p	pH	SS
Mountmellick- outlet	11/06/2008	4.327	11	75	801	5.754	3.437	7.751	64
Mountmellick- inlet	11/06/2008	38.462	228	516	1092	0.586	4.145	8.066	182
Mountmellick- upstream of plant	11/06/2008	0.354	3	NT	552	0.82	0.037	7.876	NT
Mountmellick- downstream of plant	11/06/2008	0.178	1	NT	371	1.061	0.12	8.002	NT
Mountmellick- outlet	07/05/2008	1.384	5	63	845	9.559	2.752	7.54	19
Mountmellick- inlet	07/05/2008	32.411	148	366	969	1.644	3.429	7.63	180
Mountmellick- upstream of plant	07/05/2008	0.094	1	30	550	1.116	0.016	8.027	2
Mountmellick- downstream of plant	07/05/2008	0.026	1	32	614	1.915	0.048	8.005	4
Mountmellick- outlet	23/04/2008	12.013	8	99	781	5.75	2.233	7.724	8
Mountmellick- inlet	23/04/2008	28.833	164	440	936	1.229	3.459	7.732	235
Mountmellick- upstream of plant	23/04/2008	0.027	1	72	539	1.608	0.019	8.26	2
Mountmellick- downstream of plant	23/04/2008	0.126	1	69	619	2.403	0.027	8.127	4
Mountmellick- outlet	05/03/2008	0.926	5	66	746	14.11	1.819	7.733	28
Mountmellick- inlet	05/03/2008	31.435	178	408	943	1.235	4.139	7.968	183
Mountmellick- upstream of plant	05/03/2008	0.078	6	NT	448	1.234	0.019	8.08	NT
Mountmellick- downstream of plant	05/03/2008	0.064	3	NT	448	1.768	0.029	8.035	NT
Mountmellick- outlet	15/02/2008	2.372	9	99	767	10.293	1.931	7.908	20
Mountmellick- inlet	15/02/2008	24.636	253	500	942	3.709	3.14	7.989	142
Mountmellick- upstream of plant	15/02/2008	0.082	1	NN	560	2.987	0.029	8.165	NN
Mountmellick- downstream of plant	15/02/2008	0.116	2	NN	626	3.512	0.031	8.075	NN
Mountmellick- outlet	30/01/2008	1.133	36	26	715	12.04	1.533	7.849	23
Mountmellick- inlet	30/01/2008	18.124	RNV	291	855	2.125	2.911	7.761	116
Mountmellick- upstream of plant	30/01/2008	0.11	4	NN	486	1.946	0.037	8.124	NN
Mountmellick- downstream of plant	30/01/2008	0.116	2	NN	505	2.6	0.074	7.976	NN
Mountmellick- outlet	06/12/2007	1.403	4	36	667	9.219	1.243	7.68	23
Mountmellick- inlet	06/12/2007	18.121	85	247	725	1.837	2.387	7.72	100
Mountmellick- outlet	29/11/2007	0.274	15	81	654	11.174	1.563	7.63	63
Mountmellick- inlet	29/11/2007	31.365	149	318	836	0.511	3.942	7.92	387
Mountmellick- upstream of plant	29/11/2007	0.085	4	NN	470	0.779	0.038	8.16	NN
Mountmellick- downstream of plant	29/11/2007	0.107	3	NN	382	1.019	0.085	8.08	NN
Mountmellick- outlet	04/10/2007	0.336	4	25	602	8.942	2.407	7.75	20
Mountmellick- inlet	04/10/2007	9.06	85	231	626	0	1.036	7.7	83
Mountmellick- upstream of plant	02/10/2007	0.034	1	NN	526	1.246	0.042	8.33	NN
Mountmellick- downstream of plant	02/10/2007	0.075	1	NN	556	1.588	0.056	8.17	NN
Mountmellick- outlet	20/09/2007	0.909	11	45	689	10.968	2.052	8.04	20
Mountmellick- inlet	20/09/2007	36.875	289	445	904	0.225	3.212	8.16	187
Mountmellick- upstream of plant	20/09/2007	0.042	3	NN	349	1.007	0.026	8.26	NN
Mountmellick- downstream of plant	20/09/2007	0.035	3	NN	506	2.237	0.073	8.32	NN
Mountmellick- outlet	23/08/2007	0.187	RNV	41	793	10.406	2.314	7.82	23
Mountmellick- inlet	23/08/2007	22.395	RNV	204	881	1.139	2.649	7.74	20
Mountmellick- upstream of plant	23/08/2007	0.05	RNV	NN	550	1.419	0.034	8.12	NN
Mountmellick- downstream of plant	23/08/2007	0.068	RNV	NN	585	2.048	0.047	7.99	NN
Mountmellick- outlet	18/07/2007	8.303	8	44	682	1.084	2.209	7.79	18
Mountmellick- inlet	18/07/2007	25.538	102	299	838	0.255	2.724	7.694	88
Mountmellick- upstream of plant	18/07/2007	0.067	2	NT	394	0.795	0.04	7.988	NN
Mountmellick- downstream of plant	18/07/2007	0.1	2	NN	411	1.016	0.044	7.866	NN
Mountmellick- outlet	14/06/2007	1.04	4	31	695	2.561	1.991	7.809	7
Mountmellick- inlet	14/06/2007	22.548	77	205	812	0.389	2.237	7.741	68
Mountmellick- upstream of plant	14/06/2007	0.085	2	NN	613	1.095	0.053	8.132	NN
Mountmellick- downstream of plant	14/06/2007	0.118	2	NN	563	1.255	0.225	8.044	NN

WWDL E4 - Mountmellick Sampling Results

Laois County Council

RECEIVING WATER IMPACT ASSESSMENT

MOUNTMELLICK

First draft – work in progress

Prepared on behalf of

WATER SERVICES
LAOIS COUNTY COUNCIL
County Hall
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Version: 20th August 2008

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Executive Summary

This is a receiving water impact assessment report for the Mountmellick Waste water treatment plant (WwTP). It has been prepared under Section F of the Environmental Protection Agencies Waste Water Discharge Licensing Application Guidance Note. This report was prepared during August 2008 on behalf of Laois County Council by Ecofact Environmental Consultants Ltd.

The current study was based on information compiled during a desk study and a field assessment. Information compiled during the desk study included water quality monitoring information supplied by the Environmental Protection Agency and Laois County Council, along with information on areas designated for nature conservation obtained from the National Parks and Wildlife Service (NPWS). The field study consisted of a walkover of the existing WwTP and adjoining river sections along with ecological and biological water quality appraisals at upstream (control) and downstream (receptor) sites.

The Mountmellick WwTP discharges to the Owenass River near the northern boundary of Mountmellick town. The Owenass River is part of the River Barrow and Nore Special Area of Conservation (SAC) and is known to contain a number of aquatic species designated under Annex II of the EU Habitats Directive. It flows into the River Barrow approximately 2km downstream of Mountmellick. As well as being an SAC, the River Barrow is classified as a nutrient sensitive water downstream of Portarlington WwTP outfall to Graiguenamanagh. Both rivers have been reported to have had water quality problems in the past, with sewage discharges being among the main sources of pollution in the catchment identified by the EPA.

Water quality monitoring results from the Owenass River show that Orthophosphate and Ammonia levels were elevated both upstream and downstream of the WwTP discharge to the Owenass River however concentrations of both parameters increased significantly below the WwTP outfall. The results from the current onsite biological assessment also indicate a decline in biological water quality and ecological status downstream of the WwTP. The current assessment has concluded that the Mountmellick WwTP outfall and associated discharges are having a significant negative impact on both water quality and aquatic ecology of the receiving waters.

The Mountmellick WwTP is currently at or near capacity and plans for a new sewerage scheme and treatment plant are currently being advanced by Laois County Council. The new scheme will include tertiary treatment and separation of storm water and sewage streams. This will bring the current scheme into compliance with the requirements of the Waste Water Discharge (Authorisation) Regulations and ensure protection of the water quality, fisheries, aquatic ecology, and amenity value of this part of the River Barrow catchment.

1. INTRODUCTION

1.1 Background

This report has been prepared under the Waste Water Discharge (Authorisation) Regulations, 2007, using Section F of the Environmental Protection Agencies Waste Water Discharge Licensing Application Guidance Note (EPA, 2008). The purpose of the report is to assess whether the existing waste water discharge(s) from the Mountmellick WwTP plant are having a significant adverse impact on the receiving waters, or any Natura 2000 Site. The Mountmellick WwTP discharges to the Owenass River near the eastern boundary of Mountmellick town.

This report was prepared during July/August 2008 by Ecofact Environmental Consultants Ltd. on behalf of the Water Services Section of Laois County Council.

1.1 Legislation

The current report was prepared with consideration to the following water quality legislation:-

- Waste Water Discharge (Authorisation) Regulations 2007 (SI No. 684 of 2007);
- Urban Wastewater Treatment Regulations, 2001 (S.I. No. 254 of 2001);
- Water Policy Regulations (S.I. No. 722 of 2003) and Water Policy Regulations (Amendment) (S.I. No. 413 of 2005) implementing the EU Water Framework Directive (2000/60/EC);
- Local Government (Water Pollution) Acts, 1977 (Water Quality Standards for Phosphorus) Regulations, 1998. (S.I. No. 258 of 1998), and Local Government (Water Pollution) (Amendment) Act, 1990. (Act No. 21 of 1990);
- European Communities (Quality of Salmonid Waters) Regulations, 1998 (S.I. No. 293 of 1988) implementing Freshwater Fish Directive (78/659/EEC);
- Quality of Bathing Waters Regulations, 1992 and Quality of Bathing Waters Regulations (Amendment), 1996. (implementing Bathing Water Directive, 76/160/EEC);
- European Communities Quality of Surface Water Intended for the Abstraction of Drinking Water Regulations, 1989. (Implementing the Surface Water Directive, 75/440/EEC);
- Water Quality (Dangerous Substances) Regulations, 2001.(Implementing the Dangerous Substances Directive, 76/464/EEC);
- Protection of Groundwater Regulations, 1999. (S.I. No. 41 of 1999);
- Water Quality (Dangerous Substances) Regulations, 2001 (S.I. No. 12 of 2001).

In addition, cognisance was also made to the following legislation relating to nature conservation and fisheries:-

- The European Communities (Natural Habitats) (Amendment) Regulations 2005 (S.I. No. 378/2005), The European Communities (Natural Habitats) (Amendment) Regulations 1998 (S.I. No. 233/1998), and the European Community (Natural Habitats) Regulations 1997 (S.I. No. 94/1997) (implementing Council Directives 92/43/EEC and 97/62/EC on the conservation of natural habitats and of wild fauna and flora);
- Wildlife Act, 1976 (S.I. No. 39 of 1976) and the Wildlife (Amendment) Act, 2000 (S.I. No. 71 of 2001);
- Fisheries (Amendment) Act, 1997, (S.I. No. 23 of 1997) and Fisheries (Consolidation) Act, 1959 (S.I. No. 14 of 1959);
- The EU Birds Directive (79/409/EEC).

1.2 Methodology

This report has been prepared under the Waste Water Discharge (Authorisation) Regulations, 2007, using Section F of the Environmental Protection Agencies Waste Water Discharge Licensing Application Guidance Note (EPA, 2008). The current study was carried out as a desk study, and a field assessment. The literature review and field sampling programme was designed primarily as a descriptive study to provide information on the existing environmental status of the surface water area under investigation. An integrated assessment approach was employed. This approach merges

biological (effects) and physical/chemical (causes) using a combination of field and desk study evaluations.

2.2.1 Desktop Review

A desktop review was carried out to identify features of surface water importance within the study area and surrounding region. A review of areas designated (or being considered for designation) for nature conservation was carried out by consulting the National Parks and Wildlife Service (NPWS). These included Special Areas of Conservation, Special Protection Areas for birds (both internationally important) and proposed Natural Heritage Areas (of national importance). The locations of any designated salmonid waters, recreational and bathing waters and nutrient sensitive areas within the study area were identified though consultation with the Environmental Protection Agency (EPA). Likewise the presence of any important recreational or commercial fisheries was identified through consultation with the Southern Regional Fisheries Board (SRFB).

Technical files and previous reports prepared for the WwTP were supplied by Laois County Council for review in the current assessment. These reports included the catchment report for the town prepared as part of the National Urban Waste Water Study. Also, monitoring information on the discharges from the WwTP and the receiving waters were obtained from Laois County Council and used in this assessment. A review of the published literature, including the Laois County Development Plan 2006-2012, was undertaken in order to collate data on aquatic species and habitats of conservation concern in the study area. A range of additional sources of information including scientific reports produced by, and information on the websites of the EPA, NPWS, Laois County Council, and other agencies were also reviewed. A full bibliography of information sources reviewed is given in the references section. Ordinance Survey Maps and OS aerial photographs were also reviewed during the desk assessment.

2.2.2 Field Survey Work

The field survey comprised a systematic walk over of the WwTP site, outfalls, and receiving waters. A kick sampling assessment of benthic macro-invertebrates was undertaken a point located upstream (control) and downstream (receptor) of the primary discharge to supplement information collected during the desk study. The exact location and description of these sites is provided in Table 1.

Table 1 Location of the 2008 survey sites.

	Receptor Site (d/s WwTP)	Control Site (u/s WwTP)
Location	Strahard, approximately 1km downstream of Mountmellick.	Moll Rowes corner, immediately downstream of footbridge near playing pitches
NOS Grid Reference	N 45968 08711	N 45250 07982

The kick-sampling assessment followed the EPA standard methodology (Toner *et al*, 2005). This procedure involved the use of a 'D' shaped hand net (mesh size 0.5 mm; 350 mm diameter) which was submerged on the river bed with its mouth directed upstream. The substrate upstream of the net was then kicked for one minute in order to dislodge invertebrates, which were subsequently caught in the net. This procedure was undertaken at three points across the watercourse, where depth/access allowed. Stone washings and vegetation sweeps were also undertaken to ensure a representative sample of the fauna present at each site was collected. All samples of invertebrates were combined for each site and live sorted on the river bank for 20 minutes. Specimens retained were preserved in ethanol for later identification. Identification was undertaken in the laboratory using high-power and low-power binocular microscopes.

Specimens were identified using the standard keys which are listed in the bibliography section. The abundances of organisms present was assessed as follows: Present (1 or 2 individuals), Scarce/Few (<1%), Small Numbers (<5%), Fair Numbers (5-10%), Common (10-20%), Numerous (25-50%), Dominant (50-75%) and Excessive (>75%)

The Quality Rating (Q) System (Toner *et al*, 2005) was used to obtain a water quality rating for each site. The use of this particular biotic index allows the comparison with data published by the EPA. This method categorizes invertebrates into one of five groups, depending on their sensitivity to pollution. The higher the biological diversity and the greater the abundance of invertebrate species sensitive to organic pollution, the higher the water quality is assumed to be, and the higher the 'Q value' assigned to that sampling station. The revised BMWP scheme (Walley and Hawkes, 1997) is another biotic index of water quality that was used in the current appraisal. In this system, each family recorded in the sample is assigned a habitat specific score. This score depends on the pollution sensitivity of the invertebrate family together with the characteristics of the site where the invertebrates were found. A higher BMWP score is considered to reflect a better water quality and a score over 100 is indicative of very good water quality (see Table 2).

Table 2 Interpretation of the BMWP biotic index.

BMWP score	Category	Interpretation
0-10	Very poor	Heavily polluted
11-40	Poor	Polluted or impacted
41-70	Moderate	Moderately impacted
71-100	Good	Clean but slightly impacted
>100	Very good	Unpolluted, unimpacted

2.2.3 Assessment Methodology

Impact significance is a combined function of the value of the affected feature (its water quality, fisheries or aquatic ecology importance), the type of impact and the magnitude of the impact. It is therefore necessary to identify the value of surface water features within the study area in order to evaluate the significance and magnitude of possible impacts. To achieve this, the results of the desk and field assessment were evaluated to determine the significance of identified features located in the study area on an importance scale ranging from international-national-county-local. The criteria used are shown in Table 3.

The means of assessing impact significance was based on the Institute of Ecology and Environmental Management's "*Guidelines for Ecological Impact Assessment in the United Kingdom*" (IEEM, 2006) and the EPA's "*Waste Water Discharge Licensing Application Guidance Note*" (EPA, 2008). The significance of impacts was assessed on a combined basis of the value of the feature being affected and the magnitude of the impact. According to the EPA (2008), a discharge from a WwTP would be considered to have a significant adverse effect on the receiving waters if it were to:-

- Cause a deterioration in the chemical status or ecological status (or ecological potential as the case may be) in the receiving body of surface water;
- Cause a deterioration in the chemical status in the receiving body of groundwater;
- Cause the input into groundwater of hazardous substances, except where it is established that the input concerned is in a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater;
- Cause deterioration or result in significant and sustained upward trends in the concentrations of pollutants in groundwater in the case of pollutants that are not hazardous,
- Permanently exclude or compromise the achievement of the objectives established for protected species and natural habitats in the case of European sites where the maintenance or improvement of the status of water is an important factor in their protection or which is inconsistent with the achievement of environmental quality standards established under national Regulations.

2.2.4 Appropriate Assessment

A Stage One Screening / Test of Significance Assessment was carried out to identify the effects of the discharge(s) upon the nearest Natura 2000 site(s) and consider whether these impacts are significant. The Department of the Environment, Heritage and Local Government has not published guidelines for

undertaking Appropriate Assessment in Ireland. The current screening assessment was carried out using the following guidance:

- Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg (EC 2000);
- Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg (EC 2001);
- Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission. Office for Official Publications of the European Communities, Luxembourg (EC 2007).

Table 3 Criteria used in assessing the importance of surface water features (taken from NRA, 2004).

Rating	Qualifying Criteria
A	Internationally Important Sites designated (or qualifying for designation) as SAC* or SPA* under the EU Habitats or Birds Directives. Undesignated sites containing good examples of Annex I priority habitats under the EU Habitats Directive. Major salmon river fisheries Major salmonid lake fisheries.
B	Nationally Important Sites or waters designated or proposed as an NHA* or statutory Nature Reserves. Undesignated sites containing good examples of Annex I habitats (under EU Habitats Directive). Undesignated sites containing significant numbers of resident or regularly occurring populations of Annex II species under the EU habitats Directive or Annex I species under the EU Birds Directive or species protected under the Wildlife (Amendment) Act 2000. Major trout river fisheries. Water bodies with major amenity value. Commercially important coarse fisheries.
C	High Value, Locally Important Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or significant populations of locally rare species. Small water bodies with known salmonid populations or with good potential salmonid habitat. Sites containing any resident or regularly occurring populations of Annex II species under the EU habitats Directive or Annex I species under the EU Birds Directive. Large water bodies with some coarse fisheries.
D	Moderate Value, Locally Important Sites containing some semi-natural habitat or locally important for wildlife. Small water bodies with some coarse fisheries value or some potential salmonid habitat. Any water body with unpolluted water (Q-value 4-5).
E	Low Value, Locally Important Artificial of highly modified habitats with low species diversity and low wildlife value. Water bodies with no current fisheries value and no significant potential fisheries value.

1.3 Consultation

Preparation of this report included consultation with the following agencies and state bodies:-

- Laois County Council (Laois Co. Co.);
- National Parks and Wildlife Service (NPWS);
- Environmental Protection Agency (EPA);
- Southern Regional Fisheries Board (SWRFB);
- South Eastern River Basin District Office (SERBDO);
- Waterways Ireland;
- Department of Communications, Marine and Natural Resources (DCMNR);
- Marine Institute (MI);
- Botanical Society of the British Isles (BSBI);
- Geological Society of Ireland (GSI).

2. SCHEME DESCRIPTION

2.1 Introduction

Mountmellick is a developing town with a residential population of approximately 4,000 (DOEHLG, 2003). The Owenass River runs through the town, dividing it, before joining the River Barrow just over 1km downstream of the WwTP primary outfall. The Mountmellick WwTP discharges into the Owenass River at 'Moll Rowe's corner' at the northern side of the town. The main channel of the River Barrow is protected as part of the River Nore and River Barrow candidate Special Area of Conservation (SAC) under the Habitats Directive (92/43/EEC).

Mountmellick WWTP was commissioned in the 1970's and comprises of preliminary works and secondary treatment (DOELG, 2003). Preliminary treatment consists of manual screens and manual grit removal from a grit channel. Secondary treatment is provided through aeration in an oxidation ditch, followed by settling in a secondary settlement tank. There is no tertiary treatment on site. Sludge treatment consists of thickening in a Picket Fence Thickener followed by dewatering in a centrifuge. The sludge facilities and secondary settlement tank were commissioned in 1997. The Mountmellick WWTP currently occupies an area of 0.85 hectares.

DOELG (2003) concluded "*that on the basis that the WwTP currently receives 248 kg BOD/day, the oxidation ditch is considered to be underloaded, with spare capacity at present for an additional 89.5 kg BOD/day excluding the contribution from imported leachate*". DOELG (2003) noted that the secondary settlement tank was designed for a 10,298 pe based on standard estimates, and comment that "*in theory there may be capacity available to handle additional future development, however a careful re-assessment of all relevant factors should precede any decision to significantly increase the WWTP load*".

DOELG (2003) reported that sludge from the plant is dewatered by centrifuge to a cake with a dry solids concentration of around 30 %. Approximately 150 tonnes of dry solids per annum is produced. Final disposal is to Kyletalesha Landfill. The Sludge Management Plan for County Laois designated Portlaoise as the main hub centre for sludge treatment in County Laois. Biosolids arising from the treatment of municipal wastewater sludge are promoted for use as a fertilizer in agriculture in County Laois.

2.2 Discharge Standards

The requirements of Urban Wastewater Treatment Directive 91/271/EEC for treatment plants serving more than 2000 population equivalent are:

Biochemical Oxygen Demand (BOD5)	25 mg/l O_2
Chemical Oxygen Demand	125 mg/l O_2
Suspended Solids (p.e. >10 000)	35 mg/l
Suspended Solids (p.e. 2000 - 10 000)	60 mg/l

The following additional requirements apply for discharges to areas that are deemed to be sensitive:

Total Phosphorus (10 000 – 100 000 p.e.)	2 mg/l
Total Phosphorus (over 100 000 p.e.)	1 mg/l
Total Nitrogen (10 000 – 100 000 p.e.)	15 mg/l
Total Nitrogen (over 100 000 p.e.)	10 mg/l

Previous reports have suggested that the plant operates well in achieving the required BOD and COD levels. The plant has a capacity for 10,298 p.e. and is currently at or near this capacity.

The new Mountmellick Sewerage Scheme is presently at the preliminary report stage with consultants short listed. This is being financed under the Water Services Investment Programme. The projected construction start date is 2012 with a completion date of 2014. The size will be based on population projections up to 2027.

2.3 Monitoring

Monitoring of the water quality of the outfall from the Mountmellick WwTP is undertaken by Laois County Council on an approximate monthly basis. Water quality is also monitored in the Owenass River upstream and downstream of the primary discharge. The parameters measured in the water samples are; Ammonia, Biological Oxygen Demand (BOD), Chemical Oxygen Demand (COD), Conductivity, Nitrates, Ortho-phosphate, and pH and Suspended Solids.

Figure 1 The location of the Mountmellick WwTP and the outfall, along with EPA and Laois County Council monitoring locations, 2008 kick sampling sites, and sensitive receptors.

3. RECEIVING ENVIRONMENT

3.1 Catchment Description

3.1.1 River Barrow

The River Barrow (EPA code 14/B/01) is 192 kilometers long and drains a catchment of approximately 2983 km^2. The River Barrow has the second longest main river channel in the country, after the River Shannon. It rises in the Slieve Bloom Mountains in County Laois approximately 6 km south of Clonaslee. It flows north easterly until it reaches the Offaly county boundary at Monettia Bog where it turns in a south easterly direction. From near Mountmellick, it flows in an easterly direction through Mountmellick forming part of the boundary between Laois and Offaly, to Monasterevin. From Monasterevin the river flows in a southerly direction through Athy, Carlow, Leighlinbridge, Bagenalstown, Grauigenamangh and New Ross, to its confluence with the River Suir at Cheekpoint. The Barrow is joined by the Nore approximately 4 km upstream of New Ross and is tidal for another 13 km upstream to St. Mullins.

From Monasterevin to Carlow, the channel flows over limestone and lies in an open landscape. However, the channel is bounded closely to the west by the Castlecomer Plateau from Carlow south to Goresbridge. The topography is further altered dramatically to the south of Goresbridge as the geology changes from limestone and the Barrow incises its way through a narrow gorge cut between the granite of the Blackstairs Mountains, immediately to the east, and the Brandon Hill granite, which dominates the landscape to the west (King, 2006).

The overlying soils in the Barrow catchment reflect, in large measure, the underlying geology. The highlands of the Slieve Blooms consist of blanket peat and peaty gleys of sandstone origin (King, 2006). These give way to gleys of limestone origin or to river alluvium in the catchment downstream to Monasterevin. The extensive area drained by the Slate and Figile systems, entering the main Barrow at Monasterevin, has soils of basin peat and of podzolics of limestone origin. From Monasterevin to Goresbridge, the principal soil association is one of grey brown podzolics, all of limestone origin. In the area between Athy and Goresbridge a narrow ribbon of soils is composed of morainic gravels and sands and these materials are extensively quarried in surface excavations. As with the geological changes at Goresbridge, so the soils also change and have their origins in granitic or Silurian glacial till or shales. The soil types from Athy down to the confluence with the R. Suir are all identified as excellent for tillage, with good sheep grazing soils on the granitic glacial tills.

Major commercial peat workings have been developed in the lowland areas to the north of the Slieve Blooms, around Mountmellick and in the catchments of the Slate and Figile to the north of Monasterevin. South of Monasterevin, extensive areas of good farmland occur, both on low and on elevated ground. Grassland for grazing and silage production are common as is tillage production. Cereals and root crops were traditionally grown to service major brewing and sugar-beet production in Kilkenny and Carlow respectively.

The river falls steeply in its upper reaches, dropping 400m over an initial channel length of 10 km. The high mean gradient value of 4% gives way to mean values of 0.06% between Two-Mile Bridge and Monasterevin and a value of 0.02% from Monasterevin to Athy (King, 2006). Such low gradient values are indicative of a slow-flowing channel with predominance of deep, pool-type habitat or of continuous, deep glide habitat.

The main tributaries joining the left bank (east side) are the Cushina, Figile and Slate which form one tributary at Monasterevin and the Tully, Greese, Lerr, Burren, Mountain and Poulmounty, while on the right bank (west side) it is joined by the Owenass, Triogue, Stradbally, Douglas, Fushogue, Gowran, Powerstown and Duiske tributaries.

The River Barrow has been the subject of an arterial drainage scheme (1926 – 1934) with 210 km of main rivers and tributaries and 175 km of smaller drains deepened and widened, to improve conveyance, in the course of the works programme (King, 2006). The extent of the

drainage programme was largely confined to the catchment upstream of Athy. The drainage scheme identified the natural division of the catchment between the extensive areas of flat land upriver of Athy and the narrower, corridor-like character from Athy down to St. Mullins. The scheme as executed is currently maintained by the Barrow Drainage Board, composed of the three counties of Laois, Offaly and Kildare. Management involves retaining the channel conveyance as excavated in the original scheme. This process involves in-channel work, including removal of sediment deposits, fallen trees and other physical obstructions to passage of flood flow, and management of bank slopes to retain stability.

To accommodate navigation, as well as providing hydropower to a number of industrial units, the River Barrow was regulated by a number of major weirs, creating a series of very low gradient reaches between each weir. Navigation at each weir was accommodated through a network of lock gates. The navigation system is currently managed by Waterways Ireland. Downstream of Athy, the Grand Canal – Barrow Line navigation switches from being an exclusively canal-like channel to one where navigation takes place within the riverine channel. The Barrow in conjunction with stretches of the canal, provides a navigable channel between New Ross and the main Grand Canal system at Athy. The navigation system is currently managed by Waterways Ireland. Their programme of management includes maintenance of the navigation channel within the River Barrow's cross-section, a process that can require the removal of silt deposition and in channel growths of tall emergent vegetation. The tributary channels, as with the main stem, derive their character from local topography, geology, soil and land use.

Most of the main channel of the River Barrow and its main tributaries are part of the Barrow/Nore Special Area of Conservation (SAC) which is designated under the Habitats Directive as having special conservation value because of the presence of listed species and habitats.

3.1.2 Owenass River

The Owenass River is a 3rd order watercourse which rises on the eastern slopes of the Slieve Bloom Mountains in the townland of Brisha. The upper reaches drain elevated land used primarily for commercial forestry. Less than 1.5 km from its source, the Owenass River becomes a 2nd order stream and is joined by yet another 1st order stream within another 0.5 km. For the first 4 km of its course the Owenass is a high gradient stream (310 meters at source to 160 meters) flowing through a steep valley in an easterly direction. It then flows under Cathole Bridge after being fed by a few short 1st order streams coming off the Slieve Bloom Mountains from the north. It continues flowing east for over 8 km before it reaches Mountmellick. Downstream of Cathole Bridge the river has a more moderate gradient and between here and Mountmellick it is joined by the Owennahallia (2nd order), Blackwater River (3rd order) and Murglass (2nd order) Rivers. Approximately 2 km of third class roads follow the reach of the river between Cathole Bridge and Mountmellick. This reach of the river is also crossed by four bridges and two fords. Within the town of Mountmellick, the Owenass River is crossed by the N80 national primary route and the R422 regional road. The primary discharge of the Mountmellick WwTP is further downstream at the northern outskirts of the town. Downstream of Mountmellick, the Owenass River continues on its northerly course for just over 1 km to join the River Barrow between Bay Bridge and Borness Bridge in the townland of Strahard.

The soils in the Mountmellick area are predominantly peaty gleys, blanket peat and mineral alluvium. The underlying geology of the Owenass catchment is a mixture of tournasian sandstone, mudstone, tournasian argillaceous bioclastic limestone, visean argillaceous and cherty limestone shale (GSI website). Greywacke, conglomerate and quartzite are also a component of the underlying geology around the source of the river at the Slieve Bloom Mountains.

3.2 Water quality

3.2.1 Existing information

3.2.1.1 EPA published data

A summary of EPA water quality for the Barrow and Owenass Rivers during the 2001-2003 survey is provided in Table 4. In this survey a total length of 3.5 km (22%) of the Owenass River was given an unsatisfactory biological rating. Detailed results of published EPA biological and water quality assessments on the Rivers Barrow and Owenass Rivers are provided in Tables 5-8 and discussed below.

Table 4 Summary of EPA water quality results showing overall results for the Barrow and Owenass Rivers. Data is from EPA biological surveys during the period 2001-2003 (adapted from Toner *et al,* 2005).

Catchment	Class A	Class B	Class C	Class D	Total (km)
Barrow (km)	278	189.5	139.5	9.5	616.5
Barrow (%)	45	31	22.5	1.5	100
Owenass (km)	12.5	3.5			16
Owenass (%)	78%	22%			

River Barrow

Water quality has been monitored in the River Barrow main stem and in selected tributaries by the Environmental Protection Agency (EPA) and its predecessors since 1971. Both chemical and biological variables have been measured. The main channel was surveyed in 2003 (Clabby *et al*, 2004) and some overall improvement in water quality was reported when compared to data from 1997 and 2000. However, eutrophication continued to be widespread. The sources of this enrichment varied with location in the catchment. Agriculture and peat harvesting were identified in the upper reaches of the main stem and suspected sewage and other discharges were associated with the urban centres, including Mountmellick.

A summary of overall EPA water quality results for the River Barrow is provided in Table 4. Data is from EPA biological surveys during the period 2001-2003 (adapted from Toner *et al,* 2005). The EPA monitors a site on the River Barrow upstream of the Owenass confluence (i.e. upstream of inputs from Mountmellick). This is site (Site 0220, Two-mile Bridge) is located approximately 5.5km upstream so is not a true control. A site 205m downstream of the Owenass confluence (Site 0500), Borness or Barranagh's Bridge) is also monitored. The biological water quality results for these sites during the period 1971 to 2003 are provided in Table 5. In the most recent published survey the site upstream of the Owenass confluence was rated as Q4 or unpolluted (Class A), while the site 250m downstream of the Owenass confluence was rated as Q3-4 or Slightly Polluted (Class B). Unsatisfactory conditions have prevailed at this site for most of the period since monitoring began, with the exception of the 1980's when it was assigned a rating of Q4 on 3 occasions. The upper station was give an unsatisfactory rating in 1974 and 1997, but reached an exceptional rating of Q5 in 1980. It has been rated as Q4 in the last two published surveys.

A summary of the EPA chemical water quality results for the same two sites for the period 2001 to 2003 is also provided in Table 7. The results of this assessment indicate that maximum Orthophosphate levels were elevated in samples both upstream and downstream of the Owenass confluence. Likewise maximum dissolved oxygen values recorded at both sites suggest excessive aquatic plant growth and associated photosynthetic activity occurring in response to elevated nutrient levels. Toner *et al* (2005) concluded that there was an overall improvement in the water quality results for the River Barrow since the previous 2000 survey (McGarrigle *et al*, 2002). This was despite the fact that water levels were generally below normal during the most recent survey thus providing less dilution capacity for wastes. However, the EPA concluded that eutrophication continued to be widespread in the river due

to suspected agriculture in the upper river and to sewage discharges from towns such as Mountmellick.

River Owenass

The EPA monitors water quality in the Owenass River (EPA code 14/O/01) and the most recently published survey is from 2003 (Toner et al, 2005). The nearest site upstream of the Mountmellick WwTP outfall is site 0220 (Bridge north of Irishtown House). This site is located approximately 1.4km upstream of the WwTP outfall. The nearest site downstream of the Mountmellick WwTP outfall is site 0300 which is located approximately 1km downstream of the WwTP outfall. Both of these sites were given a rating of Q3-4 (Slightly Polluted, Class B) during the 2003 survey. Historically, the downstream site has experienced seriously polluted conditions in the past, but has been consistently rated as Q3-4 since 1986. Data for the upstream site is less extensive but has generally been tending towards unsatisfactory conditions since surveys began in 1989. The fords north of Bark Mill (Station 01020, 3km upstream of Mountmellick) were rated at unpolluted (Q4, Q4-5 or Q5) throughout the 1970's and 1980's, declining to Q3-4 in 1993.

Table 5 River Barrow (EPA code 14/B/01) Biological Quality Ratings (Q values) from two sites (one 5.5km u/s and another 0.25km d/s of Mountmellick WwTP), adapted from Toner *et al,* 2005).

Sampling Station	14 /B/0/10300	14 /B/ 01/0500
Station Name	Twomile Bridge, 5.5km u/s of the Owenass River confluence	Barranagh's Bridge, 250m d/s of Owenass River confluence
1971	Q4-5	Q3-4
1974	Q3-4	Q3-4
1976	-	Q3
1978	-	Q3-4
1980	Q5	Q4
1984	-	-
1986	Q4	Q4
1989	Q4	Q4
1993	-	Q3-4
1994	Q4	Q3-4
1997	Q3-4	Q3-4
2000	Q4	Q3-4
2003	Q4	Q3-4

Table 6 Owenass River (EPA code 14/O/01) Biological Quality Ratings (Q values) from two sites (one 1.4 u/s and another c.1km d/s of Mountmellick WwTP), adapted from Toner *et al,* 2005).

Sampling Station	14/O /01/0220	14/O/ 01/0300
Station Name	Bridge North of Irishtown	d/s of Mountmellick
1971	-	Q2
1974	-	Q2
1976	-	Q1-2
1978	-	Q1-2
1980	-	Q3
1984	-	Q2
1986	-	Q3-4
1989	Q3-4	Q3-4
1993	Q3-4	Q3-4
1994	-	-
1997	Q4	Q3-4
2000	Q3-4	Q3-4
2003	Q3-4	Q3-4

A summary of the EPA chemical water quality results for the Irishtown and downstream sites for the period 2001 to 2003 is provided in Table 8. The results of this assessment indicate that median Orthophosphate levels were elevated in samples both upstream and downstream of the Mountmellick WwTP outfall, but were 166% higher in the downstream site (0.08 mg/l). Likewise Total Ammonia levels were also significantly elevated in samples taken from the downstream site, with median levels increasing from 0.04 mg/l to 0.14 mg/l (an increase of 250%).

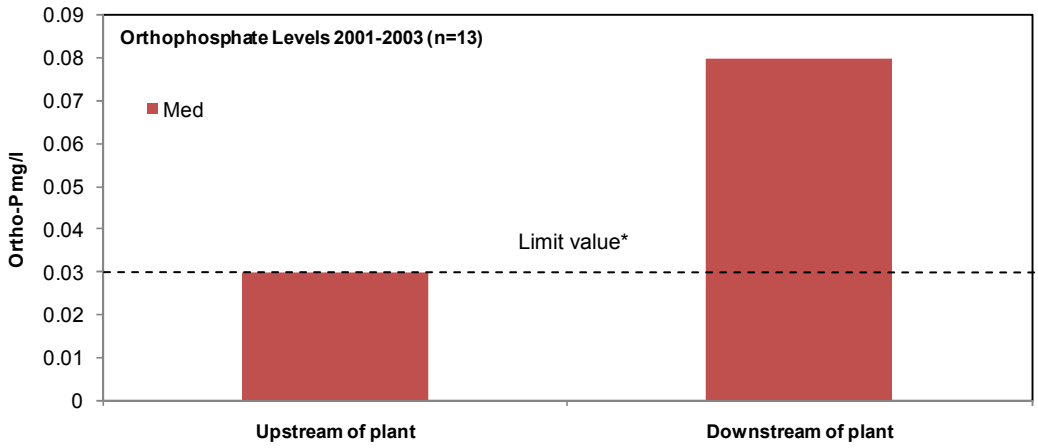

Figure 2 Median Ortho-Phosphate levels in the Owenass River during the period 2001 to 2003 (n=13 observations). Sites are located upstream and downstream and may be influenced by other factors. Taken from Toner *et al*, (2005) *Limit value is taken as 0.03 mg/l which is the interim statutory M.R.P. (broadly equivalent to Orthophosphate) annual median standard for rivers (EPA, 2001). The maximum value recorded during this period at the downstream site was over 32 times this limit value. Median values for this parameter were 166% higher in the downstream site.

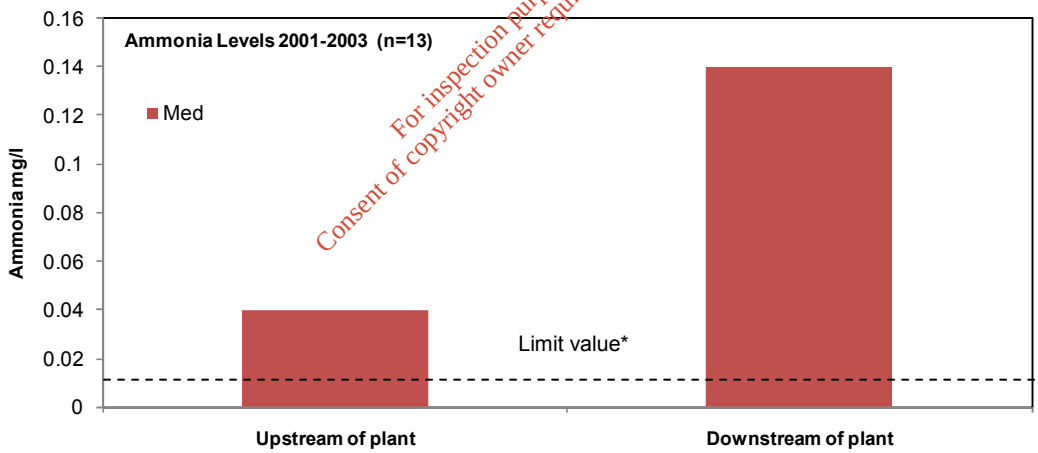

Figure 3 Median Total Ammonia levels in the Owenass River during the period 2001 to 2003 (n=13 observations). Sites are located upstream and downstream and may be influenced by other factors. Taken from Toner *et al*, (2005) *Limit value is taken as 0.1 mg/l which is given in EPA (2001) as the level at which contamination is indicated. Median values for this parameter were 250% higher in the downstream site. The maximum value recorded in the downstream site during this period was 36 times this limit value.

Table 7 EPA Chemical water quality results for the River Barrow (EPA code 14/B/01) from two sites (one 5.5 km u/s and one c.250m d/s of Mountmellick WwTP), adapted from Toner *et al,* 2005).

Parameter	Unit	14 /B/0/1/0300 (5.5 km u/s of Owenass confluence)				14 /B/ 01/0500 (250m d/s of Owenass confluence)			
		Min	Med	Max	N	Min	Med	Max	N
MRP (Ortho Phosphate as PO_4)	mg/l	0.01	0.01	**0.06**	23	0.01	0.03	**0.22**	29
Water temperature	ºC	2.8	10.2	16.5	31	2.8	10.4	16.8	31
Dissolved Oxygen	%	82	94	128	31	79	93	127	31
Dissolved Oxygen	mg/l	8.3	11.0	**14.5**	31	8.4	11.2	12.8	31
pH		7.5	7.9	8.2	31	7.6	8.0	8.3	31
Chloride	mg/l	11	16	22	31	12	17	20	31
Total Ammonia	mg/l	<0.01	0.04	0.11	29	<0.01	0.06	**0.66**	31
Unionised Ammonia	mg/l	<0.001	0.001	0.003	29	<0.001	0.001	**0.030**	31
Oxidised Nitrogen	mg/l	0.6	2.0	4.5	31	0.6	1.6	3.9	31
Colour Hazen		30	70	250	30	30	65	175	30
BOD	mgO_2/l	0.3	1.0	2.1	31	0.4	1.1	3.3	31

Table 8 EPA Chemical water quality results of the Owenass River at Irishtown House (1.4 km upstream Mountmellick) and a site located c.1km downstream of the WwTP outfall.

Parameter	Unit	Bridge north of Irishtown House (Sampling station 14/O/01/0200) u/s of Mountmellick				Downstream of Mountmellick (Sampling station 14/O/01/0300)			
		Min	Med	Max	N	Min	Med	Max	N
MRP (Ortho Phosphate as PO_4)	mg/l	0.01	**0.03**	**0.07**	13	0.02	**0.08**	**0.98**	13
Water temperature	ºC	5.0	9.1	18.5	13	5.3	10.9	19.1	14
Dissolved Oxygen	%	88	104	**170**	13	86	101	127	14
Dissolved Oxygen	mg/l	10.2	11.6	**15.9**	13	10.3	11.1	**12.4**	14
pH		7.6	8.2	8.8	13	7.7	8.2	8.8	14
Chloride	mg/l	13	16	22	13	11	17	24	14
Total Ammonia	mg/l	0.01	0.04	0.16	12	0.04	**0.14**	**3.58**	14
Unionised Ammonia	mg/l	<0.001	0.001	0.006	12	0.001	**0.007**	**0.242**	14
Oxidised Nitrogen	mg/l	0.6	1.4	3.2	13	0.8	1.5	3.5	13
Colour Hazen		20	60	175	12	15	60	175	13
BOD	mgO_2/l	0.5	1.5	2.2	13	0.7	1.6	**7.3**	14

3.2.1.2 Laois County Council Monitoring Data

Laois County Council monitors water quality in the Owenass River at stations located upstream and downstream of the Mountmellick WwTP discharge. The results of the most recent monitoring of chemical water quality at these two sites were provided by Laois County Council for use in the current assessment. This data extends from the period January 2007 to July 2008. A statistical summary of this data is provided in Appendix 2. A discussion of the results for each parameter at the upstream and downstream monitoring locations on the Owenass River is presented below. The results are very similar to those obtained in the previous 2001-2003 EPA assessment.

From the Laois County Council monitoring data it can be seen that the mean orthophosphate values for both the upstream and downstream stations exceed (or are at) the prescribed limits (0.03 mg/l) for this river. Mean orthophosphate levels were 166% higher in the samples taken from the site downstream of the WwTP outfall compared to the reference site. The maximum

values for this parameter recorded downstream of the WwTP outfall were over 7 times the limit.

The EPA considers that levels above 0.1mg/l N indicate sewage or industrial contamination (EPA, 2001). Ammonia levels measured in the samples taken from downstream of the discharge point were higher than those obtained from the reference samples. The mean upstream Ammonia values were 0.08mg/l (+/-0.006), while the downstream values were 0.0104mg/l (+/-0.007). Maximum values from both sites were considered to be elevated (>0.1 mg/l).

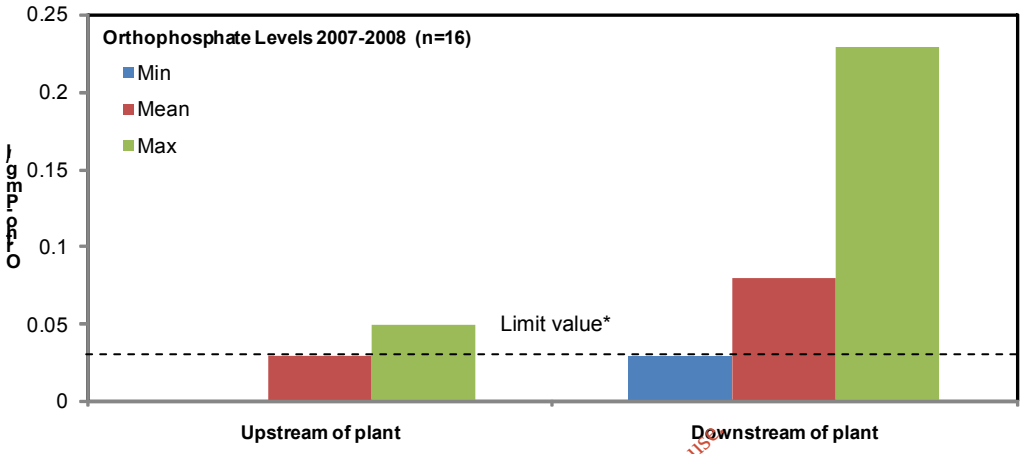

Figure 4 Mean, maximum and Minimum Ortho-Phosphate levels in the Owenass River during the period 2007 to 2008 (n=16 observations). Sites are located upstream and downstream and may be influenced by other factors. Laois County Council monitoring data. *Limit value is taken as 0.03 mg/l which is the interim statutory M.R.P. (broadly equivalent to Orthophosphate) annual median standard for rivers (EPA, 2001).

3.2.2 Results of the August 2008 on-site assessment

In the current assessment, a location adjacent to the town park just downstream of the footbridge was sampled on the Owenass River. This location was less than 0.5 km upstream of the existing WwTP. The surrounding land is used for both amenity, residential and agricultural (grassland) purposes. The river at this point is approximately 10 meters wide and fairly fast flowing. This part of the river had gabions at either side to prevent erosion and had been artificially deepened at some time. The substrate was composed mainly of stone (60%) but also of cobble (35%) and gravel (5%). The river was high at the time of the survey when the average depth was 60 cm.

A receptor site on the Owenass River was located just over 1 km downstream of Mountmellick in the townland of Strahard. This site was accessed from the R423 Portarlington road. The river at this point was fast flowing and had an average wetted width of 10 meters. This part of the Owenass had been deeply drained and had banks in excess of 2 meters high. The substrate was of rock, cobble, gravel, and cobble.

3.2.1.2 Control Site

A of total of 18 different macro-invertebrate families were recorded at this site. Group C pollution tolerant taxa dominated the macroinvertebrate community. Mayflies were represented by two families; larva of the blue-winged olive *Ephemerella ignita* was found in fair numbers while larva of the large dark olive *Baetis rhodani* was numerous. The only Plecopteran/stonefly representative was that of the needlefly *Leuctra fusca*, of which there were fair numbers at larval stage. Cased caddisfly larvae of an indeterminate species of microcaddisfly (Hydroptilidae) were found in small numbers. Larvae of the caseless trumpet-net caddisfly *Polycentropus flavomaculatus* were present. True flies were the most diverse group with larvae of blackfly (small numbers), cranefly (present), bloodworm *Chironomous sp*.

(fair numbers) and green chironomid (scarce). The adult diving beetle *Potamonectes depressus elegans* (subfamily Hydroporinae) was and larvae of the riffle beetle *Helmis sp.* were both present. Fair numbers of Jenkin's spire shell *Potamopyrgus jenkinsi,* the leech *Helobdella stagnalis* and the hog louse *Asellus aquaticus* were recorded. The orb mussel *Pisidium sp.* and the parasitic fish leech *Piscicola geometra* were both present. Small numbers of aquatic earthworms in family Lumbriculidae and freshwater shrimp *Gammarus deubeni* were recorded. Small numbers of white-clawed crayfish *Austropotamobius pallipes* were found while kick sampling rocks at this site.

Using the EPA freshwater biological monitoring system (Toner *et al.*, 2005), this part of the river is deemed to be 'Moderately Polluted, Class C (Q3)'. This is due to the absence of pollution sensitive group A indicators in combination with the relative abundance of other pollution sensitivity groups at the sampling site. The BMWP score for this site was 99.7, implying that this part of the river is 'Clean but impacted'. The corresponding average score per taxon for this site was 5.54.

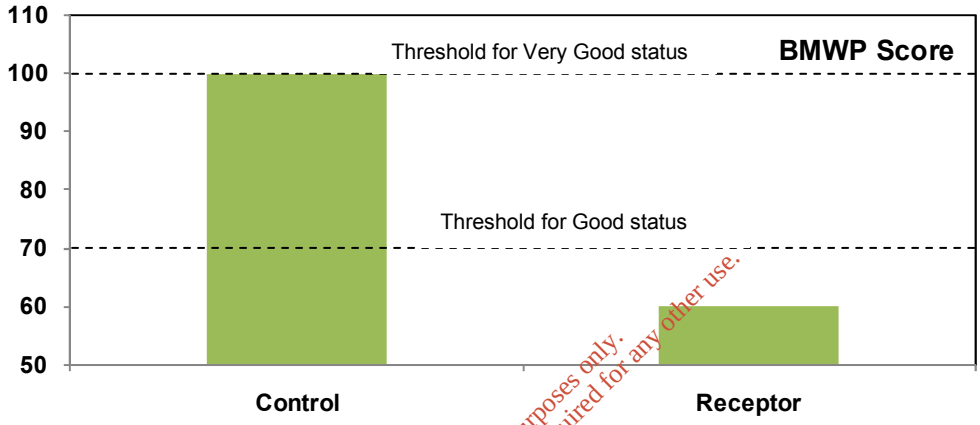

Figure 5 Variation in the BMWP score between upstream (control) and downstream (receptor) sites on the Owenass River. The results suggest a decline in ecological status between the control and receptor sites (see Table 2 for threshold values). Based on data collected during the August 2008 study.

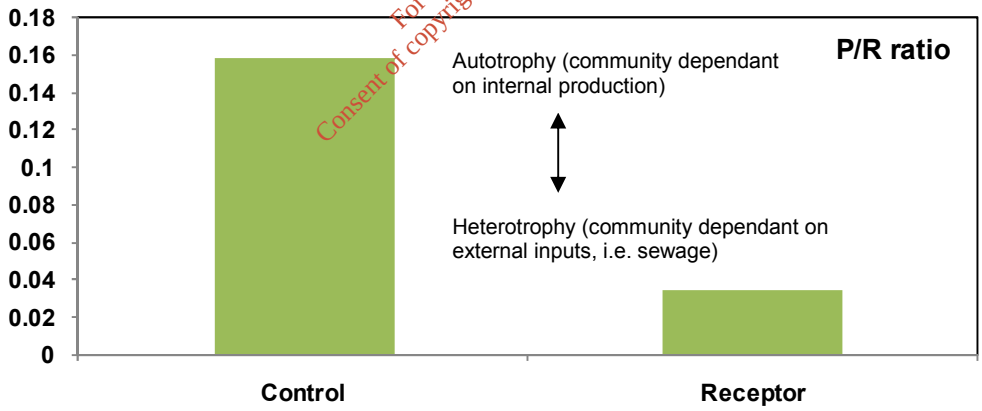

Figure 6 Variation in the P/R index (ratio of Scrapers to total collectors + shredders, a surrogate for ratio of gross primary production to community respiration) x between upstream (control) and downstream (receptor) sites on the Owenass River. The results suggest a decline in ecological status between the control and receptor sites. Based on data collected during August 2008 study.

3.2.1.3 Receptor site

There was reduced macroinvertebrate diversity at this site with only 11 families recorded. For a total of 231 organisms, 200 were blackfly larvae making this group of true flies excessive. Only one species of mayfly was recorded and was merely present; larvae of the large dark olive. Stonefly larvae of the group B needlefly were scarce as were larvae of an indeterminate species of microcaddisfly. Larvae of the cased northern caddisfly *Halesus radiatus*, cranefly, Chironomidae (bloodworm and green chironomid) were all present. Molluscs recorded at this

site were the orb mussel (scarce) and the river limpet *Ancylus fluviatilis* (present). At this site, the hog louse and the freshwater shrimp were found in small numbers.

This site mainly supported group C and group D pollution indicators and had no pollution sensitive group A indicators. Therefore, this part of the river is considered to be 'Moderately Polluted, Class C (Q3)' using the EPA Q-rating system. This site scored 60.1 on the BMWP scale for riffles. With this score, the river is interpreted as being 'Moderately impacted'. The ASPT for this site is 5.46.

Table 9 Classification of macroinvertebrate species recorded at each site in terms of their pollution sensitivity (EPA methods).

Pollution indicator group	Control site				Receptor site			
	Number	% of total	Families	% of families	Number	% of total	Families	% of families
Group A (Most sensitive)	0	0	0	0	0	0	0	0
Group B (Less Sensitive)	6	8.1	2	10.5	7	3	3	25
Group C (Tolerant)	51	68.9	12	63.2	209	90.5	6	50
Group D (Very Tolerant)	12	16.2	4	21	14	6	2	16.7
Group E (Most tolerant)	5	6.8	1	5.3	1	0.5	1	8.3
Total	74	100	19*	100	231	100	12*	100

Table 10 Functional group characteristics of the two survey sites. Dominant FFG (%) (Dominant group and its mean relative %); P/R (ratio of Scrapers to total collectors + shredders, a surrogate for ratio of gross primary production to community respiration); Heterotrophy vs Autotrophy based on a P/R threshold of > 0.75 = autotrophic) (Rabenil *et al*, 2005).

Functional Group	Control site		Receptor site	
	Numbers	%	Numbers	%
Filtering Collector	11	14.9	206	89.2
Gathering Collectors	34	45.9	1	0.4
Predator	8	10.8	0	0
Scraper	8	10.8	4	1.7
Shredder	13	17.6	20	8.7
Total	74	100	231	100
P/R	0.138		0.018	
Heterotrophy Vs Autotrophy	Heterotrophic		Highly Heterotrophic	

Table 11 Juvenile salmonid food index. Predictable invertebrate supply is the ratio of behavioral drifters (filtering and gathering collectors) to accidental drifters (scrapers, shredders and predators). Based on a threshold of >0.50 for predictable supply (Rabenil *et al*, 2005).

Site	Behavioral drifters/accidental drifters	Predictable Vs Unpredictable
Control	1.551	Predictable
Receptor	8.625	Predictable

3.2.3 Dangerous substances

An assessment of the presence of dangerous substances in the Owenass River upstream and downstream of the Mountmellick WwTP, along with an assessment of the presence of such substances in the discharge, is provided in Appendix 3. This assessment is based on sampling undertaken by Laos County Council on two occasions during 2007 and 2008. Levels of these substances recorded in the samples are compliant with required limits, except for fluoride which was slightly elevated in the Owenass River downstream of the plant on 16/05/07. However, the number of samples assessed for dangerous substances is considered to be limited and further sampling to assess the ambient levels of these substances in the effluent is recommended.

3.2.4 Assimilation capacity

The assimilation capacity of the River Barrow at the Mountmellick WwTP discharge point for BOD, Ammonia and Phosphate has been estimated by DOELG (2003). This assessment is summarized in Table 12. The results of the current suggest that there is also currently little assimilation capacity for Ammonia also.

Table 12 Assimilation capacity of the Owenass River at the Mountmellick WwTP discharge point (from DOELG, 2003).

Bio-chemical Constituent	Assimilative Capacity (kg/day)	Comment
BOD Bio-chemical Constituent	4.32 Assimilative Capacity (kg/day)	Freshwater Fish Directive Comment (inc. "Drivers")
Phosphate	Limited*	It will be necessary to incorporate phosphate removal at the WwTP.
Ammonia	4.19	Freshwater Fish Directive

3.3 Sediment quality

No information on sediment quality in the Owenass River was found during the current assessment.

3.4 Areas designated for nature conservation

Sites of international conservation importance are designated as Special Areas of Conservation (under the Habitats Directive) or Special Protection Areas (under the Birds Directive). Together, SACs and SPAs make up the Natura 2000 network of wildlife sites. The nearest SAC to the Mountmellick WwTP is the 'River Barrow and River Nore' SAC (site code 002162). The primary discharge from the Mountmellick WwTP flows into the Owenass River which forms part of the SAC. The Owenass River joins the River Barrow (also part of this SAC) just over 1 km downstream of the outfall from the Mountmellick WwTP. The River Barrow and River Nore SAC is designated due to the presence 12 Annexed habitats including floating river vegetation and tall herb fringes, both listed as Annex I habitats under the EU Habitats Directive (1992). The site is also designated for 12 Annex II species including white clawed crayfish *Austropotamobius pallipes*, river lamprey *Lampetra fluviatilis*, brook lamprey *Lampetra planeri* and sea lamprey *Petromyzon marinus* freshwater pearl mussels *Margaritifera margaritifera* and Nore freshwater pearl mussel *Margaritifera durrovensis*, Atlantic salmon *Salmo salar* and otter *Lutra lutra.*

The Slieve Bloom Mountains are both an SAC (site code 000412) and SPA (site code 004160). The SAC/SPA boundary lies approximately 5km west upstream of Mountmellick. The Owenass River rises in this SAC/SPA area. The Slieve Bloom Mountains SAC are designated for Alluvial woodland, active blanket bog and wet heath. It is designated as an SPA for the Hen Harrier *Circus pygargus*. This SPA also contains peregrine falcon *Falco peregrines* (amber listed conservation status) and red grouse *Lagopus lagopus scoticus* (red listed conservation status).

Mountmellick SAC (site code 002141) is located 3km east of Mountmellick WwTP. This SAC is not located within the catchment area affected by the discharge from the Mountmellick WwTP. This site is designated for the whorl snail *Vertigo moulinsiana.*

Sites of national importance for wildlife are designated as Natural Heritage Areas (NHAs) under the Irish Wildlife Act 2000. There are two Natural Heritage Areas located within a 5km radius of the Mountmellick WwTP. The first of these is the Slieve Bloom Mountains (site code 000412) and is already described as an SAC/SPA above. The second NHA is Clonreher Bog (site code 002357) which is 5km south of the Mountmellick WwTP. This NHA is not located within the catchment area affected by the discharge from the Mountmellick WwTP. This site is designated for containing raised and cutover bog. Areas designated for nature conservation located within five kilometer radius of the Mountmellick WwTP are listed in Table 13.

Table 13 Sites designated for nature conservation within 5km radius of the outfall from the Mountmellick WwTP.

Name	Site code	Distance from site	Designation	Notes
River Barrow and River Nore	002162	0km	SAC	This SAC is designated for 12 Annex I habitats e.g. floating river vegetation and tall herb fringes, and 12 Annex II species including white clawed crayfish *Austropotamobius pallipes*, river lamprey *Lampetra fluviatilis*, brook lamprey *Lampetra planeri* and sea lamprey *Petromyzon marinus* freshwater pearl mussels *Margaritifera margaritifera* and Nore freshwater pearl mussel *Margaritifera durrovensis*, Atlantic salmon *Salmo salar* and otter *Lutra lutra.* The the Owenass River runs through the Town of Mountmellick. This river is part of the River Barrow and River Nore SAC. The discharge from the Mountmellick WwTP flows directly into the Owenass River. The Owenass River joins the River Barrow 1.5km downstream of the Mountmellick WwTP. The River Barrow is also part of this SAC.
Mountmellick	002141	3km east	SAC	This site is designated for the whorl snail *Vertigo moulinsiana.* This site is not within the catchment area that would be affected by the discharge from the Mountmellick WwTP.
Clonreher Bog	002357	5km south	NHA	This NHA contains raised bog and cutover bog. This site is not within the catchment area that would be affected by the discharge from the Mountmellick WwTP.
Slieve Bloom Mountains	000412	5km west	SAC	This site is designated for Alluvial woodland, active blanket bog and wet heath. The site is a Special Protection Area (SPA) under the E.U. Birds Directive, of special conservation interest for Hen Harrier *Circus cyaneus*. The site boundary lies 5km to the west. The Owenass River rises in this SAC/NHA/SPA approximately 11km upstream of Mountmellick town and flows through the town. It joins the River Barrow which is part of the River Barrow and River Nore SAC 1.5km downstream of the Mountmellick WwTP.
	000412	5km west	NHA	
	004160	5km west	SPA	

3.5 Protected aquatic flora and fauna

3.5.1 White-clawed crayfish

The white-clawed crayfish *Austropotamobius pallipes* is the only freshwater crayfish recorded in Ireland. It is classified as vulnerable and rare in the IUCN Red List and is protected in Ireland under the schedules of the Wildlife Act 1976. It is also listed in Appendices II and V of the Habitats Directive (92:43: EEC). This species is present in the Owenass River and was found during the August 2008 survey at the site located upstream of the Mountmellick WwTP discharge. The species was absent at the downstream (receptor) site.

3.5.2 Lampreys

The brook lamprey *Lampetra planeri* is the smallest of the three lampreys native to Ireland and it is the only one of the three species that is non-parasitic and spends all its life in freshwater (Maitland & Campbell 1992). Brook lamprey is listed in Appendix II of the Habitats Directive (92:43: EEC) and Appendix III of the Bern Convention. This species is common on the Owenass catchment (King, 2006). The other two Irish lamprey species *(Peteromyzon marinus* and *Lampetra fluvialitis*) do not occur in the upper reaches of the River Barrow (King, 2006; Kurtz & Costello, 1999).

3.5.3 Shad

Twaite Shad *Alosa fallax* and Allis Shad *Alosa alosa* are among the rarest species of fish breeding in Irish freshwaters and are listed under Annexes II and V of the EU Habitats Directive. Both species are also listed in Appendix III of the Bern Convention. Shad have an anadromous life cycle and both species are thought to occur in the Barrow estuary. However, it is clear that these species are confined to the lower reaches of the river and would therefore not occur in the study area.

3.5.4 Atlantic salmon

The Atlantic salmon *Salmo salar* is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. It an economically important species and salmon recreational and commercial fisheries occur throughout Ireland. Salmon are present throughout the Barrow catchment (Lucey, 1998). The upper stretches of the Barrow, particularly the Owenass River, are very important for spawning (NPWS website).

3.5.5 Eurasian Otter

The otter *Lutra lutra* is a legally protected species under the Wildlife Act, 1976 (and Wildlife (Amendment) Act, 2000). It is listed under Annex II of the EU Habitats Directive and under Annex II of the Berne Convention. It is found throughout Ireland where it has apparently avoided the population declines that have occurred in many other countries (Hayden and Harrington, 2000). This species is widespread in the River Barrow catchment, and almost certainly uses the Owenass River in the study area to some degree.

3.5.6 Pearl mussels

Freshwater Pearl-Mussel (*Margaritifera margaritifera*) occurs in the River Barrow catchment; but is not present in the Owenass River (Lucey, 1998).

3.6 Recreational and Commercial fisheries

3.6.1 River Barrow

The fish fauna of Ireland is not as diverse as other European countries due to the impact of glaciation. Most of the fish species present in Irish river catchments, such as the River Barrow,

have colonized from the sea or have been artificially introduced. Native fish species in the Barrow catchment include the three Irish lamprey species (brook lamprey, river lamprey, and sea lamprey) (Kurz & Costello, 1999), the Atlantic salmon, (Lucey, 1998) and the Twaite Shad, (Lucey, 1998) all of which are listed under the EU Habitats Directive. The Barrow is the most important river in Ireland for the latter species; however these fish do not ascend past the weir at St. Mullins (King, 2002). The European eel, brown trout, and three-spined stickleback, are other common native species present in the Barrow catchment, while introduced fish species include northern pike, stone loach, roach, dace, and minnow (Lucey, 1998). The smelt *Osmerous eperlanus*, a species listed as vulnerable in the red data list (Whilde, 1993), is present in the Barrow estuary (King, 2002).

According to O'Reilly (2004) the Barrow is a fair to good salmon river. A number of fish are taken every year below the weir at St. Mullins, at Graiguenamanagh and a few at Borris. The Southern Regional Fisheries Board stated that "*the salmon fishing [on the River Barrow] is generally regarded as poor, and what fish are taken are mostly grilse, taken either during the summer or late in the season*". The River Barrow is currently closed to all salmon angling due to conservation concerns. The trout fishing is described "*as fair to good with the average size of the trout probably reaching 12oz but with trout to 2½ lb*". The best trout fishing is considered to be upstream of Monasterevin and on the tributaries.

The Barrow is not known as being as important a salmon river as its sister rivers the Nore and the Suir. This is mainly due to its sluggish nature and the number of weirs and other impoundments on the river. These impoundments affect salmon production in the river by acting as obstacles to upstream migrations, and also by impounding potential spawning and nursery habitats in upstream areas. The recent installation of a new fish pass at Ballyellen Weir by the Southern Regional Fisheries Board in association with Waterways Ireland has improved the accessibility of the upper catchment for salmon and a number of other projects on the river are ongoing (Source: Barrow Newsletters).

The River Barrow also supports areas of high-quality angling for coarse fish species. Trophy anglers regularly capture specimen pike from the Barrow (Source: CFB).

3.6.2 Owenass River

O' Reilly (2004) states that the Owenass River "*holds a very big stock of small trout and is worth fishing downstream of Mountmellick, where the fish can reach 1lb*". The Owenass River is classed as a salmon producing river (McGinnity *et al,* 2003). The Southern Regional Fisheries Board have recently assessed the feasibility of increased salmon production in the river by installing a fish pass on a waterfall in the upper reaches of the River (Source: Barrow newsletter).

The Owenass River catchment was surveyed for lampreys by King (2006) as part of a catchment wide assessment of lampreys in the River Barrow. Significant densities of brook lampreys were recorded during this survey on the Owenass main channel, and some of its tributaries. However, the density results indicated a discontinuous distribution. Two of the four sites surveyed on the main channel did not contain ammocoetes, while the other two sites had density values of 13 and 27 fish / m^2. The total sample from the Owenass spanned a range of lengths from 20 mm to 150 mm and the length frequency distribution showed the presence of a number of age groups, indicating recent recruitment.

3.7 Water abstractions

There are no Drinking water RPAs on the Rivers Owenass or Barrow within 10km downstream of the study area (Source EPA Envision). Both rivers can however be expected to be used by farms for animal drinking water.

3.8 Designated recreational and bathing waters

There are no designated recreational or bathing water on the Owenass or Barrow Rivers (Source EPA Envision).

3.9 Other amenity areas

The River Barrow main channel is an important amenity for waterside and waterborne activities. A national walking trail enables the enthusiast to walk or bike along the banks of the river. Management of the locks and navigation system permits pleasure cruisers to travel from the main line of the Grand Canal down via the Barrow Line and onto the open River Barrow itself. This permits boats to go to sea via the St. Mullins locks.

3.10 Nutrient sensitive areas

The River Barrow is classified as a nutrient sensitive water downstream of Portarlington WwTP outfall (to Graiguenamanagh Bridge) under the Urban Wastewater Treatment Regulations 2001.

4. IMPACT ASSESSMENT

4.1 Introduction

The receiving water for the Mountmellick WwTP discharge is the Owenass River which is designated as a Special Area of Conservation under the EU Habitats Directive. A summary of the receiving water impact assessment is provided in Table 14. The impact on identified receptors is outlined in the following sections.

According to the EPA (2008), a discharge from a WwTP would be considered to have a significant adverse effect on the receiving waters if it were to:-

- Cause a deterioration in the chemical status or ecological status (or ecological potential as the case may be) in the receiving body of surface water;
- Cause a deterioration in the chemical status in the receiving body of groundwater;
- Cause the input into groundwater of hazardous substances, except where it is established that the input concerned is in a quantity and concentration so small as to obviate any present or future danger of deterioration in the quality of the receiving groundwater;
- Cause deterioration or result in significant and sustained upward trends in the concentrations of pollutants in groundwater in the case of pollutants that are not hazardous,
- Permanently exclude or compromise the achievement of the objectives established for protected species and natural habitats in the case of European sites where the maintenance or improvement of the status of water is an important factor in their protection or which is inconsistent with the achievement of environmental quality standards established under national Regulations in relation to designated bathing waters, designated shellfish waters, areas designated for the protection of freshwater fish and areas designated

As there is no discharge directly into groundwater no assessment of local groundwater is made in this assessment. It is considered that through the interaction between surface and ground waters any significant impact on the receiving surface waters could also potentially result in a similar impact on local groundwater.

4.2 Impact on water quality

4.2.1 Chemical water quality

The results of the chemical water quality assessments undertaken by both the EPA (2001-2003) and Laois County Council (2007-2008) indicate that there is a significant decline in chemical water quality between control and receptor sites on the Owenass River. For example, the EPA results indicate that median orthophosphate levels are elevated in samples both upstream and downstream of the Mountmellick WwTP outfall, but were 166% higher in the downstream site. The maximum value recorded during this period at the downstream site was over 32 times the limit value. Likewise Total Ammonia levels were also significantly elevated in samples taken from the downstream site, with median levels increasing by 250% in the downstream site. The maximum value recorded in the downstream site during this period was 36 times the limit value. Laois County Council monitoring data also shows that mean orthophosphate values for both the upstream and downstream stations exceed (or are at) the prescribed for this river. However, mean orthophosphate levels were 166% higher in the samples taken from the site downstream of the WwTP outfall compared to the reference site. The maximum values for orthophosphate recorded downstream of the WwTP outfall were over 7 times the limit value. Therefore the results from both data sets suggest that the Mountmellick WwTP discharge is having a significant adverse affect on the chemical water quality of the receiving water. Indeed, the EPA has specifically mentioned the Mounmellick WwTP as being a significant contributor to water quality deterioration in the upper River Barrow catchment (Toner *et al*, 2005).

4.2.2 Biological water quality

In the most recent available EPA biological monitoring data from the Owenass River (2003), the water quality of the stations upstream and downstream of the Mountmellick WwTP has been rated as Q3-4. In the current study sites located both upstream and downstream of the WwTP outfall were rated Q3. However, there was a marked decline in the BMWP (another more sensitive biotic index) score between the upstream and downstream sites suggesting a significant decline in ecological status.

Biological water quality indices obtained from both sites located both upstream and downstream of the WwTP outfall during the current study indicated that both sites were 'Unsatisfactory'. The diversity and abundance levels of macroinvertebrates recorded at both sites were considered to be typical of an organically polluted river. The fauna was dominated by pollution tolerant group C organisms and no pollution sensitive taxa were found.

Both the control site and the receptor site were deemed to be 'Moderately Polluted' using the EPA monitoring system. However, there was a marked difference in the community composition of both sites. Group B indicators accounted for 8.1% and 3% of the community at the control and receptor sites, respectively. However, there was a shift in the relative abundances of Group C indicators between the two sites, attributed to excessive numbers of blackfly larvae at the receptor site (68.9% group C at control compared to 90.5% at receptor). Organisms present at the control site but absent from the receptor site were the Annex II listed white-clawed crayfish, fish leech, Jenkin's spire shell, beetles, caseless caddisfly larvae and blue-winged olive mayfly larvae. This decline in diversity/family richness (18 at control, 11 at receptor) was not reflected in the Q-rating index but could be seen in the BMWP scores obtained. The BMWP score for the control site was 99.7 (Very Good), while the score for the site located downstream of the WwTP outfall was 60.1 (Moderate). The respective ASPT for these sites were 5.54 and 5.46. These scores indicate that there is a decline in ecological status between the control and receptor sites.

The relative abundance of macroinvertebrate scrapers and filtering collectors in the riffle/run habitat is an indication of the periphyton community composition, availability of suspended fine particulate organic material (FPOM), and availability of attachment sites for filtering. Scrapers increase with increased diatom abundance and decrease as filamentous algae and aquatic mosses (which scrapers cannot efficiently harvest) increase.

The macro-invertebrate functional group composition varied significantly between the two sites studied in August 20098. At the control site gathering collectors comprise 45.9% of the community while other functional groups (predators, scrapers, shredders, filtering collectors) generally occurring at similar proportions. However, organisms specialised as filtering collectors, predominantly blackfly larvae constitute 89.2% of the community at the receptor site. This indeed represents an imbalance in the macro-invertebrate community at the downstream site indicating a decline in ecological status between the two sites.

The ratio of scrapers to total collectors and shredders (P/R ratio) gives the ratio of gross primary production to community respiration. The P/R ratio was low for both sites (0.138 for control, 0.018 for receptor) and showed that the communities at both sites were dependent on inputs from outside the river for sustenance. However, the P/R ratio for the receptor site was almost 87% lower than the control site, indicating that the control is more dependent on external sources (i.e. sewage) than the upstream site. The total absence of pollution sensitive grazers, such as the Heptageniid mayfly larvae, is a reflection of the poor water quality at both sites.

The juvenile Salmonid food index suggested that 'Predictable' supply of invertebrate food was available for juvenile salmonids at both sites. This index is based on the ratio of behavioral drifters (filtering and gathering collectors) to accidental drifters (scrapers, shredders and predators). The ratio for the control and receptor site was 1.551 and 8.625, respectively. The abnormally high value for the receptor site was due to the numbers of blackfly recorded and again suggests a significant decline in ecological status between the two sites.

Overall, both the upstream and downstream stations on the Owenass River are considered to be respectively impacted and moderately polluted. The diversity and abundance levels of macro-invertebrates recorded at both sites were considered to be typical of an organically polluted river. However, the situation is significantly worse downstream of the WwTP outfall with reduced community biodiversity, increased biomass, and increased allochotonous dependence pointing to a significant decline in ecological status at the downstream site.

4.2.3 Dangerous substances

The current study found that there were elevated levels of Fluoride in the Owenass River downstream of the Mountmellick WwTP outfall. A concentration of Fluoride (540µg/l) was detected downstream on 16th May 2007, slightly above the required limit is 500 µg/l. Levels of Fluoride upstream of the discharge were <100 µg/l. Elevated levels of dangerous substances, including Fluoride could impact on the ecology of the Owenass River in addition to other surface waters and ground waters within the study area. Levels of all other dangerous substances are compliant with required limits downstream of the WwTP discharge point. However, these parameters were only screened on two occasions.

4.2.4 Assimilation capacity

With respect to Orthophosphate, there is no assimilative capacity in the Owenass River. Also, in the case of Ammonia (total and unionized) the Owenass River has inadequate assimilation capacity for this parameter. In this regard, inputs from the WwTP are compounding the problem of poor water quality in the River Owenass, resulting in significant adverse impacts to the river.

4.3 Impact on areas designated for nature conservation

The discharge from the Mountmellick WwTP is directly into the 'River Barrow and River Nore' SAC (site code 002162) and the results of both the chemical and biological water quality assessments suggest that the Mountmellick WwTP discharge is having a significant adverse affect on the water quality of the receiving water. On this basis alone it must be concluded that the ongoing operation of the plant is potentially having a significant effect on the SAC itself and it is considered that a Stage 2. 'Appropriate Assessment' would be required.

4.4 Impact on protected flora and fauna

The Owenass River is part of the River Barrow SAC and is designated for the presence of a number of species of Annex II listed protected aquatic fauna including Atlantic salmon, Brook lamprey, White-clawed crayfish, and otter. The favourable conservation status of these species is directly dependant on the integrity of the Owenass River ecosystem, with particular reference to the water quality status of the river.

Poor water quality will affect the conservation status of salmon in the river; this species requires clean water (Q4) for spawning and early life stages. The juvenile salmonid food index suggested that a 'Predictable' supply of invertebrate food was available for juvenile salmonids at both sites. The very high value of 8.625 at the downstream site was attributed to excessive numbers of blackfly larvae. This shows that the ecosystem of the Owenass River downstream of the WwTP is unbalanced and under significant stress and further reduction in water quality could have adverse effects on the fisheries value of the both the Owenass River and the upper River Barrow.

Although juvenile lamprey (ammocetes) are fairly tolerant of pollution, lampreys have the same clean water requirements as salmond for spawning and early life stages. Therefore poor water quality both upstream and downstream of the WwTP outflow is likely to have a significant effect on the recruitment of brook lampreys in the river, with particular difficulties in the stretch of river downstream of the outfall.

White-clawed crayfish were found to be present at the site upstream of the WwTP discharge but were not recorded at the downstream site. This species is rated as Group C (tolerant) by the EPA (Toner et al, 2005). However, the effects of pollution on this species is unclear and it would seem sensible to consider that moderately polluted conditions could interfere with recruitment processes at least. The absence of this species at the site located downstream of the WwTP outfall may well be related to the water quality stress in this area in particular. An ongoing decline in water quality within the study area would be expected to pose a threat to the conservation status of this species in the Owenass and Barrow Rivers.

4.5 Impact on fisheries

The River Barrow and tributaries including the Owenass River is currently closed to all salmon angling due to conservation concerns. Salmonids are considered to be under pressure in the Barrow system due to poor water quality conditions. Unsatisfactory water quality will also affect other native species within the river (i.e. brown trout). The ongoing operation of the Mountmellick WwTP presents the potential for ongoing impacts to water quality and further deterioration in the fish communities present within the study area. This would have significant adverse impacts on the fisheries and recreational angling taking place on the Owenass River and the River Barrow.

4.6 Impact on water abstractions

There are no drinking water abstractions on the Owenass River or River Barrow downstream of the Mountmellick WwTP outfall. The WwTP outfall therefore does not impact on any designated water abstraction sites.

4.7 Impact on recreational areas

Neither the Owenass River nor the River Barrow have designated recreational or bathing water designations and therefore the WwTP discharge has no impact in this regard. However, cognisance of the amenity value of the river in terms of waterborne activities, including leisure craft, must be taken into account. Poor water quality on the River Barrow results in excessive algal and macrophyte growth, reducing the amenity value of the watercourse.

4.8 Impact on nutrient sensitive areas

The River Barrow is designated as a nutrient sensitive area downstream of Portarlington WwTP to Graiguenamanagh Bridge. This designation infers the sufficient treatment of wastewater to prevent adverse impacts to the receiving environment. The assimilative capacity of the River Barrow upstream of the Portarlington WwTP is considered to be at its limit. Ammonia and Orhophosphate levels were elevated downstream of the Mountmellick WwTP and probably contribute to the nutrient loading in the River Barrow upstream of the Portarlington WwTP. Therefore, inputs from the Mountmellick WwTP are likely to be compounding the impacts on water quality, resulting in a significant impact to the designated nutrient sensitive area on the River Barrow.

Table 14 Summary of receiving water impact assessment.

	Scale of impact
Water quality	Moderate Impact
Designated conservation Sites	Moderate Impact
Protected flora and fauna	Moderate Impact
Fisheries	Moderate Impact
Water abstractions	No impact
Recreational areas	Minor Impact:
Nutrient sensitive areas	Minor Impact:
Conclusion	Moderate Negative Impact on the Receiving Water

4. RECOMMENDATIONS

The requirements of the Urban Wastewater Treatment Directive 91/271/EEC for treatment plants serving more than 2000 population equivalent must be met by the Mountmellick WwTP. Further statutory limits given in the Salmonid Regulations (1988) and guidelines provided by the EPA (2001 and 2006) should be complied with, taking account of the Water Policy Regulations (S.I. No. 722 of 2003) which transposed the Water Framework Directive (2000). Although the River Owenass is not a designated Salmonid River, it should be treated as one due to its fisheries and conservation importance. The Water Policy Regulations provide for the protection of the status of all waters, preventing deterioration and the achievement of at least "*good status*" by December 2015 for all waters.

The Mountmellick WwTP is currently at or near capacity and an upgraded scheme is required to meet the current demand. Given the elevated levels of Orthophosphates and Ammonia it is recommended that the upgraded sewerage scheme include both Ammonia and Phosphate removal. Tertiary treatment is recommended for this site, as it is discharging into a Special Area of Conservation, containing protected aquatic species which are sensitive to pollution.

A significant potential factor affecting water quality in the Owenass River is the ongoing discharge of untreated waste water into the river from the storm water outfalls associated with the existing Mountmellick WwTP. The proposed upgrade of the WwTP will need (as planned) to incorporate controls for separation of both of these effluent streams.

Background levels of pollution in the River Owenass remain high and the current study suggests that a recent decline in the status of the river has occurred both upstream and downstream of the town. It is recommend that increased efforts be made to identify point and diffuse sources in the catchment and attempt to reverse this trend.

It is acknowledged that Laois County Council is currently advancing the plans for the new Mountmellick Sewerage Scheme. This scheme is presently at the preliminary report stage with consultants short listed. This is being financed under the Water Services Investment Programme. The projected construction start date is 2012 with a completion date of 2014. The size will be based on population projections up to 2027.

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PLATES

Plate 1 Mountmellick WwTP.

Plate 2 Activated sludge aeration at the Mountmellick WwTP.

Plate 3 Clarification tank at the Mountmellick WwTP.

Plate 4 Primary outfall from the Mountmellick WwTP.

Plate 4 The Owenass River upstream of the Mountmellick WwTP and storm water outfalls. This site was sampled for macro-invertebrates during August 2008.

Plate 4 The Owenass River approximately 1km downstream of Mountmellick WwTP. This site was also sampled for macro-invertebrates during August 2008.

APPENDIX 1 NPWS Designated site description

SITE SYNOPSIS
SITE NAME: RIVER BARROW AND RIVER NORE
SITE CODE: 002162

This site consists of the freshwater stretches of the Barrow/Nore River catchments as far upstream as the Slieve Bloom Mountains and it also includes the tidal elements and estuary as far downstream as Creadun Head in Waterford. The site passes through eight counties – Offaly, Kildare, Laois, Carlow, Kilkenny, Tipperary, Wexford and Waterford. Major towns along the edge of the site include Mountmellick, Mountmellick, Monasterevin, Stradbally, Athy, Carlow, Leighlinbridge, Graiguenamanagh, New Ross, Inistioge, Thomastown, Callan, Bennettsbridge, Kilkenny and Durrow. The larger of the many tributaries include the Lerr, Fushoge, Mountain, Aughavaud, Owenass, Boherbaun and Stradbally Rivers of the Barrow and the Delour, Dinin, Erkina, Owveg, Munster, Arrigle and King's Rivers on the Nore. Both rivers rise in the Old Red Sandstone of the Slieve Bloom Mountains before passing through a band of Carboniferous shales and sandstones. The Nore, for a large part of its course, traverses limestone plains and then Old Red Sandstone for a short stretch below Thomastown. Before joining the Barrow it runs over intrusive rocks poor in silica. The upper reaches of the Barrow also runs through limestone. The middle reaches and many of the eastern tributaries, sourced in the Blackstairs Mountains, run through Leinster Granite. The southern end, like the Nore runs over intrusive rocks poor in silica. Waterford Harbour is a deep valley excavated by glacial floodwaters when the sea level was lower than today. The coast shelves quite rapidly along much of the shore.

The site is a candidate SAC selected for alluvial wet woodlands and petrifying springs, priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate CSAC for old oak woodlands, floating river vegetation, estuary, tidal mudflats, *Salicornia* mudflats, Atlantic salt meadows, Mediterranean salt meadows, dry heath and eutrophic tall herbs, all habitats listed on Annex I of the E.U. Habitats Directive. The site is also selected for the following species listed on Annex II of the same directive – Sea Lamprey, River Lamprey, Brook Lamprey, Freshwater Pearl Mussel, Nore Freshwater Pearl Mussel, Crayfish, Twaite Shad, Atlantic Salmon, Otter, *Vertigo moulinsiana* and the plant Killarney Fern.

Good examples of Alluvial Forest are seen at Rathsnagadan, Murphy's of the River, in Abbeyleix estate and along other shorter stretches of both the tidal and freshwater elements of the site. Typical species seen include Almond Willow (*Salix triandra*), White Willow (*S. alba*), Grey Willow (*S. cinerea*), Crack Willow (*S. fragilis*), Osier (*S. viminalis*), with Iris (*Iris pseudacorus*), Hemlock Water-dropwort (*Oenanthe crocata*), Angelica (*Angelica sylvestris*), Thin-spiked Wood-sedge (*Carex strigosa*), Pendulous Sedge (*C. pendula*), Meadowsweet (*Filipendula ulmaria*), Valerian (*Valeriana officinalis*) and the Red Data Book species Nettle-leaved Bellflower (*Campanula trachelium*). Three rare invertebrates have been recorded in this habitat at Murphy's of the River. These are: *Neoascia obliqua* (Diptera: Syrphidae), *Tetanocera freyi* (Diptera: Sciomyzidae) and
Dictya umbrarum (Diptera: Sciomyzidae).

A good example of petrifying springs with tufa formations occurs at Dysart Wood along the Nore. This is a rare habitat in Ireland and one listed with priority status on Annex I of the EU Habitats Directive. These hard water springs are characterised by lime encrustations, often associated with small waterfalls. A rich bryophyte flora is typical of the habitat and two diagnostic species, *Cratoneuron commutatum* var. *commutatum* and *Eucladium verticillatum*, have been recorded.

The best examples of old Oak woodlands are seen in the ancient Park Hill woodland in the estate at Abbeyleix; at Kyleadohir, on the Delour, Forest Wood House, Kylecorragh and Brownstown Woods on the Nore; and at Cloghristic Wood, Drummond Wood and Borris Demesne on the Barrow, though other patches occur throughout the site. Abbeyleix Woods is a large tract of mixed deciduous woodland which is one of the only remaining true ancient woodlands in Ireland. Historical records show that Park Hill has been continuously wooded

since the sixteenth century and has the most complete written record of any woodland in the country. It supports a variety of woodland habitats and an exceptional diversity of species including 22 native trees, 44 bryophytes and 92 lichens. It also contains eight indicator species of ancient woodlands. Park Hill is also the site of two rare plants, Nettle-leaved Bellflower and the moss *Leucodon sciuroides.* It has a typical bird fauna including Jay, Long-eared Owl and Raven. A rare invertebrate, *Mitostoma chrysomelas,* occurs in Abbeyleix and only two other sites in the country. Two flies *Chrysogaster virescens* and *Hybomitra muhlfeldi* also occur. The rare Myxomycete fungus, *Licea minima* has been recorded from woodland at Abbeyleix.

Oak woodland covers parts of the valley side south of Woodstock and is well developed at Brownsford where the Nore takes several sharp bends. The steep valley side is covered by Oak (*Quercus* spp.), Holly (*Ilex aquifolium*), Hazel (*Corylus avellana*) and Birch (*Betula pubescens*) with some Beech (*Fagus sylvatica*) and Ash (*Fraxinus excelsior*). All the trees are regenerating through a cover of Bramble (*Rubus fruticosus* agg.), Foxglove (*Digitalis purpurea*) Wood Rush (*Luzula sylvatica*) and Broad Buckler-fern (*Dryopteris dilatata*).

On the steeply sloping banks of the River Nore about 5 km west of New Ross, in County Kilkenny, Kylecorragh Woods form a prominent feature in the landscape. This is an excellent example of a relatively undisturbed, relict Oak woodland with a very good tree canopy. The wood is quite damp and there is a rich and varied ground flora. At Brownstown a small, mature Oak-dominant woodland occurs on a steep slope. There is younger woodland to the north and east of it. Regeneration throughout is evident. The understorey is similar to the woods at Brownsford. The ground flora of this woodland is developed on acidic, brown earth type soil and comprises a thick carpet of Bilberry (*Vaccinium myrtillus*), Heather (*Calluna vulgaris*), Hard Fern (*Blechnum spicant*), Cowwheat (*Melampyrum* spp.) and Bracken (*Pteridium aquilinum*).

Borris Demesne contains a very good example of a semi-natural broad-leaved woodland in very good condition. There is quite a high degree of natural re-generation of Oak and Ash through the woodland. At the northern end of the estate Oak species predominate. Drummond Wood, also on the Barrow, consists of three blocks of deciduous woods situated on steep slopes above the river. The deciduous trees are mostly Oak species. The woods have a well established understorey of Holly (*Ilex aquifolium*), and the herb layer is varied, with Brambles abundant. Whitebeam (*Sorbus devoniensis*) has also been recorded.

Eutrophic tall herb vegetation occurs in association with the various areas of alluvial forest and elsewhere where the flood-plain of the river is intact. Characteristic species of the habitat include Meadowsweet (*Filipendula ulmaria*), Purple Loosestrife (*Lythrum salicaria*), Marsh Ragwort (*Senecio aquaticus*), Ground Ivy (*Glechoma hederacea*) and Hedge Bindweed (*Calystegia sepium*). Indian Balsam (*Impatiens glandulifera*), an introduced and invasive species, is abundant in places. Floating River Vegetation is well represented in the Barrow and in the many tributaries of the site. In the Barrow the species found include Water Starworts (*Callitriche* spp.), Canadian Pondweed (*Elodea canadensis*), Bulbous Rush (*Juncus bulbosus*), Milfoil (*Myriophyllum* spp.), *Potamogeton* x *nitens,* Broad-leaved Pondweed (*P. natans*), Fennel Pondweed (*P. pectinatus*), Perfoliated Pondweed (*P. perfoliatus*) and Crowfoots (*Ranunculus* spp.). The water quality of the Barrow has improved since the vegetation survey was carried out (EPA, 1996).

Dry Heath at the site occurs in pockets along the steep valley sides of the rivers especially in the Barrow Valley and along the Barrow tributaries where they occur in the foothills of the Blackstairs Mountains. The dry heath vegetation along the slopes of the river bank consists of Bracken (*Pteridium aquilinum*) and Gorse (*Ulex europaeus*) species with patches of acidic grassland vegetation. Additional typical species include Heath Bedstraw (*Galium saxatile*), Foxglove (*Digitalis purpurea*), Common Sorrel (*Rumex acetosa*) and Bent Grass (*Agrostis stolonifera*). On the steep slopes above New Ross the Red Data Book species Greater Broomrape (*Orobanche rapum-genistae*) has been recorded. Where rocky outcrops are shown on the maps Bilberry (*Vaccinium myrtillus*) and Wood Rush (*Luzula sylvatica*) are present. At Ballyhack a small area of dry heath is interspersed with patches of lowland dry grassland. These support a number of Clover species including the legally protected

Clustered Clover (*Trifolium glomeratum*) – a species known from only one other site in Ireland. This grassland community is especially well developed on the west side of the mud-capped walls by the road. On the east of the cliffs a group of rock-dwelling species occur, i.e. English Stonecrop (*Sedum anglicum*), Sheep's-bit (*Jasione montana*) and Wild Madder (*Rubia peregrina*). These rocks also support good lichen and moss assemblages with *Ramalina subfarinacea* and *Hedwigia ciliata*.

Dry Heath at the site generally grades into wet woodland or wet swamp vegetation lower down the slopes on the river bank. Close to the Blackstairs Mountains, in the foothills associated with the Aughnabrisky, Aughavaud and Mountain Rivers there are small patches of wet heath dominated by Purple Moor-grass (*Molinia caerulea*) with Heather (*Calluna vulgaris*), Tormentil (*Potentilla erecta*), Carnation Sedge (*Carex panicea*) and Bell Heather (*Erica cinerea*).

Saltmeadows occur at the southern section of the site in old meadows where the embankment has been breached, along the tidal stretches of in-flowing rivers below Stokestown House, in a narrow band on the channel side of Common Reed (*Phragmites*) beds and in narrow fragmented strips along the open shoreline. In the larger areas of salt meadow, notably at Carrickcloney, Ballinlaw Ferry and Rochestown on the west bank; Fisherstown, Alderton and Great Island to Dunbrody on the east bank, the Atlantic and Mediterranean sub types are generally intermixed. At the upper edge of the salt meadow in the narrow ecotonal areas bordering the grasslands where there is significant percolation of salt water, the legally protected species Borrer's Saltmarsh-grass (*Puccinellia fasciculata*) and Meadow Barley (*Hordeum secalinum*) (Flora Protection Order, 1987) are found. The very rare Divided Sedge (*Carex divisa*) is also found. Sea Rush (*Juncus maritimus*) is also present. Other plants recorded and associated with salt meadows include Sea Aster (*Aster tripolium*), Sea Thrift (*Armeria maritima*), Sea Couch (*Elymus pycnanthus*), Spear-leaved Orache (*Atriplex prostrata*), Lesser Sea-spurrey (*Spergularia marina*), Sea Arrowgrass (*Triglochin maritima*) and Sea Plantain (*Plantago maritima*).

Salicornia and other annuals colonising mud and sand are found in the creeks of the saltmarshes and at the seaward edges of them. The habitat also occurs in small amounts on some stretches of the shore free of stones.

The estuary and the other Habitats Directive Annex I habitats within it form a large component of the site. Extensive areas of intertidal flats, comprised of substrates ranging from fine, silty mud to coarse sand with pebbles/stones are present. Good quality intertidal sand and mudflats have developed on a linear shelf on the western side of Waterford Harbour, extending for over 6 km from north to south between Passage East and Creadaun Head, and in places are over 1 km wide. The sediments are mostly firm sands, though grade into muddy sands towards the upper shore. They have a typical macro-invertebrate fauna, characterised by polychaetes and bivalves. Common species include *Arenicola marina*, *Nephtys hombergii*, *Scoloplos armiger*, *Lanice conchilega* and *Cerastoderma edule*.

The western shore of the harbour is generally stony and backed by low cliffs of glacial drift. At Woodstown there is a sandy beach, now much influenced by recreation pressure and erosion. Behind it a lagoonal marsh has been impounded which runs westwards from Gaultiere Lodge along the course of a slow stream. An extensive reedbed occurs here. At the edges is a tall fen dominated by sedges (*Carex* spp.), Meadowsweet, Willowherb (*Epilobium* spp.) and rushes (*Juncus* spp.). Wet woodland also occurs. This area supports populations of typical waterbirds including Mallard, Snipe, Sedge Warbler and Water Rail.

The dunes which fringe the strand at Duncannon are dominated by Marram grass (*Ammophila arenaria*) towards the sea. Other species present include Wild Sage (*Salvia verbenaca*), a rare Red Data Book species. The rocks around Duncannon ford have a rich flora of seaweeds typical of a moderately exposed shore and the cliffs themselves support a number of coastal species on ledges, including Thrift (*Armeria maritima*), Rock Samphire (*Crithmum maritimum*) and Buck's-horn Plantain (*Plantago coronopus*).

Other habitats which occur throughout the site include wet grassland, marsh, reed swamp, improved grassland, arable land, quarries, coniferous plantations, deciduous woodland, scrub and ponds.

Seventeen Red Data Book plant species have been recorded within the site, most in the recent past. These are Killarney Fern (*Trichomanes speciosum*), Divided Sedge (*Carex divisa*), Clustered Clover (*Trifolium glomeratum*), Basil Thyme (*Acinos arvensis*), Hemp nettle (*Galeopsis angustifolia*), Borrer's Saltmarsh Grass (*Puccinellia fasiculata*), Meadow Barley (*Hordeum secalinum*), Opposite-leaved Pondweed (*Groenlandia densa*), Autumn Crocus (*Colchicum autumnale*), Wild Sage (*Salvia verbenaca*), Nettle-leaved Bellflower (*Campanula trachelium*), Saw-wort (*Serratula tinctoria*), Bird Cherry (*Prunus padus*), Blue Fleabane (*Erigeron acer*), Fly Orchid (*Ophrys insectifera*), Broomrape (*Orobanche hederae*) and Greater Broomrape (*Orobanche rapum-genistae*). Of these the first nine are protected under the Flora Protection Order 1999. Divided Sedge (*Carex divisa*) was thought to be extinct but has been found in a few locations in the site since 1990. In addition plants which do not have a very wide distribution in the country are found in the site including Thin-spiked Wood-sedge (*Carex strigosa*), Field Garlic
(*Allium oleraceum*) and Summer Snowflake (*Leucojum aestivum*). Six rare lichens, indicators of ancient woodland, are found including *Lobaria laetevirens* and *L. pulmonaria.* The rare moss *Leucodon sciuroides* also occurs.

The site is very important for the presence of a number of EU Habitats Directive Annex II animal species including Freshwater Pearl Mussel (*Margaritifera margaritifera* and *M. m. durrovensis*), Freshwater Crayfish (*Austropotamobius pallipes*), Salmon (*Salmo salar*), Twaite Shad (*Alosa fallax fallax*), three Lamprey species - Sea (*Petromyzon marinus*), Brook (*Lampetra planeri*) and River (*Lampetra fluviatilis*), the marsh snail *Vertigo moulinsiana* and Otter (*Lutra lutra*). This is the only site in the world for the hard water form of the Pearl Mussel *M. m. durrovensis* and one of only a handful of spawning grounds in the country for Twaite Shad. The freshwater stretches of the River Nore main channel is a designated salmonid river. The Barrow/Nore is mainly a grilse fishery though spring salmon fishing is good in the vicinity of Thomastown and Inistioge on the Nore. The upper stretches of the Barrow and Nore, particularly the Owenass River, are very important for spawning.

The site supports many other important animal species. Those which are listed in the Irish Red Data Book include Daubenton's Bat (*Myotis daubentoni*), Badger (*Meles meles*), Irish Hare (*Lepus timidus hibernicus*) and Frog (*Rana temporaria*). The rare Red Data Book fish species Smelt (*Osmerus eperlanus*) occurs in estuarine stretches of the site. In addition to the Freshwater Pearl Mussel, the site also supports two other freshwater Mussel species, *Anodonta anatina* and *A. cygnea*.

The site is of ornithological importance for a number of E.U. Birds Directive Annex I species including Greenland White-fronted Goose, Whooper Swan, Bewick's Swan, Bartailed Godwit, Peregrine and Kingfisher. Nationally important numbers of Golden Plover and Bar-tailed Godwit are found during the winter. Wintering flocks of migratory birds are seen in Shanahoe Marsh and the Curragh and Goul Marsh, both in Co. Laois and also along the Barrow Estuary in Waterford Harbour. There is also an extensive autumnal roosting site in the reedbeds of the Barrow Estuary used by Swallows before they leave the country.

Landuse at the site consists mainly of agricultural activities – many intensive, principally grazing and silage production. Slurry is spread over much of this area. Arable crops are also grown. The spreading of slurry and fertiliser poses a threat to the water quality of the salmonid river and to the populations of Habitats Directive Annex II animal species within the site. Many of the woodlands along the rivers belong to old estates and support many non-native species. Little active woodland management occurs.

Fishing is a main tourist attraction along stretches of the main rivers and their tributaries and there are a number of Angler Associations, some with a number of beats. Fishing stands and styles have been erected in places. Both commercial and leisure fishing takes place on the rivers. There is net fishing in the estuary and a mussel bed also. Other recreational activities such as boating, golfing and walking, particularly along the Barrow towpath are also popular.

There is a golf course on the banks of the Nore at Mount Juliet and GAA pitches on the banks at Inistioge and Thomastown. There are active and disused sand and gravel pits throughout the site. Several industrial developments, which discharge into the river, border the site. New Ross is an important shipping port. Shipping to and from Waterford and Belview ports also passes through the estuary.

The main threats to the site and current damaging activities include high inputs of nutrients into the river system from agricultural run-off and several sewage plants, overgrazing within the woodland areas, and invasion by non-native species, for example Cherry Laurel and Rhododendron (*Rhododendron ponticum*). The water quality of the site remains vulnerable. Good quality water is necessary to maintain the populations of the Annex II animal species listed above. Good quality is dependent on controlling fertilisation of the grasslands, particularly along the Nore. It also requires that sewage be properly treated before discharge. Drainage activities in the catchment can lead to flash floods which can damage the many Annex II species present. Capital and maintenance dredging within the lower reaches of the system pose a threat to migrating fish species such as lamprey and shad. Land reclamation also poses a threat to the salt meadows and the populations of legally protected species therein.

Overall, the site is of considerable conservation significance for the occurrence of good examples of habitats and of populations of plant and animal species that are listed on Annexes I and II of the E.U. Habitats Directive respectively. Furthermore it is of high conservation value for the populations of bird species that use it. The occurrence of several Red Data Book plant species including three rare plants in the salt meadows and the population of the hard water form of the Pearl Mussel which is limited to a 10 km stretch of the Nore, add further interest to this site.

APPENDIX 2 Laois County Council Monitoring Data

Table A2.1 Summary water quality results for the Owenass Riverupstream and downstream of the outfall of the Mountmellick WwTP during the period January 2007 to June 2008, along with data for the primary discharge. Derived from data supplied by Laois County Council. Elevated values (above limits in EPA, 2001) are highlighted in bold.

Ammonia (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	17	**0.104**	0.026	**0.389**	0.083	0.007
WwTP outlet	31	3.878	0.097	12.013	3.618	13.090
Upstream of plant	17	0.088	0.000	**0.354**	0.080	0.006

BOD (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	16	1.69	1.00	3.00	0.79	0.63
WwTP outlet	30	7.87	3.00	36.00	6.06	36.74
Upstream of plant	16	2.13	1.00	**6.00**	1.50	2.25

COD (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	2	50.50	32.00	69.00	26.16	684.50
WwTP outlet	31	47.79	13.00	99.00	22.54	508.23
Upstream of plant	2	51.00	30.00	72.00	29.70	882.00

Conductivity (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	17	511.65	371.00	626.00	83.99	7054.62
WwTP outlet	31	756.74	556.00	854.00	74.22	5509.20
Upstream of plant	17	496.18	349.00	613.00	67.36	4538.03

Dissolved Oxygen (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	17	9.42	**6.95**	11.40	1.42	2.02
WwTP outlet	0					
Upstream of plant	17	9.67	**5.25**	12.71	1.82	3.31

Nitrate (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	17	1.82	0.38	**3.51**	0.74	0.54
WwTP outlet	31	7.12	0.34	14.11	4.42	19.53
Upstream of plant	17	1.40	0.32	**2.99**	0.64	0.41

Nitrite (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	2	0.02	0.02	0.03	0.00	0.00
WwTP outlet	2	0.66	0.54	0.77	0.17	0.03
Upstream of plant	2	0.02	0.02	0.02	0.00	0.00

Orthophosphate (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	16	**0.08**	**0.03**	**0.23**	0.06	0.00
WwTP outlet	30	2.42	1.08	3.44	0.63	0.39
Upstream of plant	16	**0.03**	0.00	**0.05**	0.01	0.00

pH (pH units)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	17	8.06	7.87	8.32	0.11	0.01
WwTP outlet	31	7.76	7.54	8.06	0.13	0.02
Upstream of plant	17	8.13	7.88	8.43	0.14	0.02

Suspended Solids (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	2	4.00	4.00	4.00	0.00	0.00
WwTP outlet	30	25.10	7.00	**64.00**	15.21	231.20
Upstream of plant	2	2.00	2.00	2.00	0.00	0.00

Total Nitrogen (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	2	2.80	2.70	2.90	0.14	0.02
WwTP outlet	2	9.85	2.30	**17.40**	10.68	114.01
Upstream of plant	2	2.10	1.80	2.40	0.42	0.18

Total Phosphorus (mg/l)

	N	Mean	Minimum	Maximum	St.Dev.	Variance
Downstream of plant	2	0.06	0.03	0.09	0.04	0.00
WwTP outlet	2	**3.08**	**2.70**	**3.45**	0.53	0.28
Upstream of plant	2	0.05	0.00	0.09	0.06	0.00

APPENDIX 3 Biological Water Quality Assessment (2008)

Table A3.1 Biological water quality assessment results.

Group/organism	Pollution sensitivity group	Functional group	Relative abundance at site	
			Control site	Receptor site
MAYFLIES (Uniramia, Ephemeroptera)				
Spiny crawler mayflies (Ephemerellidae)				
Blue-winged olive *Ephemerella ignita*	C	Gathering collector	5	
Baetidae				
Large dark olive *Baetis rhodani*	C	Gathering collector	26	1
STONEFLIES (Order Plecoptera)				
Needleflies (Leutridae)				
Leutra fusca	B	Shredder	4	3
CASED CADDIS FLIES (Tricoptera)				
Northern caddisflies (Limnephilidae)				
Halesus radiatus	B	Shredder		1
Microcaddisflies (Hydroptilidae)				
Indeterminate sp.	B	Scraper	2	3
CASELESS CADDIS FLIES (Trichoptera)				
Trumpet-net caddisflies (Polycentopodidae)				
Polycentropus flavomaculatus	C	Filtering collector	1	
TRUE FLIES (Diptera)				
Blackfly (Simulidae)	C	Filtering collector	3	200
Craneflies (Tipulidae)	C	Shredder	1	1
Dicronata sp.	C	Shredder	1	
Family Chironomidae				
Bloodworm *Chironomous sp.*	E	Filtering collector	5	1
Green chironomid	C	Filtering collector	1	2
BEETLES (Coleoptera)				
Diving beetles (Dytiscidae)				
Sub family Hydroporinae				
Potamonectes depressus elegans	C	Predator	2	
Riffle Beetle (Elmidae)				
Helmis sp. (larvae)	C	Predator	1	
SNAILS (Mollusca, Gastropoda)				
Family Lymnaeidae				
Wandering snail *Lymnaea peregra*	D	Shredder		
Family Hydrobiidae				
Jenkin's spire shell *Potamopyrgus jenkinsi*	C	Scraper	4	

Group/organism	Pollution sensitivity group	Functional group	Relative abundance at site	
			Control site	Receptor site
Family Ancylidae				
River limpet *Ancylus fluviatilis*	C	Scraper		1
MUSSELS (Mollucsa, Lamellibranchiata)				
Orb/Pea Mussels (Sphaeridae)				
Pisidium sp.	D	Filtering Collector	1	3
LEECHES (Hirudinae)				
Glossiphonidae				
Helobdella stagnalis	D	Predator	4	
Piscicolidae				
Piscicola geometra	C	Predator	1	
SEGMENTED WORMS (Annelida, Clitellata)				
Aquatic earthworm (Lumbriculidae)	D	Gathering Collector	3	
CRUSTACEANS (Crustacea)				
Amphipods (Amphipoda, Gammaridae)				
Freshwater shrimp *Gammarus deubeni*	C	Shredder	3	4
Isopods, Asellidae				
Hog louse *Asellus aquaticus*	D	Shredder	4	11
Astacidae				
White-clawed crayfish *Austropotamobius pallipes*	C	Scraper	2	
Total number of organisms			74	231
Number of families			18	11
Q value			3	3
Quality class			C	C
BMWP score			99.7	60.1
ASPT			5.54	5.46

**Present (1 or 2 individuals), **Scarce/Few (<1%), ***Small Numbers (<5%), ****Fair Numbers (5-10%), *****Common (10-20%), ******Numerous (25-50%), *******Dominant (50-75%), ********Excessive (>75%).*

Table A3.2 Selected water quality characteristics of the two sites surveyed on the Owenass Rivernear the Mountmellick WwTP outfall on the 4th August 2008.

	Control site	Receptor site
Temperature (°C)	15.9	15.3
Dissolved Oxygen (%)	99.7	93.7
Dissolved Oxygen (mg O2l-1)	9.86	9.38
Conductivity (µS cm-1)	478	368

Table A3.3 Selected physical characteristics of the two sites surveyed on the Owenass Rivernear the Mountmellick WwTP outfall on the 4th August 2008.

	Control site	Receptor site
Wetted width (m)	10	10
Mean depth (cm)	50	60
Maximum depth (cm)	1.5	100
Rock (%)	25	60
Cobble (%)	40	35
Gravel (%)	30	5
Fine (%)	5	-
Shade (%)	5	-
Instream vegetation (%)	-	-
Bank height (m)	2.2	1.5
Bank slope (°)	60	70
Bank cover (%)	100	75
Evaluation	10	10

APPENDIX 5 Dangerous substances

	Upstream Mountmellick WwTP		Mountmellick WwTP combined outlet	Downstream Mountmellick WwTP				Dangerous substances standards (µg/l) for freshwater.		Dangerous substances standards (µg/l) for all freshwater	Freshwater Fish Directive (78/659/EEC) limit	Salmonid Water Regulations (1998) limit	Compliant / Not Compliant
Sample date	**24/04/08**	**07/05/08**	**07/05/08**	**16/05/07**	**05/11/07**	**24/04/08**	**07/05/08**	**$CaCO_3$ mg/l**					
								<100	>100				
Arsenic (µg /l)	0.4	0.6	<2.0	0.4	0.7	0.6	0.7	25	25	-	N/A	N/A	✓
Atrazine (µg /l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	1	N/A	N/A	✓
Barium (µg /l)	337.8	386.4	145.7	-	-	269.5	567.5	-	-	N/A	N/A	N/A	✓
Boron (µg /l)	30	20	<200	-	-	30	20	-	-	2000	N/A	N/A	✓
Cadmium (µg /l)	<0.1	<0.1	<0.1	-	-	<0.1	<0.1	-	-	5	N/A	N/A	✓
Chromium (µg /l)	<1.0	<1.0	<10.0	<1	<1	<0.1	<1.0	5	30	-	N/A	N/A	✓
Copper (µg /l)	<3.0	<3.0	<30.0	<3.0	<3.0	<3.0	<3.0	5	30	-	< 0.04 mg/l Cu	depends on water hardness < 0.005 – 0.112 mg/l Cu	✓
Cyanide (µg /l)	<5.0	<5.0	<5.0	<10	<5.0	<5.0	<5.0	10	10	-	N/A	N/A	✓
Dichloromethane (µg /l)	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	-	-	10	N/A	N/A	✓
Fluoride (µg/l)	<100	<100	400	**540**	230	<100	<100	500	500	-	N/A	N/A	Not compliant on 16/05/07
Lead (µg /l)	<0.3	<0.3	<3.0	0.4	<0.3	1.3	<0.3	5	10	-	N/A	N/A	✓
Mercury (µg /l)	<0.02	<0.02	<0.2	-	-	<0.02	<0.02	-	-	N/A	N/A	N/A	✓
Nickel (µg /l)	1.3	2.2	<5.0	1.3	1.4	2.1	1.7	8	50	-	N/A	N/A	✓
o xylene (µg /l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	10.0	N/A	N/A	✓
p,m xylene (µg /l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	-	-	10.0	N/A	N/A	✓
Selenium (µg /l)	<0.2	0.3	<2.0	-	-	0.6	0.7	-	-	N/A	N/A	N/A	✓
Simazine (µg /l)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	-	1	N/A	N/A	✓

	Upstream Mountmellick WwTP		Mountmellick WwTP combined outlet	Downstream Mountmellick WwTP				Dangerous substances standards (µg/l) for freshwater.		Dangerous substances standards (µg/l) for all freshwater	Freshwater Fish Directive (78/659/EEC) limit	Salmonid Water Regulations (1998) limit	Compliant / Not Compliant
Sample date	**24/04/08**	**07/05/08**	**07/05/08**	**16/05/07**	**05/11/07**	**24/04/08**	**07/05/08**	**$CaCO_3$ mg/l**					
Toluene (µg /l)	<0.1	<0.1	<0.1	<0.5	<0.1	<0.1	<0.1	-	-	10.0	N/A	N/A	✓
Tributyl Tin (µg /l)	<0.02	<0.02	<0.02	-	-	<0.02	<0.02	-	-	0.001 (applies to tidal rivers only)	N/A	N/A	✓
Zinc (µg /l)	4.9	10.3	26.5	21.9	5.5	18.8	2.1	See note[1]	100	-	N/A	depends on water hardness <0.03 - 0.5 mg/l Zn	✓

Note[1] *In the case of zinc, the standard is 8 µg/l for water hardness less than or equal to 10 mg/l $CaCO_3$ or 50 µg/l for water hardness greater than 10mg/l $CaCO_3$ and less than or equal to 100 mg/l $CaCO_3$.*

Appendix 6 Assessment of Impacts and Impact Significance

Criteria for assessing impact type and magnitude are presented in Tables A6.1 and A6.2, respectively.

In assessing the magnitude and significance of impacts it is important to consider the value of the affected feature, this is taken into account in Table A2.2.

Table A6.1. Criteria for assessing impact type.

Impact type	Criteria
Positive impact:	A change is likely to improve the ecological feature in terms of its ecological value.
Neutral	No effect.
Negative impact:	The change is likely to adversely affect the ecological value of the feature.

Table A6.2 Criteria for assessing impact magnitude.

Impact magnitude	Definition
No change:	No discernible change in the ecology of the affected feature.
Imperceptible Impact:	A change in the ecology of the affected site, the consequences of which are strictly limited to within the development boundaries.
Minor Impact:	A change in the ecology of the affected site which has noticeable ecological consequences outside the development boundary, but these consequences are not considered to significantly affect the distribution or abundance of species or habitats of conservation importance.
Moderate Impact:	A change in the ecology of the affected site which has noticeable ecological consequences outside the development boundary. These consequences are considered to significantly affect the distribution and/or abundance of species or habitats of conservation importance.
Substantial Impact:	A change in the ecology of the affected site which has noticeable ecological consequences outside the development boundary. These consequences are considered to significantly affect species or habitats of high conservation importance and to potentially affect the overall viability of those species or habitats in the wider area.
Major Impact:	A change in the ecology of the affected site which has noticeable ecological consequences outside the development boundary. These consequences are considered to be such that the overall viability of species or habitats of high conservation importance in the wider area[2] is under a very high degree of threat (negative impact) or is likely to increase markedly (positive impact).