ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT WORKS AT LOUGH GUITANE, COUNTY KERRY

for: **Nicholas O'Dwyer Ltd.**

Consulting Engineers
Nutgrove Office Park,
Nutgrove Avenue,
Rathfarnham,
Dublin 14

by: **Environmental Impact Services**

4th Floor
7 Red Cow Lane
Smithfield
Dublin 7

OCTOBER 2009

Table of Contents

List of Figures

List of Tables

List of Appendices

Section 1 Introduction

1.1 Introduction and Terms of Reference

Kerry County Council have abstracted water from the combined sources of Lough Guitane and the Owgarriff River since the early 1980's. These are both on the Finow River sub-catchment of the River Flesk on the River Laune / Lough Leane catchment. There is an existing treatment plant which provides a basic level of treatment but requires substantial upgrading.

The Council now proposes to construct a new treatment plant which will treat the abstracted waters to a higher standard. The management regime for abstraction from the two sources will be adjusted to improve security of supply while continuing to satisfy the terms of the Water Abstraction Order[1] (WAO). The upgraded plant will operate within the terms of the same existing Order. The proposal is the subject of an accompanying application for consent under Part 8 of the Planning and Development Regulations 2001. (S.I. 600 of 2001).

Environmental Impact Services has been commissioned by consulting engineers Nicholas O'Dwyer Ltd to assess the likely environmental effects of this proposal.

1.2 Screening for EIA Requirement

1.2.1 Definition

The first stage of the Environmental Assessment process was to ascertain whether or not the project requires an Environmental Impact Statement (EIS) to be prepared in accordance with the relevant Regulations[2]. This stage is referred to as *screening*.

1.2.2 Background

The upgrade to the treatment plant will primarily include:

- the construction of new buildings, settlement and storage tanks and ancillary works to improve water treatment, as described in Section 4 of this report; and
- works to the existing Plant Building.

No increase in the rate of water abstraction is proposed. However, due to climate change effects, combined with more accurate modelling techniques than were available in the late 1970s when the WAO was granted, it is now predicted that there will be a greater drawdown of the surface level of Lough Guitane than was previously anticipated.

No works to the distribution network, including pipes and reservoirs, are included within the remit of this assessment.

[1] Granted by the Minister for the Environment in 1979

[2] Environmental Impact Statements (EIS's) are carried out in response to the requirements of the European Community Council Directives of 1985 and 1997, on the assessment of the effects of certain public and private projects on the environment. The enabling statutory instruments (S.I.'s) which transpose these Directives into law in Ireland are the European Communities (Environmental Impact Assessment) Regulations, as amended, with the main legislation being the Local Government (Planning and Development) Regulations, 2001 (S.I. 600/01). These Regulations outline the classes of projects subject to Environmental Impact Assessment (EIA) and the statutory format and content for an EIS.

1.2.3 Evaluation

An EIS is normally required for developments that are:

- of a class specified by Annex 1 of the EIA Directive 85/337/EEC as amended or by Article 5 of the Planning and Development (Strategic Infrastructure) Act 2006

or

- likely to have significant effects on the environment

or

- likely to have a significant effect on any 'European Sites' protected by the provisions of the Habitats Directive 92/43/EEC

The proposed development is not of a class that requires an EIS because:

- The proposed development is not of a class specified by Annex 1 of the EIA Directive 85/337/EEC as amended
- The rate of abstraction will remain within the terms of the exisitng WAO
- The proposed development is not likely to have a significant effect on any 'European Site'

In light of these factors there are no grounds requiring the preparation of an EIS nor is there any consent mechanism that involves the requirement for an EIS.

Notwithstanding the above, it has been determined that in the interest of observing best practice it would be prudent to prepare an *Environmental Report*[3] on the environmental effects of the project.

While the Finow and Flesk Rivers are part of an SAC (the Killarney National Park, Macgillycuddy's Reeks and Caragh River SAC - site code 000365), no *Appropriate Assessment*[4] is required for the proposed upgrade of the Water Treatment Plant because as described in Section 2, there will be no discharge from the Plant and compensation flows will be maintained in accordance with the terms of the existing Water Abstraction Order.

It has however been determined that an Appropriate Assessment should be carried out on the ecological effects of the increased drawdown of the water level in Lough Guitane. This is an assessment of the likely significant effects of the drawdown on the Lake's status as a Special Area of Conservation (SAC). As this effect is not directly related to the Part 8 consent procedure for the upgrade to the treatment plant, the Appropriate Assessment is presented as a separate, stand-alone document.

1.3 Scoping & Consultation

Scoping is the process of determining which environmental issues are important during an environmental assessment and which are not.

It was determined that the most important issues in the case of this Environmental Report are:

- The visual impact of the proposed structures
- The potential archaeological impact of the scheme
- Potential terrestrial and aquatic impacts of the scheme

These issues are examined, amongst others, in the following sections of this report as listed hereunder:

[3] Ref. *Guidelines on the information to be contained in Environmental Impact Statements* EPA (2002) - sections 2.4.4 & 2.4.7

[4] This is an assessment per. Article 6(3) of the Habitats Directive. The conditions for such requirement are discussed in Circular L8/08 issued by the Department of Environment, Heritage and Local Government on 2 September 2008.

Section Number	Topic	Author
Section 3	Human Beings	Brendan Allen, AOS Planning
Section 4	Noise	Dr Stephen Smyth, AWN Consulting
Section 5	Terrestrial Flora and Fauna	Dr. Catherine Farrell
Section 6	Landscape and Visual Impact	Conor Skehan, Environmental Impact Services
Appendix IV	Biological Water Quality	Dr Pascal Sweeney
Appendix V	Freshwater Pearl Mussel Survey	Dr Eugene Ross
Appendix VII	Archaeology	Kerry County Archaeologist

Table 1.1 Arrangement of Topics in this Report (showing names of consultants)

Due to sensitivity of the Finow River, including presence of the freshwater pearl mussel *Margaritifera margaritifera*, it was decided to change an initial plant design to avoid the need for any discharge other than surface water from the Plant. Prior to making this decision surveys of the River's freshwater pearl mussel population and of it's biological water quality were carried out. These are included by way of supplementary baseline information as Appendices to this report.

Consultations on the proposal and in particular on the scope of this assessment were carried out via correspondence and discussions/meetings with the National Parks and Wildlife Service (NPWS) section of the Department of the Environment, Heritage and Local Government and with the South Western Regional Fisheries Board (SWRFB). The NPWS provided detailed input on the scope of an *Appropriate Assessment* of the likely significant effects of the drawdown on Lough Guitane's status as a Special Area of Conservation (SAC) (ref. Section 1.2.3 above). The SWRFB raised a number of issues which are discussed and addressed in the Appropriate Assessment report. They also provided a detailed evaluation of the operation of the fish pass at the outflow from Lough Guitane (prepared by the Department of Agriculture, Fisheries and Food on their behalf) which expressed reservations about the compensation flow regime. However the required compensation flow is prescribed in the Water Abstraction Order (WAO, ref section 2.1) granted by the Minister for the Environment in 1979 and the current proposal provides for upgrading of the treatment facilities while staying within the terms of the existing WAO. This report does not therefore examine the adequacy of the compensation flow but does detail measures which are being undertaken as part of this proposal to ensure compliance with the compensation flow requirements of the WAO (ref. sections 2.2.2, 2.4.1 and 2.4.4).

Section 2 Project Description

2.1 Background

The Kerry Central Regional Water Supply Scheme (CRWSS) is the largest water supply scheme in County Kerry and caters for the water supply requirements of the principal population centres of Tralee and Killarney as well as Castleisland, Castlemaine and an extensive rural area in County Kerry. It serves in excess of 59,000 persons or approximately half the population of County Kerry, across an area equivalent to 25% of the County (685 km^2) incorporating strong industrial, agricultural and tourism activities. The scheme has two raw water sources, at Lough Guitane and the Owgarriff River which are located in adjacent sub-catchments of the Flesk River, some 6 km south east of Killarney (see Figure 2.1).

In 1979, following a Public Inquiry, Kerry County Council obtained a Water Abstraction Order (WAO) under the 1942 Water Supplies Act permitting the abstraction of up to 54,540m^3/day (12 million gallons per day) of water from Lough Guitane and the Owgarriff River.

2.2 Existing Plant Overview

2.2.1 Raw Water Intake

The original design concept for the existing scheme provides for the abstraction of the maximum quantity possible from the Owgarriff River by gravity and supplements this supply from Lough Guitane as required. Supply from the Owgarriff intake is reduced or suspended on the occasions of high colour/turbidity, in which case the supply from Lough Guitane acts as the main or the sole source of supply.

At the existing intake on the Owgarriff River, the river is channelled in a concrete structure comprising two side walls, floor, control weir, intake chamber and compensation flow channel incorporating a flume. The raw water enters the intake chamber via coarse and fine screens which are manually cleaned. After screening, the raw water outlets to a 500mm raw water trunk main to the Lough Guitane site. At the Lough Guitane site the 500mm main is cross-connected to the 700mm trunk main to Sheheree Reservoir. However, at present, water from the Owgarriff River is used to generate electricity at the Lough Guitane site and the power generated is used to partially drive the high lift pumps at the Lough Guitane Pumping Station. The tail water from the turbine is discharged to the Finow River, which is the river flowing out of Lough Guitane. The Owgarriff water is currently not used as a water supply source. Owgarriff Water has not been used for water supply since 1999 due to unacceptable levels of colour and turbidity.

The Lough Guitane intake system comprises two submerged 120m long 1200mm pipes which extend into the lake to meet a bed level of 76mOD, 2.8m below the crest level of the outlet weir crest (78.8 mOD). There is a coarse box screen at the inlet to both pipes. Raw water from the lake normally gravitates to the intake chamber of the high lift pumping station. Provision also exists to pump water from the lake in an extremely dry year. At the intake chamber the water is screened using coarse and fine screens before entering the twin compartment pump sump.

It is possible for water from the high level Owgarriff Intake to gravitate to the main service reservoir for the scheme at Sheheree (approximately 4km NW), while water abstracted from Lough Guitane is transferred to Sheheree Reservoir by pumping.

2.2.2 Fish Pass and Compensation Flows

A fish pass has been in place since the construction of the existing plant. Details of the pass and the barrage at the lake's outflow are included as Appendix I.

The pass includes a fish ladder arrangement and was designed in conjunction with the Department of the Marine and the Inland Fisheries Trust. It allows for fish migration at water levels from the estimated minimum level of 77.417mOD (the invert of the lowest gate is actually 77.05mOD). A minimum water level of 77.417mOD with a cill level of 77.05mOD, was considered acceptable at design stage as the cill level was equivalent to the existing downstream bed level. In addition it should be noted that at water levels lower than 77.417mOD would only arise in an extreme drought when fish migration would be unlikely.

The fish pass comprises a series of four manually operated sluice gates at alternate levels on the lake side and its outflow discharges into a pool on the downstream side of the barrage. It is designed so that one gate is open at a time, to suit the lake's water level. The 77.05mOD invert of the lowest gate is the original river bed level and it would not be practical to provide for fish migration below this level.

The pass is also designed to control and channel the compensation flow downstream which is required under the WAO to be maintained at 9,092m^3/day.

The compensation flow for the Owgarriff is specified in the WAO as 1,136m^3/day. A measurement flume and compensation water system were incorporated into the original intake structure to facilitate the maintenance of this flow. The measurement flume has not been operational for some time and it is planned that this will be reinstated in early 2009.

2.2.3 Treatment Facilities

Current facilities provide for disinfection with a combination of chlorine gas and chlorine dioxide for fluoridation and for pH correction.

2.3 Overview of Proposed Upgrade

In order to comply with the current Drinking Water Regulations (S.I. 278 of 2007) and to minimize the risk of cryptosporidium entering the scheme's supply, it is proposed to upgrade and expand the facilities.

The new plant will be capable of producing up to 51,000 m^3 over a 20 hour operational day. The proposed improvement works comprise:

i) Water Treatment Building to accommodate water treatment plant and equipment capable of producing 51,000 m^3/day of treated water.
ii) Raw Water Storage Tank of capacity 5,000m^3.
iii) Clear Water Storage Tank of capacity 10,000m^3.
iv) High Lift Pumping Station.
v) Filter Washwater Recovery Tank and Pumping Plant.
vi) Sludge Processing Plant including Sludge Balancing Tank, Thickeners and Dewatering Plant.
vii) Improvements to the existing Plant Building.
viii) Site Works including landscaping, security fencing and surface water drainage.
ix) Ancillary Works associated with the development.

It is proposed that the improvement works will be procured as a Design, Build and Operate contract.

The demand assessment[5] identified a future design requirement of 51,000m^3/day for the scheme. This figure is within the licensed abstraction of 54,540m^3/day obtained by Kerry County Council for the scheme in 1979. An assessment of the existing sources[6] has confirmed their capability to satisfy the requirement for 54,540m^3/day.

The proposed scheme will involve the utilisation of both the Owgarriff and Lough Guitane sources on a conjunctive use basis. Water from both sources will be collected at the existing inlet chamber at Lough

[5] Hydrological Review, prepared by Nicholas O'Dwyer Ltd and Patrick J Tobin & Co Ltd.
[6] ditto

Guitane. New low lift pumps will be located in the existing pumping station to transfer water to a new Raw Water Blending Tank which will be located over the proposed Clear Water Storage Tank. Water from the Raw Water Blending Tank will gravitate to the new treatment facility which will be located adjacent to the existing pumping station. Treated water will gravitate to a new clear water tank and existing high lift pumps which will draw treated water from the new clear water tank will be relocated in a new high lift pumping station. The treated water will be pumped to Sheheree Reservoir via the existing 700mm rising main.

Sludge and filter washwaters will be collected, processed and dewatered on site.

As it is proposed to procure the new treatment plant as a Design Build Operate Contract, it has been decided to undertake the Preliminary Design of the plant on the basis of a conventional Sludge Blanket Clarification system, which would occupy a larger footprint than any other acceptable plant which may be proposed by tenderers.

2.4 Proposed Intake System

2.4.1 Overview

Under the proposed scheme, the issue of coloured or turbid water at the Owgarriff source will be removed as the proposed treatment system will be designed to reduce colour and turbidity to acceptable levels. Accordingly, it will be possible to abstract the maximum quantity available from the Owgarriff source above the compensation flow threshold of 1,136m^3/day. This arrangement will be established by piping the tail water from the generator at the Lough Guitane site to the main intake chamber. At this location, the waters from both the sources will mix prior to entry to the main pump sump.

This proposed arrangement will have a number of benefits including:

1) The utilisation of the Owgarriff River as the main source will reduce, to the greatest extent possible, the level of abstraction required from Lough Guitane. Under the proposed arrangement Lough Guitane water will be used to supplement the Owgarriff source and the positive impacts of this regime will be particularly felt when the water level at Lough Guitane is at or below the overflow crest level.
2) The operation of the existing power generation plant at Lough Guitane will continue to be maximised.
3) The terms of the Water Abstraction Order will be fully complied with as the sources will be utilised on a conjunctive use basis.

The following is a list of improvements required on both the Owgarriff and Lough Guitane intake systems:

A. Owgarriff

1) Provision of mechanical screens with self cleaning mechanism.
2) Re-establishment of measuring flume and compensation water system, ensuring that the required compensation water flow of 1,136 m^3/day is maintained.
3) Regular dredging of inlet pool.
4) Normal Health and Safety provision including lighting for night time inspections.

B. Lough Guitane

1) Provision of new mechanical screens to replace the existing fine screens at the inlet to the raw water pumping station.
2) Remedial works to the intake pipes such as replacement of damaged concrete collars and pipe supports.
3) Maintenance dredging of silt build up in the area of the intake pipe inlets to be undertaken on ongoing basis.

2.4.2 Intake Chamber and Pump Sump

It is proposed to retain the existing intake chambers and pump sumps at Lough Guitane with the following modifications:

1) Construction of reinforced concrete wall with penstock between the Intake Chambers and the Pump Sumps. This provision will be necessary in order to remove one of the intake chambers/screen chambers or pump sumps from service for maintenance purposes without impacting on the abstraction system.
2) Appropriate Health and Safety provisions to facilitate access for operation and maintenance of screens and chambers.

2.4.3 Raw Water Pumping Station

After mechanical screening the mixed raw water from both sources will enter the two pump sumps. Four (2 duty, 2 standby) raw water pumps, two drawing from each of the two wells, will transfer water to the Raw Water Blending Tank. Any two pumps operating in parallel will be capable of delivering 54,540 m^3 over a 20 hour day.

The condition of existing high lift pumps, control panel, and surge vessel will be assessed with a view to their retention for reuse at the new high lift pumping station.

2.4.4 Fish Pass and Compensation Flows

The following works will be carried out to facilitate the operation of the fish pass and to ensure the provision of the required compensation flows:

1) Re-establishment of flow metering device within fish pass to ensure that the required compensation flow (9,092 m^3/day) is maintained.
2) Re-establishment of staff gauge for water level monitoring on Lough Guitane.
3) Channel cleaning and maintenance of required depths on lake side of fish pass to allow migration of fish per original design. Required depth at lowest gate is 77.05mOD. The length of this channel will be adequate to connect main body of lake to fish pass at a lake water level of 77.417mOD.
4) Re-establishment of measuring flume and compensation water system at Owgarriff intake, ensuring that the required compensation water flow of 1,136 m^3/day is maintained.

In addition, the DBO operator will have a contractural obligation to comply with the terms of the WAO. This will include maintaining the stipulated compensation flows downstream of both intakes and operating the fish pass by utilizing the appropriate intake gate at the necessary level. The operator will also be obliged to ensure that these features are maintained so that they can continue to perform as intended.

2.4.5 Water Treatment Plant

2.4.5.1 Existing Facilities

It is proposed to retain the existing raw water pumps, electrical distribution and metering room and treatment facilities for chlorination, fluoridation and pH correction within the existing plant building. The existing site layout is shown on Figure 2.2.

2.4.5.2 New Plant Building

The new water treatment plant will be accommodated within a large (90m x 45m x 11.4 m high) cladded structure. This building will accommodate the treatment units, chemical storage and dosing facilities, backwash pumps and air blowers, control room and welfare facilities. The proposed plant is shown on Figure 2.3 to Figure 2.5.

2.4.5.3 Clear Water Storage Tank / Raw Water Blending Tank

The proposed Clear Water Storage Tank will be compartmentalised to incorporate separate sump areas for both the filter backwash and the high lift pumps. The roof slab of this tank will be at ground level.

A raw water blending tank will be located directly on top of the Clear Water Tank and will be used to store and blend raw waters from Lough Guitane and the River Owgarriff before treatment. The maximum dimensions of the tank will be 33m x 33m x 6.5m high.

2.4.5.4 High Lift Pumping Station

The new pumping station (approximate dimensions: 30m x 14m x 10m high) will accommodate the pumping plant and associated control panels. These pumps will transfer treated water to the main service reservoir at Sheheree.

2.4.5.5 Filter Washwater Recovery Tanks and Pumping Plant

Three Filter Washwater Recovery Tanks of approximate size 14 x 6 x 5m deep, will collect and process all washwater arising from the filter backwashing process. These units will also collect supernatant and filtrate for the Sludge Processing Plant. Supernatant from the Washwater Recovery Tanks will be recycled to the raw water inlet tank. The top of these tanks will be approximately at ground level. The associated pumping station will have approximate dimensions 14.5 x 7 x 7.4m high.

2.4.5.6 Sludge Processing Plant

The Sludge Processing Plant comprises four stages as described hereunder:

a) Sludge Balancing Tank and Pumping Station
This circular tank of approximate surface area 110 m^2 will collect sludge bleed water from the Water Treatment units. The top of this tank will be at ground level and will be up to 5 m deep. Homogenised sludge from this tank will be pumped to the sludge thickeners. The sludge pumps will be housed in a pumping station of approximate dimensions 6.5 m x 7 m x 5.7 m high, located adjacent to the Sludge Balancing Tank.

b) Sludge Thickeners
2 No. Sludge Thickener of approximate diameter 8 m will be provided near the Sludge Dewatering Building. The height of these units will be approximately 3.5 m above the adjacent ground level.

c) Thickened Sludge Storage Tanks
3 No. Thickened Sludge Storage Tanks, each with a surface area of 12.5m^2 approximately will be provided adjacent to the Sludge Dewatering Building. The height of these units will be approximately 3.5m above the adjacent ground level.

d) Sludge Dewatering Building
The Sludge Dewatering Building of approximate dimensions 25 x 13 x 10m high, will house the Sludge Dewatering Plant. This structure will also accommodate chemical storage and dosing facilities for the sludge treatment process and sludge pumps/conveyors etc.

2.4.5.7 Site Works and Roads

The site works will involve new site roads, parking areas, landscaped areas, a new entrance, fencing and surface water drainage including settlement ponds, as shown in the drawings.

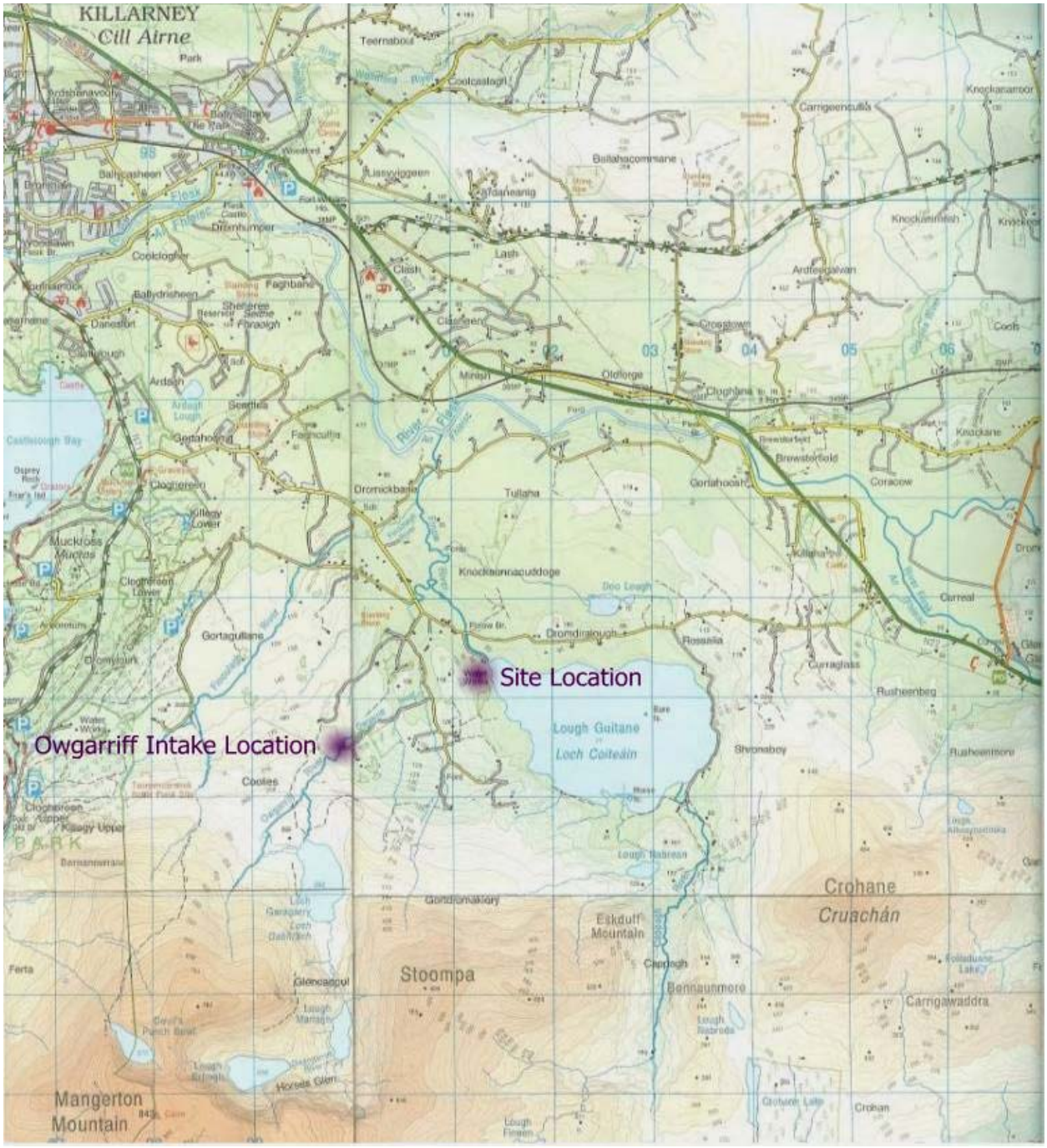


Figure 2.1 Location Map

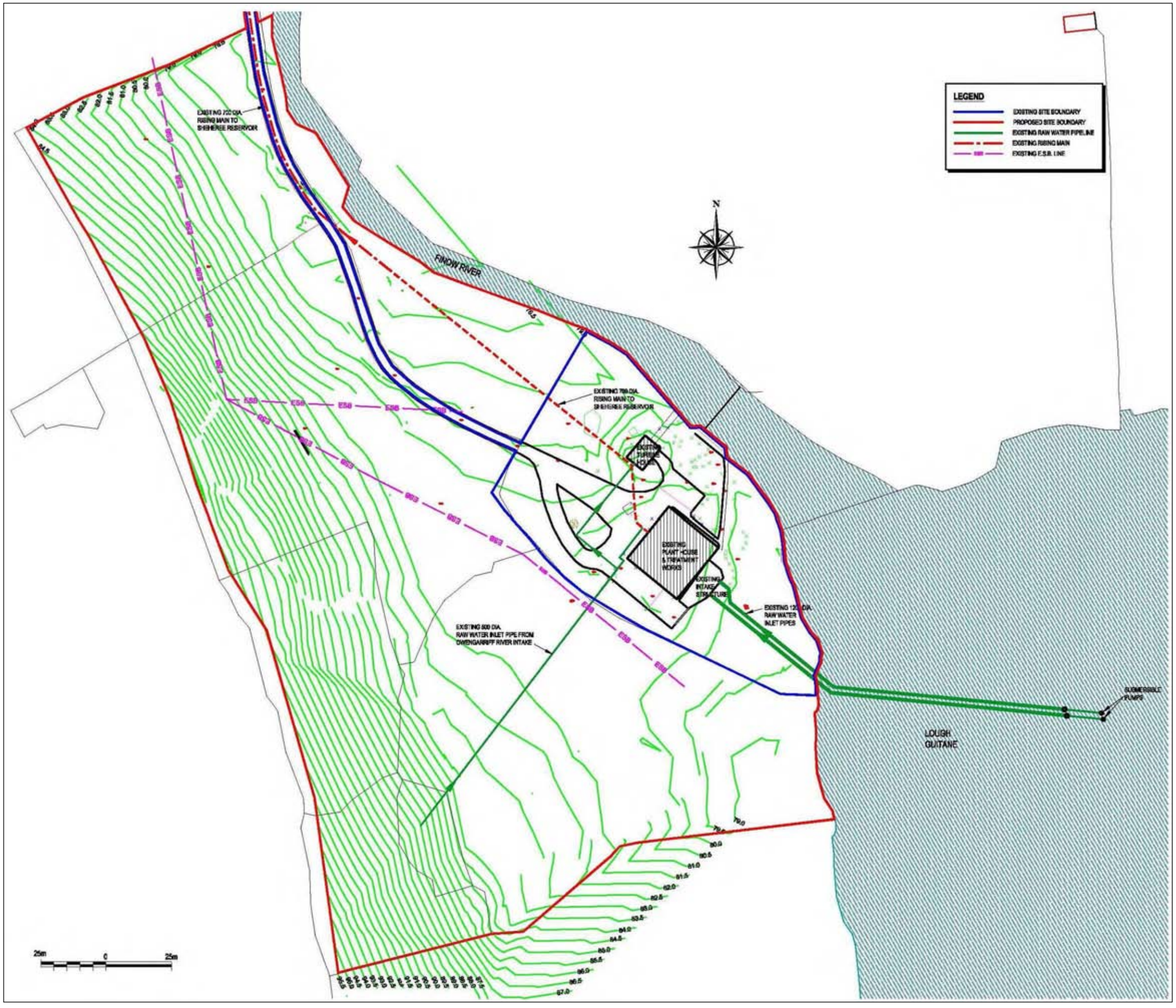


Figure 2.2 Existing Site Plan

Figure 2.3 Proposed Site Plan

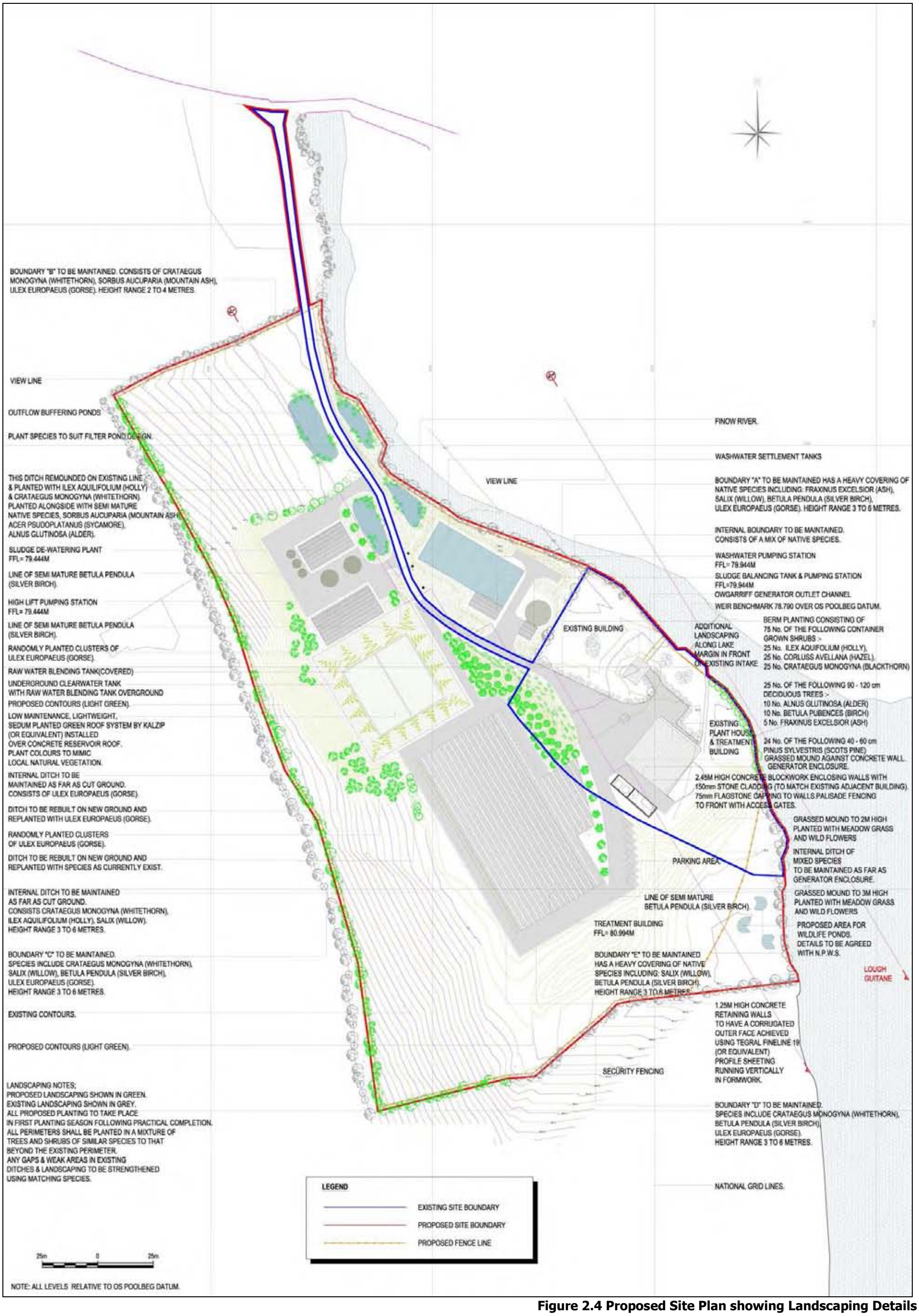


Figure 2.4 Proposed Site Plan showing Landscaping Details

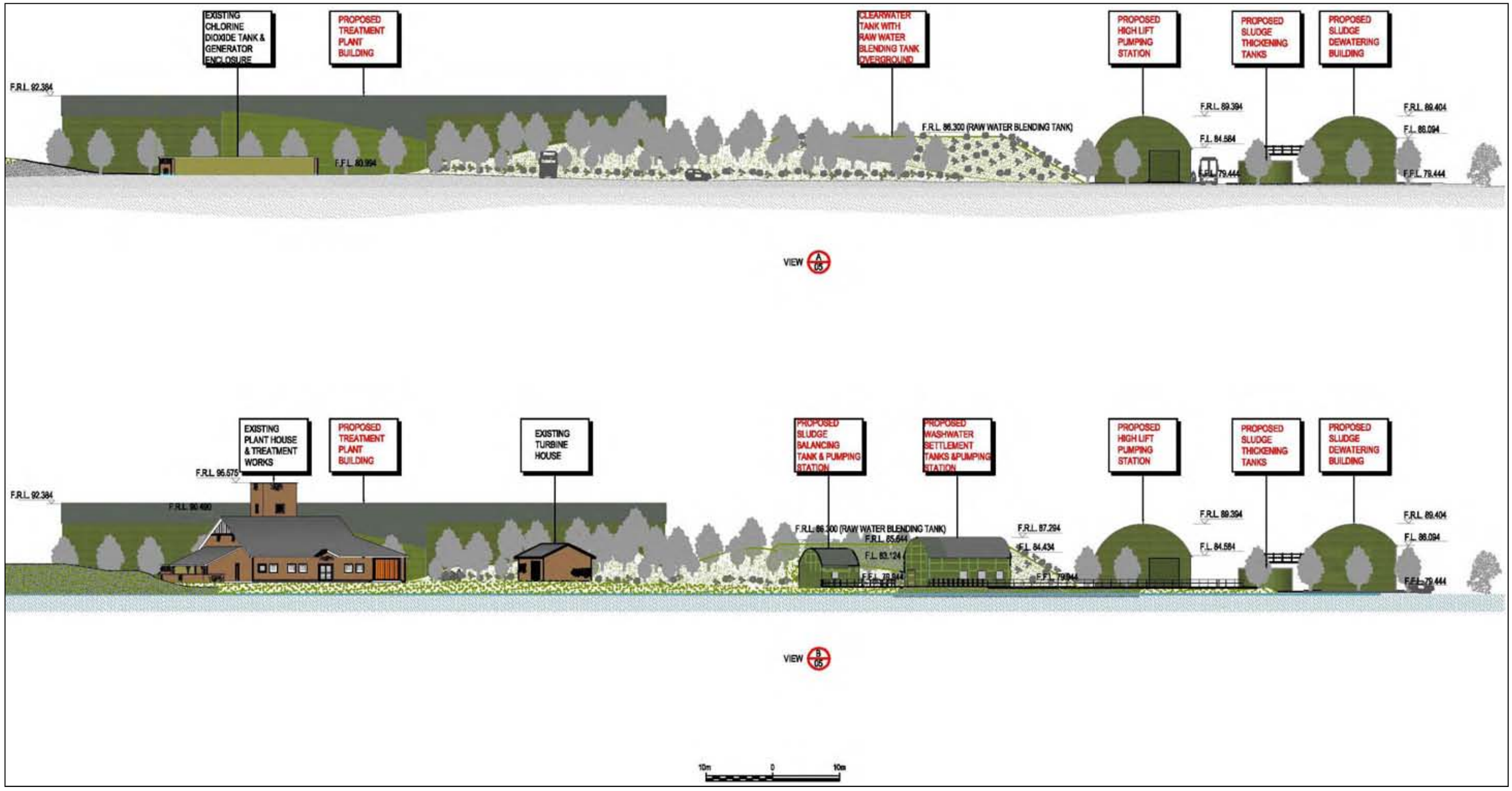


Figure 2.5 Elevations[7]

[7] Views from lines A and B on Figure 2.4

2.5 County Development Plan Context

2.5.1 Background

As the subject proposal has been designed to avoid the need for any discharge other than surface water, it will not affect water quality and so no specific water quality assessment has been carried out for this report. Notwithstanding this a number of objectives of the current and forthcoming County Development Plans which specifically relate to the protection of the lake's water quality are set out and discussed below. Other Development Plan provisions are discussed in other sections of this report, as relevant.

2.5.2 Kerry County Development Plan 2003-2009

The current County Development Plan contains objectives that seek to protect the water quality in lakes, including Lough Guitane, as demonstrated by the below extracts.

10.1.8. Lough Guitane is the primary source of drinking water for County Kerry. A high level of importance shall therefore be afforded to maintaining the quality of its waters. Continued development within the vicinity of the lake could result in increased risk of pollution to the water body, and it is therefore important that the precautionary principle be adopted with regard to development within the catchment area of the lake.

The following objectives from section 10.1.10. also relate to Lough Guitane.

Objective No.

EN 10-4	It is an objective of the Council to prohibit any form of development within the catchment area of Lough Guitane that will have a potentially detrimental effect on water quality.
EN 10-5	Prohibit all new percolation areas for on-site wastewater treatment facilities within 100m of the shore of each lake.
EN 10-6	Assess and monitor any proposed development that has the potential to discharge to a watercourse which drains into any of the lakes identified.
EN 10-7	Require the installation of additional nutrient reduction measures involving the use of on-site wastewater treatment for all new private development within the catchments of these lakes.
EN 10-8	Continue the implementation of the Local Authority Management Proposals recommended in the Lough Leane Management and Monitoring Report.

As can be seen from the preceding subsections of this report, the subject proposal does not include or require any new wastewater treatment facility, percolation area or discharge into the lake. The proposal will not affect the lake's water quality and is therefore in conformity with the above objectives.

2.5.3 Draft County Development Plan 2009-2015

11.1.7 Lough Guitane is the primary source of drinking water for County Kerry. A high level of importance shall therefore be afforded to maintaining the quality of its waters. Continued development within the vicinity of the lake could result in increased risk of pollution to the water body, and it is

therefore important that the precautionary principle be adopted with regard to development within the catchment area of the lake.

Objective No.	It is an objective of the Council to:
EN 11-7	a. Prohibit any form of development within the catchment area of Lough Guitane (including Lough Guitane itself), as shown on Map 11.4, that will have a potentially detrimental effect on water quality. b. Have regard to the Lough Guitane Source Protection Plan.

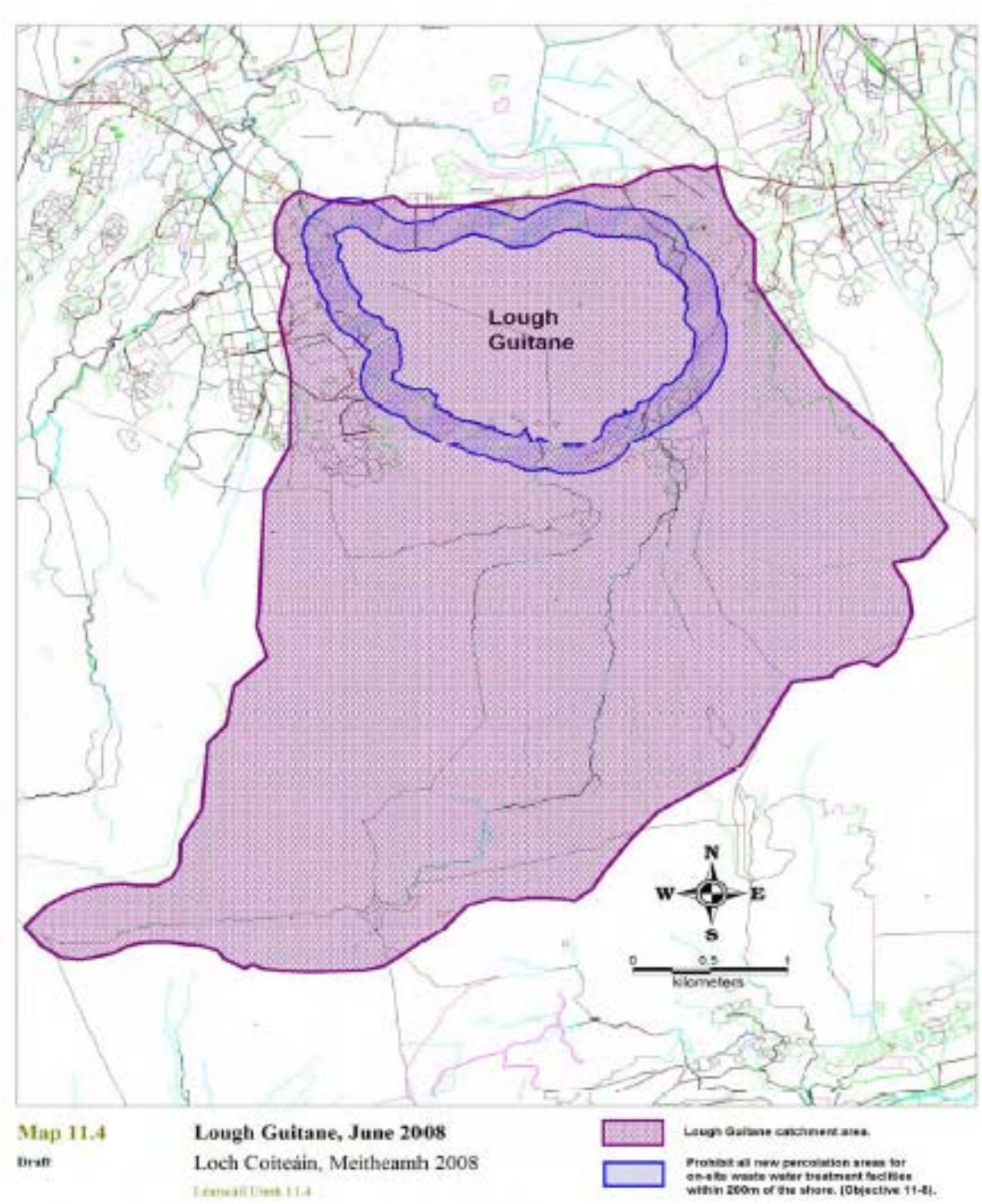


Figure 2.6 Lough Guitane Source Protection Plan Map

The following objectives apply to Lough Guitane.

Objective No.	It is an objective of the Council to:
EN 11-8	Prohibit all new percolation areas for on-site wastewater treatment facilities within 200m of the shore of each lake.
EN 11-9	Assess any proposed development that has the potential to discharge to a watercourse which drains into any of the lakes identified in terms of its potential impact on the lake.
EN 11-10	Require the installation of additional nutrient reduction measures involving the use of on-site wastewater treatment for all new private development within the catchments of these lakes.
EN 11-11	Continue the implementation of the Local Authority Management Proposals recommended in the Lough Leane Management and Monitoring Report.
EN 11-12	Have all forestry proposals within the catchment of each lake assessed in terms of their potential impact on the water quality of the lake.
EN 11-13	Prohibit any development which would have an adverse impact on the water quality in these lakes.

The subject proposal does not include or require any new wastewater treatment facility, percolation area or discharge into the lake. The proposal will not affect the lake's water quality and is therefore in conformity with the above objectives.

Section 3 Human Beings

3.1 Introduction

This section examines the socio-economic impacts resulting from the proposed developments associated with the Kerry Central Regional Water Supply Scheme (CRWSS). The proposed development is required to serve the future water needs of the principal population centres of Tralee, Killarney, Castleisland, Castlemaine, and areas of rural Kerry.

3.2 Proposed Development

Water demands in the region (in terms of both quantity and quality) have increased significantly over the last 15 years in the area served by the Kerry Central Regional Water Supply Scheme (CRWSS), particularly in the main population centres of Tralee and Killarney, which have experienced significant population, tourism and industrial growth. The proposed development is required to provide for the needs of both current and future populations.

The proposed development involves the provision of a new water treatment facility to cater for the Kerry Central Region to the year 2026. This will involve the provision of new treatment buildings and infrastructure at the site of the existing treatment facility adjacent to Lough Guitane and at the Owgarriff headworks. Additional works in other locations include additional storage at Sheheree, Scart and Lissardboola and capacity increases to trunk mains and major pumping stations.

The proposed development at the Lough Guitane site and at the Owgarriff headworks is expected to involve an estimated capital expenditure of approx. €20million. The construction period is expected to last approx. 2 years with construction employment likely to be in the region of 30 to 40 people. Ongoing operational employment will be generated by the development. It is likely that the intake and treatment elements will be procured as a Design, Build and Operate scheme with a 20 year operate phase. The water distribution system will continue to be operated by Kerry County Council.

3.3 Types of Potential Impacts

Two types of impacts can typically arise, from direct and indirect impacts. The direct impacts typically occur at a local level, through changes in the immediate environment that arise as a result of the engineering and other works. Indirect impacts typically arise outside the immediate area where the physical works take place. They occur at a regional level often relating to changes in population and industrial patterns that will arise as a result of the improvement in infrastructure.

3.4 Data Sources and Documentation Consulted

The following data sources and documentation were referred to during the preparation of this section of the assessment:

- *Project Documentation – Nicholas O'Dwyer Limited*
- *Kerry County Development Plan 2003*
- *Kerry County Draft Development Plan 2009-2015*
- *Census of Population 2006 and 2002 - Central Statistics Office*
- *Relevant Irish Tourist Board Publications and Website - Fáilte Ireland*
- *Water Quality in Ireland 1998-2000 - Environmental Protection Agency*
- *Second interim Report of the Lough Leane Catchment Monitoring & Management System – Kerry County Council and Department of the Environment and Local Government*

- *Other miscellaneous publications and websites*

3.5 Existing Environment

This section sets out the key socio-economic issues that are relevant to the proposed development.

3.5.1 Population

The Lough Guitane treatment works and pumphouse are located in a rural area adjacent to the lake. Lough Guitane is located approximately 8km south-east of Killarney Town and 3km south of the N22 National Primary Route. There are a number of scattered dwellings within a 1km radius of the treatment works but in general the area is rural in character.

Lough Guitane and surrounding areas are located within the Killarney Rural Electoral Area. The population recorded for this electoral area was 26,097 in 2002, and 28,413 in 2006 a rise of 8.9%. There is a strong urban population in Killarney Town and surrounding villages. The remaining population is scattered throughout the area. Whilst some of it is agriculturally based, it is increasingly becoming related to economic activities in the urban areas.

The area served by the existing Kerry Central Regional Water Supply Scheme (CRWSS) includes the other major population centres of Tralee, Castleisland and Castlemaine. Overall the area served by the CRWSS has a population in excess of 59,000 people.

Population increases are anticipated to continue at or slightly below prevailing levels in the medium term.

3.5.2 Employment and Industry

In terms of employment in County Kerry, Tralee and Killarney Town rank as the largest centres of employment. A very significant proportion of the working population is employed in tourism and related industries.

In general, unemployment in Kerry has remained consistently above the national average. The demand for employment has arisen from the increase in the labour force and the decline in agricultural and industrial employment. The industrial base has traditionally been concentrated in food processing, textiles and manufacturing. All these areas have declined in the county and the county has been trying to diversify into the fast growing technology/telecommunications sector and other high growth service sectors including tourism. Despite the best attempts of job creation agencies, significant growth has not occurred in these areas. The peripheral location and lack of adequate infrastructure have been given as the main reasons for lack of employment growth. Traditionally Kerry County Council has supported employment creation through provision of the physical infrastructure (roads, water and sewerage services) necessary for economic activity.

The proposed development represents a very important continuation of these positive supports.

3.5.3 Existing Water Demands and Quality

The treatment plant currently supplies water to the principal population centres of Tralee, Killarney, Castleisland, Castlemaine, and areas of rural Kerry. Currently, water abstracted from the lake and river is pumped to the nearby water treatment plant for treatment before being fed by gravity into the water supply network for distribution to the region. The design capacity of the existing pumping plant is 37,000m^3 per day but in practice the plant has produced in excess of 48,000m^3 per day by using standby pumps. Present treatment provides for disinfection with a combination of chlorine gas and chlorine dioxide for fluoridation and for pH correction. Current regulations require additional levels of treatment and the scheme is currently included in the EPA's remedial action list. The purpose of this project is to upgrade and expand the existing treatment facilities to fully meet the requirements of the Drinking Water

Regulation. The proposed upgrade will satisfy the future water requirements in terms of quantity and quality for the area served by the Kerry CRWSS.

3.5.4 Land Uses

3.5.4.1 Local

Landuse in the immediate area of Lough Guitane is predominantly agricultural and forestry, interspersed with rural housing. Land is generally of poor to medium quality with the main activity being rough grazing. Lough Guitane itself is situated at the foothills of Mangerton and Crohane Mountains. As discussed in more detail in section 5.3.2, the lake and surrounding mountains have Special Area of Conservation (SAC) status. The site of the treatment works is not designated.

The area is generally sparsely populated with a small number of rural dwellings in the vicinity. Extracts from the current (2003-2009) and the proposed draft (2009-2015) Kerry County Development Plans in section 6.3.2 show that the lands around the lake are classed as Secondary Special Amenity and set out consequent restrictions on development.

3.5.4.2 Regional

The patterns of regional landuse are of indirect relevance to the proposed development. There may be marginal changes in landuses due to the higher quality water supplies (i.e. expansion of the residential and industrial uses in Killarney and other areas).

3.5.4.3 Tourism / Amenity

Killarney is a key tourism hub and tourism is of key economic importance to the area. Located on the north-eastern shore of Lough Leane, the town lies in an area renowned for its natural beauty and scenery and is almost centrally located in County Kerry. It is situated on the National Primary Route N22, thirty-three kilometres from Tralee and eighty-seven from Cork. In addition to being a key tourism centre, the town has traditionally functioned as a market/service centre and is an important centre for industrial and commercial activity within the County.

Killarney town itself is a major attraction to visiting tourists given the range of services available – including accommodation, transportation, local heritage features, shopping opportunities, entertainment venues and cultural activities but the main purpose of visitors to the area is to visit the surrounding lakes, mountains and countryside.

Lough Guitane is located approximately 8km south-east of Killarney Town. In itself it is not a tourist attraction but it forms part of the wider landscape that attracts tourists. It is visible from Mangerton and surrounding mountains and lies within a landscape designated as a special amenity landscape, and is therefore part of the wider tourism product in the area.

While it supports a large stock of small brown trout; in terms of angling, Lough Guitane is not a noted fishery nor is there evidence of widespread angling occurring here. The lake is the location for an annual *Killarney Gig* rowing regatta.

3.6 Predicted Impacts

3.6.1 Population

The proposed development has little potential to create significant impacts on the population levels either locally or regionally, as it is not proposed to increase the quantity of water being abstracted above that currently licensed. Population changes are most likely to continue at the prevailing levels based on factors which are unrelated to the proposed development.

3.6.2 Employment and Industry

The proposed development has little potential to create significant impacts on the levels of industrial activity and associated employment levels either locally or regionally, as it is not proposed to increase the quantity of water being abstracted above that currently licensed. Industrial activity is most likely to continue at the prevailing levels based on factors which are unrelated to the proposed development.

3.6.3 Land Uses

There will be a small increase in the area occupied by the treatment works and there will be some new structures. The required lands are immediately adjacent to the existing treatment plant and will not displace any existing land uses, therefore adverse impacts on local landuses are not likely to occur.

3.6.4 Tourism / Amenity

The proposed development will create a small change in the appearance of Lough Guitane and the existing treatment works as a result of the proposed new structures.

Having regard to the sensitive design of the proposed structures, the change in appearance is not likely to create any adverse impacts on tourism and amenity as the general character of the lake and surrounding area will remain the same when seen from surrounding areas. The section on Landscape and Visual Impacts assesses this issue in more detail.

In terms of angling, Lough Guitane and the Owgarriff River are not noted fisheries however, some local angling takes place.

No specific tourism and amenity resources are likely to be affected, therefore from a tourism and amenity perspective there are not likely to be significant adverse impacts.

3.7 Mitigation Measures

As no adverse socio-economic impacts are predicted to arise as a result of the proposed development, no mitigation measures are required or proposed.

Section 4 Noise

4.1 Introduction

The nearest noise sensitive locations to the proposed development at Lough Guitane are the residential properties along the local road nework to the north of the site (Figure 4.1).

Noise level measurements were undertaken at three locations around the perimeter of the site. Based on the results of the noise survey and other relevant guidance an assessment of the contribution of noise from the proposed upgrade to the overall noise environment has been undertaken.

4.2 Survey Details

An environmental noise survey was conducted in order to quantify the existing noise environment at existing treatment facility. The survey was conducted in accordance with ISO 1996: 2007: *Acoustics – Description and measurement of environmental noise*. Specific details are set out below.

4.2.1 Choice of Measurement Locations

Three measurement locations were selected; each is described in turn and shown on Figure.

Location 1 is located on the eastern boundary of the site in the vicinity of the River Finnow.

Location 2 is located within the facility to the west of the pumping station.

Location 3 is located on the northern boundary of the site. Note an unattended noise monitor was also placed at this location.

The monitoring locations were selected to give noise level data representative at the site boundaries.

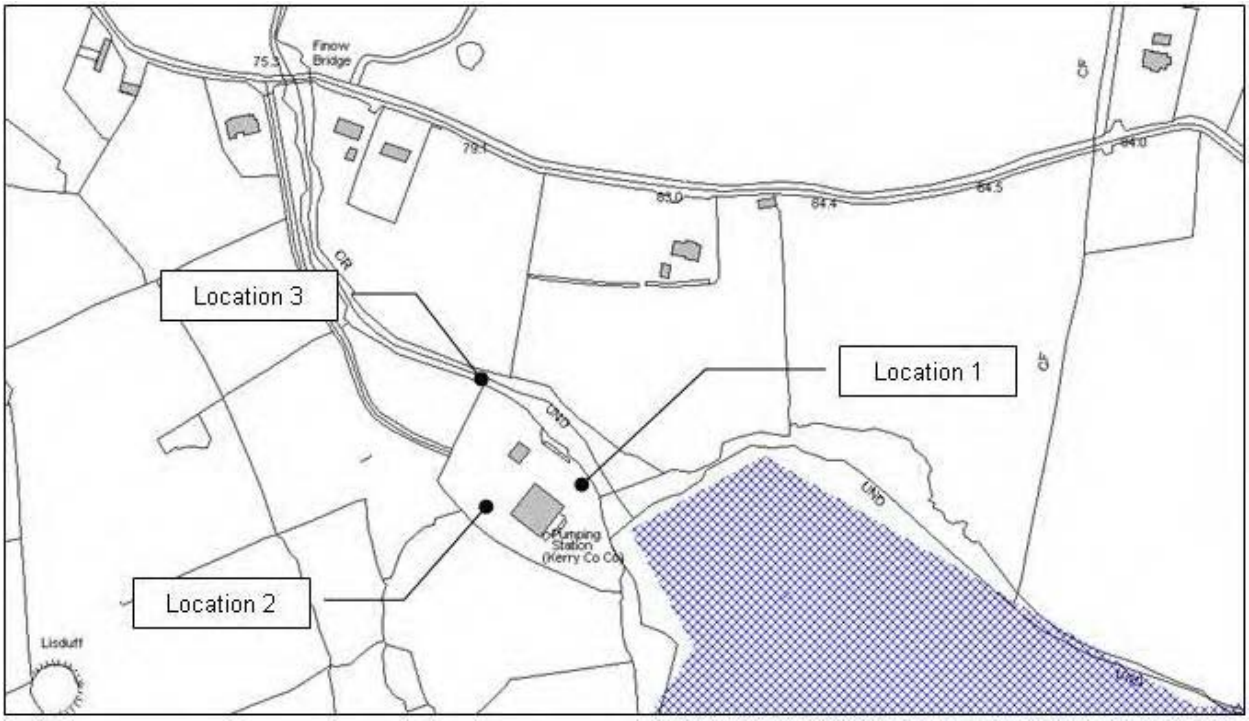


Figure 4.1 Noise Survey Locations

4.2.2 Survey Periods

Attended measurements were conducted between 23:00hrs on the 20 April 2009 and 02:00hrs on the 21 April 2009 and between 08:00hrs and 11:00hrs on the 21 April 2009.

Unattended measurements were conducted between 21:00hrs on 20 April 2009 and 21:00hrs on the 21 April 2009.

4.2.3 Personnel and Instrumentation

Niall Vaughan (AWN) conducted the noise level measurements during the attended survey periods.

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

4.2.4 Weather

The weather during the survey period was dry with a southerly breeze of approximately 2.5m/s.

4.2.5 Measurement Parameters

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

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

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

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

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

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

The "A" suffix denotes the fact that the sound levels have been "A-weighted" in order to account for the non-linear nature of human hearing. All sound levels in this report are expressed in terms of decibels (dB) calculated as per ISO 1996-1: 2003: *Acoustics – Description and measurement of environmental noise – Part 1: Basic Quantities and Assessment Procedures* as,

Sound Level in Decibels = $10\log_{10}(p/p_0)^2$ (1)

Where: p is the sound pressure level in Pascals (Pa)
p_0 is the reference sound pressure level of $20x10^{-5}$ Pa

4.2.6 Procedure

Measurements were conducted on a cyclical basis during daytime and night-time periods. Sample periods were 15 minutes long during both survey periods. The results were saved to the instrument memory for later analysis. Survey personnel noted all primary noise sources contributing to noise build-up.

4.2.7 Survey Results

Location 1

The survey results for Location 1 are summarised in Table 4.1 below.

Time (hrs)	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
23:00 - 23:15	62	66	59	62	61
00:00 - 00:15	62	65	60	62	61
01:00 - 01:15	62	65	60	62	61
08:00 - 08:15	63	66	61	64	62
09:00 - 09:15	63	66	61	64	62
10:03 - 10:18	63	67	61	64	62

Table 4.1Summary of noise measurements at Location 1

During the daytime survey periods, the dominant noise source at this location was water flow over the nearby weir. Other sources noted during this survey period were birdsong and the turbine located within the existing treatment facility. Noise levels were of the order of 63dB L_{Aeq} and background levels were of the order of 62dB L_{A90}.

During the night-time survey periods, the dominant noise source at this location was again water flow over the nearby weir. Other sources noted during this survey period were birdsong and the turbine located within the existing treatment facility. Noise levels were of the order of 62dB L_{Aeq} and background levels were of the order of 61dB L_{A90}.

Please note that the survey engineer noted that the turbine within the existing treatment facility was in operation during all survey periods at this location. This has been confirmed by examining the power consumption of the treatment plant during the survey periods. Appendix VIII details the electrical consumption data for the Lough Guitane facility. This data indicates that at 21:45hrs on 21 April 2009 there is a step in demand which indicates that the turbine was not in operation for a period after this time. However, prior to this step and during the survey period of 21:00hrs on 20 April 2009 and 21:00hrs on the 21 April 2009, the electrical consumption remains relatively constant indicating that the turbine was in operation for the entirety of this period.

No tonal or impulsive components in site noise emissions were noted at this location during the survey periods.

Location 2

The survey results for Location 2 are summarised in
Table 4.2 below.

Time (hrs)	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
23:18-23:33	48	60	45	51	46
00:17 - 00:32	47	57	44	50	46
01:18 - 01:33	48	54	45	49	47
08:17 - 08:32	46	54	45	46	45
09:19 - 09:34	50	61	44	51	45
10:21 - 10:36	47	58	44	47	45

Table 4.2 Summary of noise measurements at Location 2

During both the daytime and night-time survey periods the dominant noise source at this location was the existing high-lift pumps. Note that during the second period of the daytime survey and all three periods of the night-time survey, the Chloride Dioxide pump was also in operation and audible.

During the daytime, noise levels were in the range of 46 to 50dB L_{Aeq} and background levels were of the order of 45dB L_{A90}. During the night-time, noise levels were in the range of 47 to 48dB L_{Aeq} and background levels were in the range of 46 to 47dB L_{A90}.

No tonal or impulsive components in site noise emissions were noted at this location during the survey periods.

Location 3

The attended survey results for Location 3 are summarised in Table 4.3 below.

Time (hrs)	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
	L_{Aeq}	L_{Amax}	L_{Amin}	L_{A10}	L_{A90}
23:39 - 23:54	35	63	31	34	32
00:37 - 00:52	34	49	32	34	33
01:39 - 01:54	33	43	31	33	32
08:38 - 08:53	50	67	35	53	37
09:40 - 09:55	48	65	35	52	37
10:42 - 10:57	47	66	36	49	37

Table 4.3 Summary of noise measurements at Location 3

During the daytime survey periods the dominant noise source at this location was water flow from the nearby river. Other sources noted during this survey period were birdsong and other animal noise. Noise levels were in the range of 47 to 50dB L_{Aeq} and background levels were of the order of 37dB L_{A90}.

During the night-time survey periods the dominant noise source at this location was again water flow from the nearby river. Noise levels were in the range of 33 to 35dB L_{Aeq} and background levels were in the range of 32 to 33dB L_{A90}.

No tonal or impulsive components in site noise emissions were noted at this location during the survey periods.

Full details of the unattended survey results are in Appendix IX. In summary, noise levels during the daytime were in the range of 37 to 59dB L_{Aeq} and background levels were in the range of 35 to 37dB L_{A90}. During the night-time noise levels were in the range of 36 to 59dB L_{Aeq} and background levels were in the range of 35 to 47dB L_{A90}.

4.3 Review of Relevant Guidance Documents

There are several published documents that provide guidance on appropriate external noise criteria.

The following guidance taken from the World Health Organisation publication "*Community Noise*" indicates an acceptable external noise level during the daytime period.

> *"To protect the majority of people from being moderately annoyed during the daytime, the sound pressure level should not exceed 50dB L_{Aeq}."*

The noise criteria found in the Environmental Protection Agency publication '*Guidance Note For Noise In Relation To Scheduled Activities*' are for both day and night-time periods. This document states:

> "*Ideally, if the total noise level from all sources is taken into account, the noise level at sensitive locations should be kept below an $L_{Ar\ T}$ value of 55dB(A) by daytime. At night, to avoid disturbance, the noise level at noise sensitive locations should not exceed an $L_{Aeq\ T}$ value of 45dB(A)..... Audible tones and impulsive noise at sensitive locations at night should be avoided, irrespective of the noise level*".

The $L_{Ar\ T}$ value is a *'rating level'* which takes account of tonal and impulsive events by applying a correction to the measured $L_{Aeq\ T}$ level. The EPA guidance sets out a +5dB correction which should be applied when there is either a tonal or impulsive component to the measured sound field. The same correction also applies when there is a combination of both tonal and impulsive elements. Please note that the subscript *'T'* in both the $L_{Ar\ T}$ and $L_{Aeq\ T}$ represents the time period over which the measurements are taken. It is common practice to take a 1 hour period during the day and a 5 minute period at night. The shorter period at night is chosen to reflect the greater annoyance attributed to noise at night as it requires compliance with the criterion for each 5 minute period.

However, the EPA document also gives more information with respect to areas where there are already low noise levels,

> *"In particularily quiet areas, such as remote or rural settings, where background noise levels are very low (e.g. below approximately 35dB measured as L_{90}), lower noise limits may be more appropriate..."*

In this instance the background noise levels measured in the vicinity of the site boundary closest to the nearest residential dwellings are below 35dB L_{A90} during the night-time period. Taking into consideration the guidance discussed above and the results of the ambient noise survey discussed in Section 2.0, the following noise criteria are deemed appropriate for this development:

External Noise Levels

- Daytime (07:00 to 23:00hrs) 50dB $L_{Aeq,1hour}$
- Night-time (23:00 to 07:00hrs) 40dB $L_{Aeq,5min}$

Considering that there were no tonal or impulsive character to the noise levels measured during the noise survey the noise criteria above are decribed using the $L_{Aeq\ T}$ indicator, i.e. a rating of zero is applied so that $L_{Ar\ T}$ equals $L_{Aeq\ T}$. It should also be noted that a lower noise limit during the night-time period has been chosen based on the low background noise levels measured during the baseline environmental noise survey.

4.4 Description of the Proposed Development

The existing treatment facility at Lough Guitane contains several items of mechanical plant which generate significant levels of noise. In order of their noise emissions from high to low these plant items are:

- High lift pumps;
- Turbine; and
- Generator.

Figure 4.2 indicates the locations of these plant items on the existing site layout.

During the proposed upgrade of the treatment facility these plant items are to remain on site, however, it is proposed to relocate the high lift pumps to an alternative location. The items of plant associated with the proposed facility are as follows:

- High lift pumps;
- Turbine;

- Generator; and
- Low lift pumps.

Figure 4.3 shows the site plan of the proposed site and the locations of the major noise sources. In addition to the sources identified in Figure 3 there will also be several smaller pumps located within the other buildings on the site.

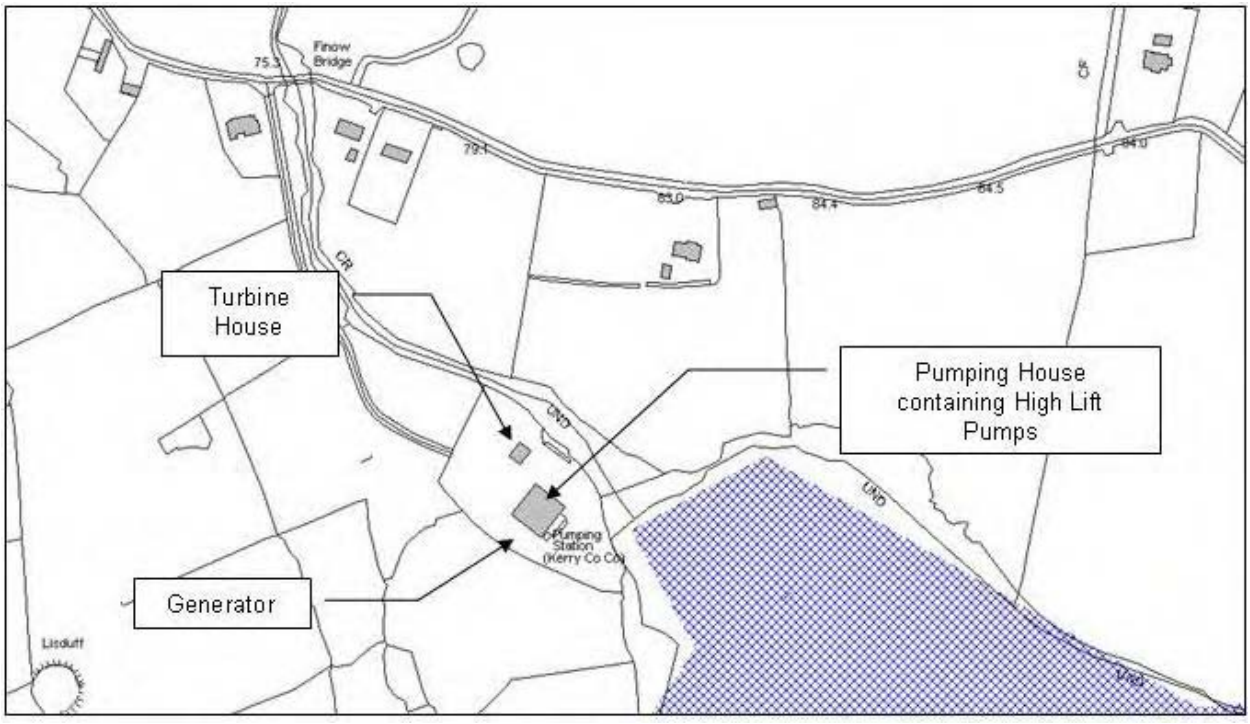


Figure 4.2 Mechanical Plant Locations on Existing Site

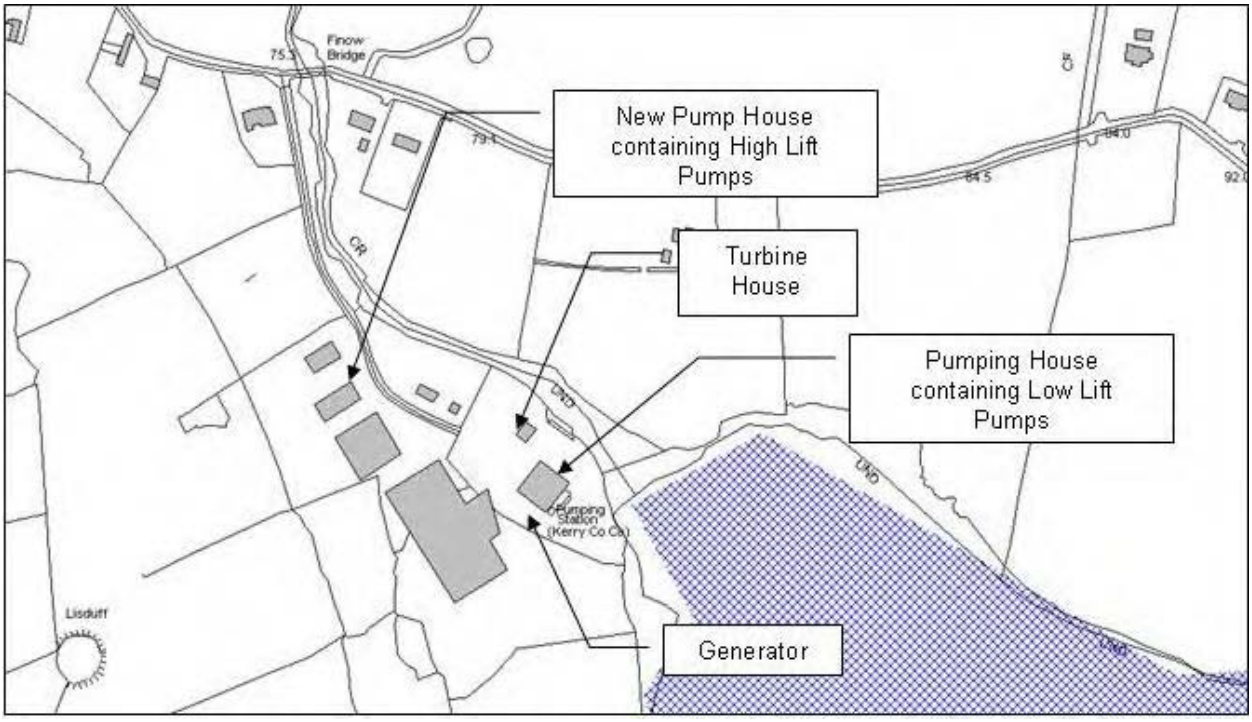


Figure 4.3 Mechanical Plant Locations in Proposed Site Layout

4.5 Assessment Methodology

The noise levels at the façades of the nearest noise-sensitive locations have been predicted for both the existing and proposed treatment plant. Figure 4.4 indicates the locations of the nearest noise-sensitive receptors. The predictions are based on the noise levels measured by AWN from the existing items of plant within the facility.

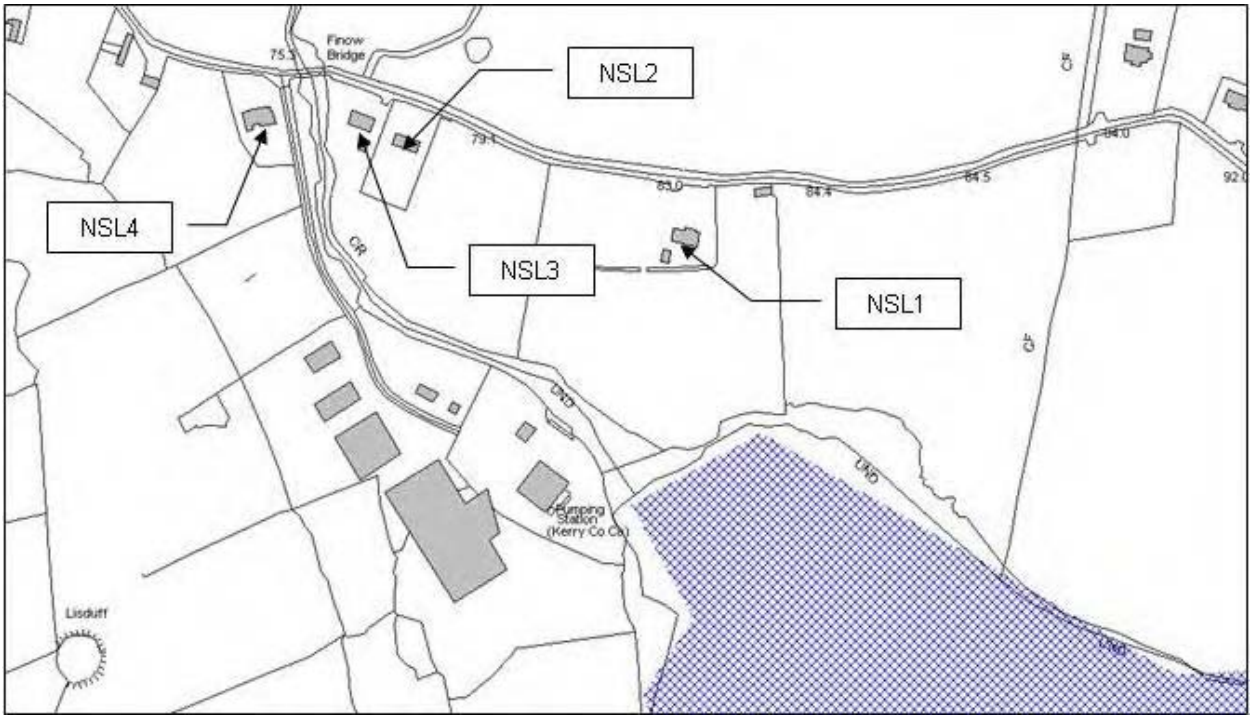


Figure 4.4 Noise Sensitive Locations

4.5.1 Source Noise Levels

Table 4.4 below lists the sound levels for the plant items as measured by AWN. The measurements in the table are those taken at each façade of the relevant site buildings at a distance of 3m.

Description	Sound Level, dB L_{Aeq} (re $2x10^{-5}$ Pa) Octave Band Centre Frequency (Hz)								
	31.5	63	125	250	500	1k	2k	4k	8k
Pump House NE façade	51	56	58	53	44	45	40	39	33
Pump House NW façade	55	57	59	55	54	59	52	47	37
Pump House SW façade	59	55	57	44	45	48	46	44	37
Pump House SE façade	52	58	64	54	55	52	42	46	35
Inside Pump House	71	78	83	80	79	88	79	72	65
Turbine Room SE façade*	55	54	59	58	56	55	51	48	39
Inside Turbine Room	64	68	76	81	76	77	76	74	64

Table 4.4 Plant Items associated with the existing facility

Note * This façade has a roller shutter which is considered to represent the weakest façade

Using the information in
Table 4.4, the sound power (L_w) levels at the façades of both the existing and proposed plant buildings on site have been calculated. Equation 2 below details the formula for calculating sound power from the measured sound pressure (L_p) levels:

$$L_w = L_p - 20*\log_{10}(r) - 11 + QF \quad (2)$$

Where: L_p is the sound pressure level in dB
r is the distance at which the sound pressure level was measured
QF is the surface directivity which in this case is equal to 6dB

When calculating the sound power levels at the façade of the proposed buildings a correction must be applied to take into account the sound insulation performace of the proposed building constructions. Based on the drawings received from Environmental Impact Services Ltd. the following construction has been assummed:

- Walls – 12mm thick Fibrecement cladding, and;
- Roof – Corrugated Cladding.

The sound reduction indices used for this construction are listed in Table 4.5.

Description	Sound Power Level re 10^{-12} W at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Walls[8]	18	18	25	31	36	29	30	30
Roof[9]	14	14	19	24	27	34	43	52

Table 4.5 Sound Reduction Indices for the Proposed Building Constructions

Table 4.6 below lists the sound power levels at the façades of the existing buildings used in the calculations.

Description	Sound Power Level re 10^{-12} W at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
Pump House NE façade	70	73	67	59	59	55	53	48
Pump House NW façade	71	73	70	69	74	66	61	51
Pump House SW façade	70	71	59	59	62	60	59	52
Pump House SE façade	67	73	78	68	69	67	56	60
Pump House Roof	89	91	87	86	91	84	79	69
Turbine Room SE façade	70	69	73	72	71	70	65	62
Generator	83	89	98	101	102	102	98	92

Table 4.6 Source Sound Power Levels used for the Existing Site[10]

Table 4.7 below lists the sound power levels at the façades of the proposed buildings used in the calculations.

8 Source: Acoustical Investigation & Research Organisation Ltd Test Data
9 Source: Sound Research Laboratories Test Data
10 Derived from the date in Table 4 using the formula described thereafter

Description	Sound Power Level re 10^{-12} W at Octave Band Centre Frequency (Hz)							
	63	125	250	500	1k	2k	4k	8k
New Pump House NE façade	94	95	85	78	82	80	73	65
New Pump House NW façade	90	92	82	75	79	77	69	62
New Pump House SW façade	94	95	85	78	82	80	73	65
New Pump House SE façade	90	92	82	75	79	77	69	62
Pump House Roof	73	88	86	87	96	81	65	60
Turbine Room SE façade	70	69	73	72	71	70	65	62
Generator	83	89	98	101	102	102	98	92

Table 4.7 Source Sound Power Levels used for the Proposed Site[3]

4.5.2 Calculation Methodology

For this assessment Brüel & Kjær Type 7810 Predictor has been used to calculate the noise levels at the nearest noise sensitive locations. This is a proprietary noise calculation package for computing noise levels in the vicinity of noise sources. Predictor predicts noise levels in different ways depending on the selected prediction standard. The resultant noise level is generally calculated taking into account a range of factors affecting the propagation of sound, including:

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

Prediction calculations have been performed using Predictor in accordance with ISO9613. The degree of accuracy associated with this prediction method is shown in Table 4.8 below.

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

Table 4.8 Estimated Accuracy for Broadband Noise of $L_{AT(DW)}$

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

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

4.6 Predicted Noise Levels

Based on the source levels described in Section 4.5.1 the noise impact of the treatment plant has been assessed for both the existing and future scenarios. For both scenarios noise contours across the surrounding area have been calculated in addition to more detailed noise level predictions at the façades of the nearest noise sensitive locations.

4.6.1 Existing Scenario

Table 9 presents the predicted noise levels at the nearest noise sensitive locations to the existing treatment facility. It should be noted that as a worst case it is assumed that the plant is in operation continuously during both the daytime and night-time periods. Therefore, it is appropriate to compare the predicted results with the more stringent night-time noise criterion of 40dB $L_{Aeq,5min}$.

Location	Predicted Noise Level, dB $L_{Aeq,5min}$	Design Goal, dB $L_{Aeq,5min}$	Mitigation Required?
NSL1	38	40	No
NSL2	35		
NSL3	31		
NSL4	35		

Table 4.9 Predicted Noise Levels from the Existing Facility using the Source Levels from Table 4.6

Figure 4.5 below presents the calculated noise contours for the existing facility.

The predicted noise levels are within the adopted design goal of 40dB $L_{Aeq,5min}$ during the night-time periods which indicates that the daytime design goal of 50dB $L_{Aeq,1hr}$ is also achieved. It should be noted that the predicted noise levels for the existing facility are of the same order of magnitude as the lowest noise levels measured during the ambient noise survey.

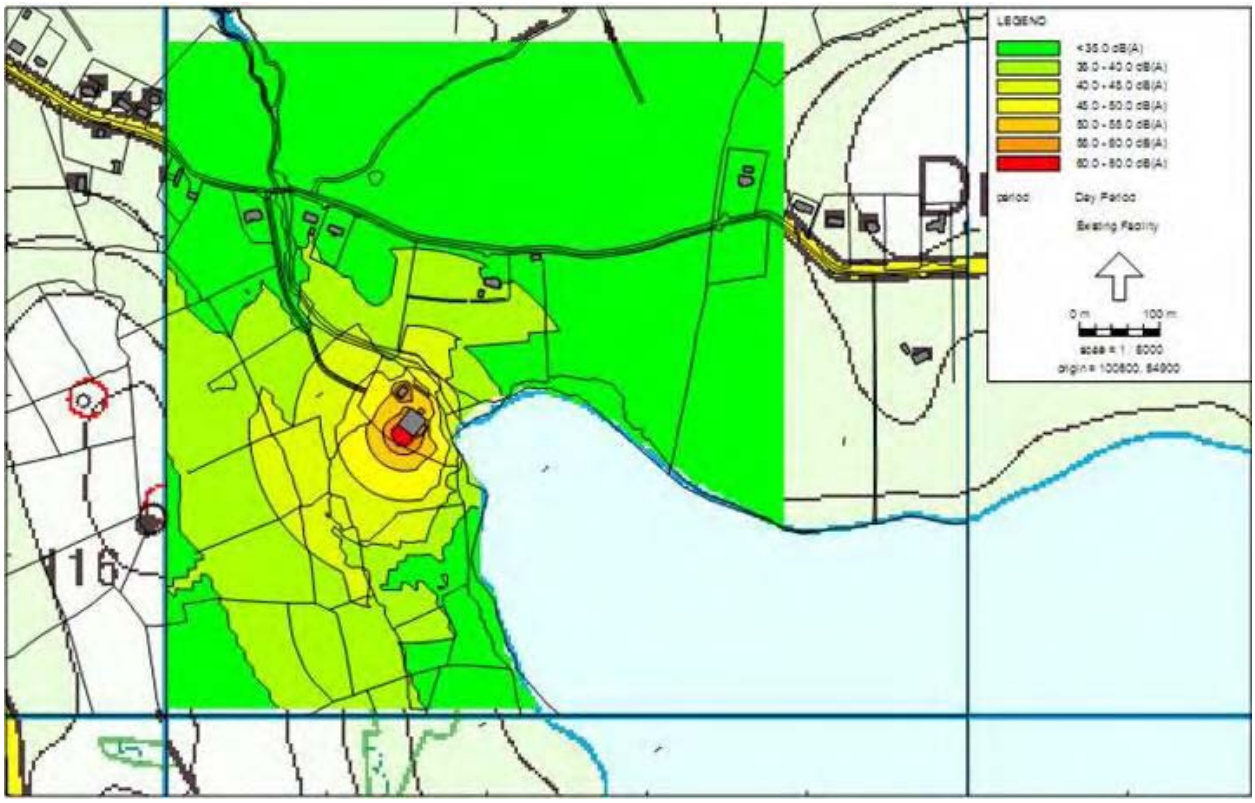


Figure 4.5 Noise Contours for the Existing Facility

4.6.2 Future Scenario

Table 10 presents the predicted noise levels at the nearest noise sensitive locations to the treatment facility for the proposed future layout. As before a worst case scenario has been assumed where the plant is in operation continuously during both the daytime and night-time periods. Therefore, it is only appropriate to compare the predicted results with the more stringent night-time noise criterion of 40dB $L_{Aeq,5min}$.

Location	Predicted Noise Level, dB $L_{Aeq,5min}$	Design Goal, dB $L_{Aeq,5min}$	Mitigation Required?
NSL1	30	40	No
NSL2	37		
NSL3	32		
NSL4	32		

Table 4.10 Predicted Noise Levels from the Proposed Facility using the Source Levels from Table 4.7

Figure 4.6 below presents the calculated noise contours for the proposed facility.

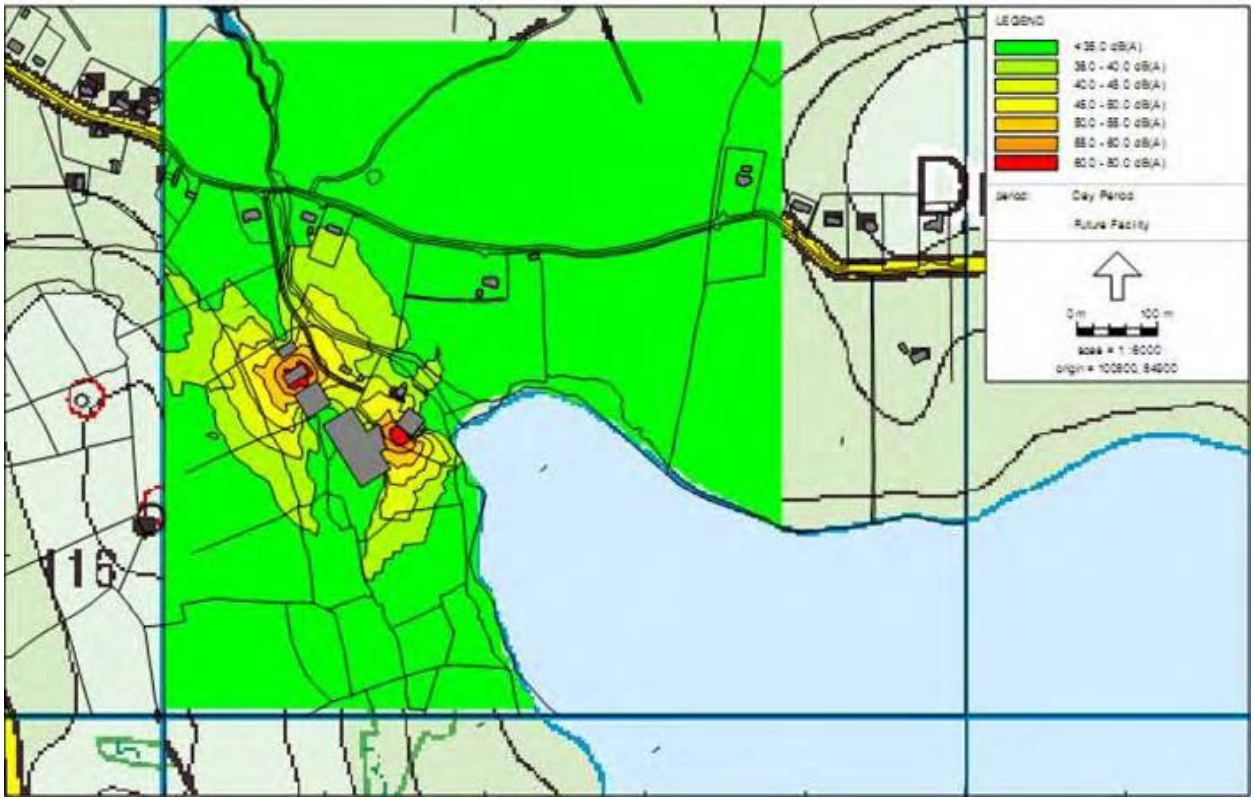


Figure 4.6 Noise Contours for the Proposed Facility

The predicted noise levels at the nearest noise sensitive locations are within the adopted night-time design goal of 40dB $L_{Aeq,5min}$. The changes to the site layout have resulted in the noise level increasing at locations NSL2 and NSL3 by less than 2dB. This is due to the fact that the high lift pumps are closer to these locations following their relocation. In order to provide some context to the impact that these increases will have. Table 4.11 provides a subjective guide to the level of impact associated with a range of noise level increases.

Change in Sound Level (dB)	Subjective Reaction	Impact
< 3	Inaudible	Imperceptible
3 – 5	Perceptible	Slight
6 – 11	Up to a doubling of loudness	Moderate
11 – 15	Over a doubling of loudness	Significant
> 15		Profound

Table 4.11 Likely Impact Associated with Change in Noise Level

It should also be noted that the noise levels are predicted to decrease at NSL1 and NSL4. This decrease is due to the relocation of the high lift pumps further away from NSL1 and also due to the shielding effect of the proposed de-sludge building which is located between the high lift pumps and NSL4.

It should be noted that the predicted noise levels in Table 4.10 only consider the noise generated from the high lift pumps, the turbine and the generator as these items of plant are to be retained following the upgrade and noise level data is available. However, there will also be several other smaller items of plant throughout the facility following the upgrade. At this stage the details of these plant items are unavailable making it impossible to predict the noise impact. It is considered, however, that provided that these other items are located inside the buildings on site there will be minimal additional impact. The high lift pumps, which have been included in the calculations, are expected to be the noisiest items of plant on site and therefore will dominate the noise levels.

4.7 Conclusions

An environmental noise survey has been carried out to assess the existing noise environment. Note that the noise levels measured during the survey are representative of the situation where the turbine within the facility is in continuous operation.

Based on the results of the noise survey and making reference to relevant published guidance documents appropriate noise criteria have been adopted for both the daytime and night-time periods.

Calculations have been carried out to predict the noise levels associated with the proposed items of plant within the facility. Both the existing and future site layouts have been assessed in order to provide a comparison.

Based on the results of these calculations it is concluded that the noise levels from the proposed upgrade do not change significantly from the existing situation and are within the adopted noise criteria. Therefore, it is unlikely that complaints will arise due to the external noise levels of the plant items.

Section 5 Terrestrial Flora and Fauna

5.1 Introduction

The proposed development is evaluated in the context of (a) the existing ecology at and around the site and (b) the potential impacts of the development on these features. Areas of scientific and/or conservation interest, as well as the presence of protected plant and animal species within the vicinity of the proposed development site are investigated. On the basis of consideration of the interactions of these factors, the predicted impact of the development is assessed. The cumulative impact of the development in light of existing land-use in the area is also considered.

This section focuses on the terrestrial ecology with reference to the freshwater ecology as appropriate. The habitats are evaluated and recommendations are made as to the mitigation of potential impacts on the local ecology.

The main ecological considerations relating to the development are the potential impacts on the adjacent Finow River, which is part of the Killarney National Park SAC/NHA. The Finow drains the development site. It flows from Lough Guitane into the River Flesk, both of which are salmonid waters. There are also populations of Freshwater Pearl Mussel *Margaritifera margaritifera* recorded from the Finow River and the River Flesk.

An evaluation of the biological water quality at the Lake outflow and the section of the Finow River immediately downstream of the outflow was carried out during an early stage of the environmental assessment process because a new discharge to the Finow was proposed at an early stage of the design development process. To avoid potential environmental issues the design was changed to avoid any need for a discharge. A survey of the Freshwater Pearl Mussel population of the Finow River and of a portion of the River Flesk was also carried out before the design was changed to avoid the need for the new discharge. The biological water quality assessment and Freshwater Pearl Mussel survey are included as Appendices IV and V to this report, respectively, by way of supplemental baseline information.

5.2 Methodology

The site of the proposed development was visited in November 2007 to provide data on habitats and fauna. The fieldwork consisted of a walkover survey of the site. The main habitats were identified and the species composition listed. Fauna noted at the site (actual sightings and observed tracks) were also recorded.

The habitats are classified according to Fossitt (2000). The habitats are described in the text and habitat codes (after Fossitt 2000) are presented in parentheses. Nomenclature for vascular plants follows Webb *et al.* (1996).

National Parks and Wildlife (NPWS), the South Western Fisheries Board (SRFB) and Environmental Protection Agency (EPA) databases were consulted for relevant ecological information relating to the site and surrounding areas. Informal consultation was carried out with local NPWS staff to provide site specific information relating to the area (NPWS Ranger, Tim Burkitt).

The proposed development site is evaluated for its ecological significance based on the outcome of desk and field studies. The temporary and permanent impacts of the development are evaluated using the *Guidelines for Ecological Evaluation and Impact Assessment* (Regini 2000). An outline of the decision framework is provided in Table 5.3 in section 5.3.6 and in Tables 3 and 4 in Appendix II.

5.3 Receiving Environment

5.3.1 General Site Description

The development site is located on the north-west shore of Lough Guitane between the townlands of Dromdiralough and Ford, approx. 8km south east of Killarney town. The site is rural and accessed by a narrow access road off a regional road that links the local area with the N71. There is an established water works facility at the site and water is presently abstracted from Lough Guitane.

The development site is approx. 5.5ha and irregular in shape. The existing buildings on site are surrounded by a landscaped and fenced area. The remainder of the development site comprises agricultural grasslands, scrub and hedgerow. The edge of Lough Guitane and banks of the Finow River are fringed with riparian woodland.

Land use in the study area is low intensity agriculture with extensive areas of blanket bog around Doo Lough to the north and freshwater habitats (Lough Guitane) to the south of the development site. Land-use in the area is therefore a mix of (a) established artificial habitats at the existing Water Works site, (b) agricultural lands adjacent to the proposed development site and (c) nature conservation and amenity/angling in the area of Lough Guitane.

The landscape around the site is rolling with low drumlins to the north, east and west, rising sharply to Crohane and Stoompa mountains south of Lough Guitane.

5.3.2 Rare Species and Designated Areas Records

There are no records for rare plants or animals within the development site and no rare or restricted distribution plants or animals were recorded during the survey of the site[11]. There are species listed in Annex II of the EU Habitats Directive present and utilising the wider area (personal communication with *NPWS*: Tim Burkitt). These include Otter, *Lutra lutra*, and Hare, *Lepus timidus hibernicus*. Other species such as Badger (*Meles meles*) and Fox (*Vulpes vulpes*) are likely to be present. The main corridors of activity for species of conservation interest however are within the designated Finow River and Lough Guitane habitats (see later and detailed site synopsis in Appendix III). The main conservation interests in the site area are the salmonid and Freshwater Pearl Mussel populations of the Finow and Flesk Rivers.

Areas of conservation interest located within 10km of the development site are outlined in Table 5.1. The dominant feature of the area is the Killarney National Park, Macgillycuddy's Reeks and Caragh River SAC, as shown in Figure 5.1. Lough Guitane and the Finow River are part of this designated area while the actual development site lies outside of the designated area boundary. Other areas of conservation interest in the wider area are Killarney National Park SPA and a number of Nature Reserves. There are a number of NHAs also within 10km of the site: Doo Lough and Killarney National Park NHA.

Name	Site Code	Designation	Distance from Development Site
Killarney National Park, Macgillycuddy's Reeks and Caragh River	000365	SAC/NHA	Adjacent
Killarney National Park	004038	SPA	5km W
Doo Lough	000350	NHA	1km N
Sheheree Bog	000382	SAC	4km NW

Table 5.1 Designated conservation areas within 5km of the development site

[11] It should be noted that all flora and fauna are protected in Ireland under the Wildlife and Amendment Acts (1976 and 2000).

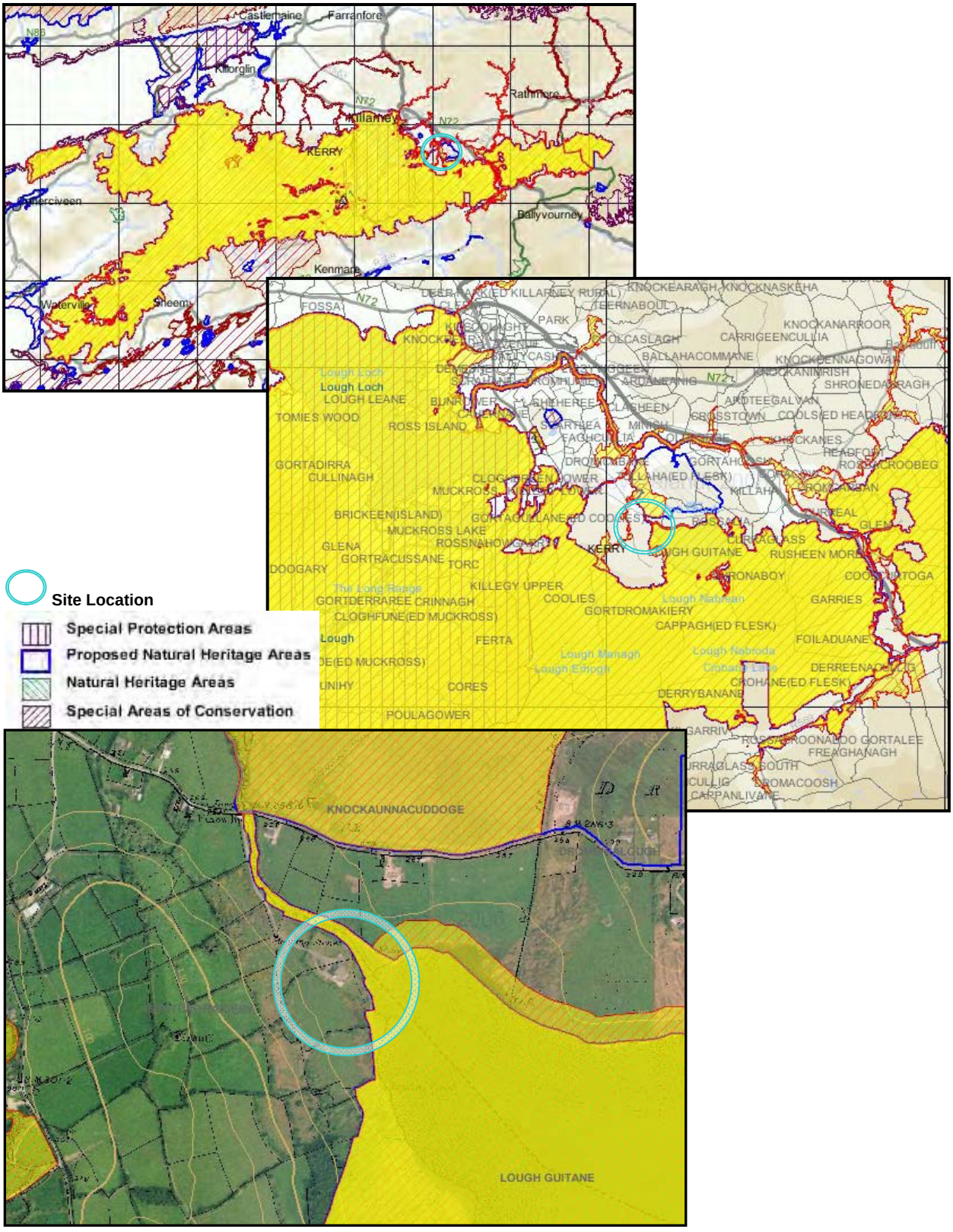


Figure 5.1 Ecological Designations

N.B. The Killarney National Park, Macgillycuddy's Reeks and Caragh River SAC is highlighted in yellow

Killarney National Park SAC, SPA, NHA

This site comprises an extensive land area and a range of habitats. The boundary of the designated area with the development site is marked by the natural boundary of the freshwater habitats of Lough Guitane and the Finow River. A brief overview of the qualifying conservation interests is provided here, with a full site synopsis of this and other conservation areas outlined in Appendix III. The main feature of interest however in relation to the development is the Finow River, which flows into the River Flesk.

The Killarney National Park, Macgillycuddy's Reeks and Caragh River site encompasses the mountains, rivers and lakes of the Iveragh peninsula, and the Paps Mountains which stretch eastward from Killarney towards Millstreet. It is the most mountainous region in Ireland and includes Carrauntoohil (1039m), the highest peak in the country.

The site is of great ecological interest, with at least ten habitats which are listed on Annex I of the EU Habitats Directive. The site is a candidate SAC selected for blanket bog, Yew wood and alluvial woodlands, priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for lowland oligotrophic lakes, upland oligotrophic lakes, floating river vegetation, alpine heath, dry heath, wet heath, *Molinia* meadows, old Oak woodlands, Rhynchosporion, Calaminarian grassland and Juniper scrub, 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 – Killarney Fern, Slender Naiad, Freshwater Pearl Mussel, Kerry Slug, Marsh Fritillary, Killarney Shad, Atlantic Salmon, Brook Lamprey, River Lamprey, Sea Lamprey, Lesser Horseshoe Bat and Otter.

The main qualifying conservation interests of the SPA site are the diversities of birds typical of upland and woodland habitats. Several nationally rare woodland species are present, notably Redstart. Two species, Red Grouse and Ring Ouzel, are Red-listed species of high conservation concern. Of note is the three species which occur regularly and are listed on Annex I of the E.U. Birds Directive, i.e. Peregrine, Merlin and Greenland White-fronted Goose. The goose population is also of significance as it is the most southerly in the country.

5.3.3 Finow River and River Flesk: Conservation Interest and Water Quality

The Finow River flows from Lough Guitane and joins with the River Flesk 2.5km north of the development site. Water quality is high, Q5 values were recorded upstream of Lough Guitane and Q4-5 downstream of Finow Bridge. The Flesk is a notable salmon fishery and both rivers are part of the greater River Laune catchment.

The water quality is high (see EPA data below) and there are recorded populations of Freshwater Pearl Mussel in both the Finow and Flesk. Other species of interest recorded along the river are Kingfisher and Otter (pers. comm. with T. Burkitt, NPWS Ranger).

From: http://www.epa.ie/downloads/pubs/water/rivers/epa_river_water_quality_report_2004.pdf

Hydrometric Area: 22 (Part)
River and Code: FINOW 22/F/04
Tributary of: Flesk OS Catchment No: 207
OS Grid Ref: W 010 875 Date(s) Surveyed : 14/10/2004

Sampling Stations	Biological Quality Ratings (Q Values)					
No. Location	1990	1994	1996	1998	2001	2004
0100 Br 0.3km u/s L Guitane	-	5	5	5	4-5	5
0300 Br (Ford) u/s Flesk R confl	4-5	4-5	4-5	4-5	4-5	4-5

Assessment: Satisfactory with no significant change. The pearl mussel, a protected species, lives in parts of the river.

5.3.4 Habitats

5.3.4.1 Introduction

The habitats recorded from the development site are outlined below. The habitats included are those from the actual development site and those that are located within immediate proximity of the development site, with a brief description provided of those in the surrounding area. The main habitat is Buildings and artificial surfaces (BL3) with landscaped areas at the existing Water Works facility (BC4). The main habitats on the footprint of the proposed extension of the facility are wet grassland (GS4) with a patchy network of hedgerows (WL1) and areas of gorse scrub (WS1) and dense bracken (HD1). The habitat along the lake and riverbank is riparian woodland (WN5). The Finow River is classified as an upland/eroding river (FW1) while Lough Guitane is considered an oligotrophic lake (FL2).

Habitat type	**Habitat code**
Buildings and artificial surfaces	BL3
Gardens, etc	BC4
Wet grassland	GS4
Hedgerows	WL1
Scrub	WS1
Habitats adjacent the development site	
Riparian woodland	WN5
Eroding/upland river	FW1
Oligotrophic lake	FL2

Table 5.2 Summary of the habitat types recorded at and adjacent to the development site

5.3.4.2 Habitat Descriptions

Buildings and artificial surfaces, BL3 and BC4

The existing Water Works facility comprises buildings and landscaped areas enclosed by a fence. The main habitats relate to actual functional aspects of the facility. The photograph at Figure 5.2 was taken from the north of the existing Water Works facility facing south east. The artificial nature of the habitats present is obvious by the existing buildings, access and landscaped area.

Figure 5.2 Photograph of Existing Water Works Facility

This picture was taken looking in a southeasterly direction towards the plant house & treatment works building (r.h.s.) and the turbine building (l.h.s.).

Wet grassland, GS4

This is the dominant habitat that lies outside of the existing facility and dominates the footprint of the proposed new water treatment areas. The main species present are Yorkshire Fog Holcus lanatus, with creeping bent Agrostis stolonifera and patches of soft rush Juncus effusus. Herbs recorded include clover Trifolium repens with occasional dock Rumex spp, buttercup Ranunculus repens, daisy Bellis perennis, and plantain Plantago lanceolata. There is a taller stand of wet grassland adjacent to the Finow River and north of the existing buildings. This is more diverse with other species such as centaury Centaurea nigra and meadowsweet Filipendula ulmaria and patches of dense bramble Rubus fruticosus. (ref. Figure 5.3)

Hedgerows, WL1

Hedgerows are present along the boundaries of the existing fenced facility and the other field boundaries. The composition and structure is diverse and structurally variable comprising hawthorn Crataegus monogyna, blackthorn Prunus spinosa, holly Ilex aquifolium, bramble Rubus fruticosus, willow Salix spp., spindle Euonymus europaeus, honeysuckle Lonicera periclymenum and dog rose, Rosa canina. Mature trees are scattered with ash Fraxinus excelsior, frequent. (ref. Figure 5.3)

Scrub, WS1 and Dense bracken, HD1

There are scattered patches of gorse Ulex europaeus scrub at the western edges of the development site, intermixed with batches of dense bracken Pteridium aquilinum. (ref. Figure 5.3)

Figure 5.3 Site of the Proposed Water Treatment Building

This photograph was taken facing southwest and shows the site of the proposed water treatment building. The main habitat is wet grassland with bordering hedgerows and scrub, and dense bracken in parts.

Oligotrophic lake FL2, Eroding stream FW1, Riparian woodland WN5

The main habitat outside of the development footprint is Lough Guitane, an example of an oligotrophic lake, FL2. The Finow River is classified as an eroding/upland river (FW1). Both the lake and river are bordered by riparian woodland (WN5). This woodland comprises a narrow strip at the edge of both the lake and river. The lake edge is dominated by willow Salix spp., birch Betula pubescens and gorse while the river bank is dominated by alder Alnus glutinosa, birch, and willow with some ash. The Royal Fern Osmunda regalis is dominant in the ground layer along the river bank.

Figure 5.4 Photograph of Natural Riparian Woodland (WN5) present along the Finow River (FW1).
The riparian zone is dominated by alder, birch and willow with royal fern in the understorey.

Habitats in the adjacent areas

The habitats occurring in the surrounding area include improved farmland areas and associated residential and outhouse buildings with mostly improved agricultural fields (GA1) and hedgerows. There is an extensive area of blanket bog (PB3) to the north of the site at Doo Lough.

Figure 5.5 Photograph of Existing Outflow of Turbine Tail Water to the Finow River
There are a number of houses in the surrounding area and land-use is mainly agricultural.

5.3.5 Fauna

Mammals
There were no direct sightings of mammals during visits to the development site. There were cattle and sheep grazing lands adjacent the site, and cattle feeders were installed at the development site which reflects the current land-use.

Mammals likely to be traversing the site are foxes (Vulpes vulpes) and hares (Lepus timidus hibernicus). Otter (Lutra lutra) has been recorded along the riparian habitats (personal communication with NPWS: T. Burkitt)[12]. Other species such as badger (Meles meles) may also utilise the site. There is no evidence of badger setts or fox dens, but they may utilise the area for foraging. Other species that may be active in the area are pygmy shrew (Sorex minutus), wood mouse (Apodemus sylvaticus) and brown rat (Rattus norvegicus). All of the aforementioned mammals may use the site for hunting and/or foraging (Hayden & Harrington 2000). The existing buildings are not noted as being an established bat roost. However, bats may utilise the hedgerows, scrub and riparian zones for feeding and movement.

Birds
A number of bird species were recorded on the site. These included: robin (Erithacus rubecula), wood pigeon, (Columba palumbus), wren (Troglodytes troglodytes) and over flying rook (Corvus frugilegus) and magpie (Pica pica). Other species may utilise the site such as common hedgerow species: blackbird (Turdus merula), blue tit (Parus caeruleus) and great tit (Parus major).

There is a wide diversity of birds utilising the wider area, particularly within the adjacent designated areas. These bird species may cross the site from time to time and utilise areas outside of the designated areas for foraging. Kingfisher has been recorded along the Finow River (personal communication with NPWS: Tim Burkitt).

Other vertebrates and invertebrates
There are no records of vertebrates for the site, however, other vertebrates likely to utilise the area are frogs (Rana temporaria). No invertebrates were recorded at the site but it is likely that the site is host to common butterflies. A range of small beetles, spiders and ants would also be found amongst the grassland vegetation, hedgerows and open water habitat.

N.B. Again, this relates to the actual development site. As noted already, Freshwater Pearl Mussel has been recorded from the Finow River.

5.3.6 Evaluation of the Ecological Value of the Site and Surrounding Area

An attempt is made here to provide an evaluation of the habitats within the proposed development site, and also in the context of the habitats recorded directly adjacent to the development site. The evaluation follows the Regini (2000) guidelines for ecological evaluation. This evaluation considers the presence/absence of noteworthy species and a judgement of the viability of the habitat present. The levels of ecological value are listed in Table 5.3.

[12] The results of a detailed otter survey are included in the *Appropriate Assessment of Predicted Increase in Drawdown of the Water Levels in Lough Guitane* which accompanies the Part 8 Application along with this report.

Ecological Value	
A	International value
B	National value
C	Regional Value
D	High local value
E	Moderate local value
F	Low local value
G	Negligible

Table 5.3 Levels of Ecological Value

The proposed development site is located adjacent to, and is hydrologically linked to a site of International value, A. This assignment is justified for the following reasons:

- The proposed development site is drained by the Finow River and is on the north-west edge of Lough Guitane, both freshwater systems of conservation significance for salmonid habitat and the former for recorded Fresh Water Pearl Mussel populations. The lake and river form part of the greater Killarney National Park SAC, NHA and proximal SPA. SACs and SPAs form part of the Natura 2000 network and are recognised as being of international and national importance within the EU and Ireland.

The actual development site lies outside of the designated area. The ecological value of the habitats within the proposed development site is considered to be of **Moderate local value, E**. This assignment is justified for the following reasons:

- The development site is adjacent to and hydrologically linked to the Killarney National Park SAC, SPA and NHA.
- A large part of the development site is dominated by the existing Water Works facility.
- The un-developed part of the development site comprises habitats that are low grade and widespread throughout the local area (agricultural grassland and scrub).
- There are no records or sightings of rare plants or animals within the proposed development site footprint. However, there are records of rare animals using the wider area and may cross the site at times.
- The hedgerow, scrub and riparian woodland network that form the natural boundary with the adjacent freshwater habitats provide a wildlife corridor for birds and mammals.

5.4 Characteristics of the Proposed Development

The footprint of the proposed development will impact on an area of approx. 4.6ha.

The development will comprise upgrade and expansion of the Water Treatment Plant and Abstraction Works including the construction of a proposed water treatment building, clear water tank, sludge treatment facility and wash-water settlement tanks and pumping station as described in Section 2. The existing discharge of water from the Owgarriff into the Finow River, as shown in Figure 5.5, will be ceased as this water will now be used as part of the plant's raw water intake.

The intensity of use will remain at a similar level to the current use.

5.5 Potential Impacts

The levels of magnitude of impact are assessed according to the Regini (2000) Guidelines (*see* Appendix II). Impacts are considered as (a) temporary (0-25 years) and (b) permanent (from 25 years) following from the initiation of development (Regini 2000).

5.5.1 Temporary Impacts during Proposed Activity

There will be a number of temporary impacts on the site during the construction and operational phases.

Designated conservation areas and rare species
Other than dredging work to be completed in Lough Guitane to re-establish dredged channel leading into the fish pass there will be no temporary impacts on Finow River and Lough Guitane habitats. The construction work will focus on the area outside of the freshwater and riparian zones. There will be no effect on species listed under Annex II and IV of the Habitats Directive.

N.B. This is given that (a) there are strict controls to limit run-off of sediment laden waters during construction and landscaping around the site and (b) that emission limits are set to avoid impacts on the current water quality of the Finow River.

Habitats and Fauna
There will be a high magnitude temporary impact on the habitats within the development site. The development involves the construction of facilities over the greater part of the development site. This will result in loss of the existing habitats. There will be high magnitude impact on the fauna present in the development area due to disturbance. This will be largely due to the loss of habitat from the site and disturbance during the construction and operation of the facility. However, the site is largely comprised of artificial habitats and faunal activity is currently low.

Following construction works the impacts will be of very low magnitude over the entire site. There will be no temporary impacts on habitats in the surrounding area, given that the activity will be restricted to the development site.

5.5.2 Permanent Impacts of the Development

Under the Regini (2000) guidelines, the permanent impacts are considered in the period after 25 years of onset of the development.

There will be no permanent impacts on any designated areas provided mitigation measures as set out in Section 5.7 are implemented.

There will be very low magnitude permanent impacts on habitats and fauna at the development site. The development will result in loss of existing grassland, hedgerows and scrub habitat (common and widespread in the wider area) and establishment of replacement artificial habitats[13].

5.6 Do-nothing Scenario

If the proposed development does not proceed, there will be no changes in the ecological value of the site and/or the surrounding area and no impacts on current populations of species.

5.7 Mitigation Measures

In any application for development consent, appropriate mitigation measures should be included as required to avoid or reduce any negative impacts on flora, fauna, habitats and aquatic systems.

5.7.1 Freshwater Pearl Mussel and Water Quality

Freshwater Pearl Mussel: All surface waters draining the site should be treated for protection of the receiving aquatic environment as set out below.

During construction: the main potential impact will be silt-laden waters. Silt traps will be located at all outfalls from the site to mitigate against excessive silt entering the Finow River.

[13] The *Appropriate Assessment of Predicted Increase in Drawdown of the Water Levels in Lough Guitane* which accompanies the Part 8 Application along with this report contains commitment to mitigation measures such as creation of frog ponds at the south east of the site.

During both construction and operational phases; oil receptors will be fitted on all drainage outfalls to mitigate against oil entering watercourses.

Reference will be had to the Fisheries Boards guidelines relating to construction works along rivers entitled *Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites,* (available at http://www.swrfb.com/environment/construction.htm). The aim of the guidance notes is to identify the likely impact on fisheries habitat in the course of construction and development work, and to outline practical measures for the avoidance and mitigation of damage. The following specific measures will be implemented:

1. Fuels, oils, greases and hydraulic fluids will be stored in bunded compounds well away from the watercourse. Refuelling of machinery, etc., will be carried out in bunded areas.
2. Run-off from machine service and concrete mixing areas will not be permitted to enter the watercourse.
3. Stockpile areas for sands and gravel will be kept to minimum size, well away from the watercourse.
4. Run-off from the above will only be routed to the watercourse via suitably designed and sited settlement ponds/filter channels.
5. Settlement ponds will be inspected daily and maintained regularly
6. The river bank will not be disturbed. A durable and highly visible fence will be erected to mark a 2m exclusion zone along the river's edge to ensure this.

5.7.2 Compensatory Habitats

The proposed development will result in the loss of grassland, scrub and patchy hedgerow. It is recommended that a programme of tree planting be incorporated into the overall site design. Trees and shrubs will be planted along the perimeter of the site, to link with the existing riparian woodland along the lake shoreline and provide a network of woodland habitats. This will provide a visual screen while also providing compensatory habitat and wildlife corridors to adjacent habitats. Native species will be planted, with a focus on trees already on site, such as hawthorn *Crataegus monogyna*, blackthorn *Prunus spinosa*, ash *Fraxinus excelsior*, rowan *Sorbus aucuparia*, holly *Ilex aquifolium*, and oak *Quercus robur*. Alder *Alnus glutinosa* and willow *Salix* spp. will be encouraged to expand in places directly along the lake shoreline.

The *Appropriate Assessment of Predicted Increase in Drawdown of the Water Levels in Lough Guitane* which accompanies the Part 8 Application along with this Environmental Report contains commitment to further mitigation measures such as creation of frog ponds at the south east of the site.

5.8 Predicted Impact

5.8.1 Direct and Indirect Impacts

The impact of the development will be a product of (a) construction of the facility, (b) the loss of habitat, (c) the use of the facility and (d) the mitigation measures incorporated into the design and operating phases.

Based on the field and desk studies presented here, it is predicted that the impact of the development on the proposed development site will be of moderate ecological significance (Regini 2000, see Table 5 in Appendix II). This evaluation is based on consideration of:

- The juxtaposition of the proposed development site relative to the Killarney National Park SAC/SPA/NHA.
- The widespread occurrence of similar habitat types within the local area and directly adjacent to the development site (the habitats at the site are considered to be of low grade and widespread in occurrence).
- The implementation of the outlined mitigation measures.

- Cessation of discharge of waters from the Owgarriff into the Finow River which will help protect the populations of the Freshwater Pearl Mussel and salmonids present.
- Planting of native trees and shrubs will increase the current ecological value of the site, particularly encouragement of riparian woodland.

The main negative impacts as outlined previously will be the loss of habitat from the development site, which is largely artificial and common in the local area, and disturbance of faunal activity through loss of habitat and disturbance. These are viewed as temporary and direct impacts.

As outlined there will be high magnitude impacts on the actual development area, which is marginal to the Killarney National Park designated area. Given the marginality of the site and the low-grade ecological value of the current habitats on site the overall predicted impact is of moderate significance.

Treatment of surface waters will mitigate against any potential impacts on water quality, and tree planting will provide compensatory habitat for scrub.

There are no negative indirect effects foreseen from the development on the flora and fauna within the local, regional and national context.

5.8.2 Cumulative Impacts

The development should be considered in the context of land-uses in adjacent areas. In particular, the existing Water Works. The development comprises an upgrading of the current facility which has been in operation for a number of years. Disturbance through existing noise and traffic has been ongoing for a number of years and will not impact further on habitats and faunal activity on the area.

5.9 Reinstatement and Residual Impacts

There is no re-instatement necessary. The facility will be operational for the long-term.

There are no negative residual impacts foreseen at this stage of the development.

5.10 References

Fossitt, J. 2000. *A Guide to the Habitats of Ireland*. The Heritage Council.
Hayden, T. & Harrington, R. 2000. Exploring Irish Mammals. Town House and Country House Ltd., Dublin.
Regini, K. 2000. Guidelines for ecological evaluation and impact assessment. *In Practice. Bulletin of the Institute of Ecology and Environmental Management*, 29, 2-7.
Webb, D.A., Parnell, J. & Doogue, D. 1996. *An Irish Flora.* (7th Edn.) Dundalgan Press, Dundalk.

Section 6 Landscape and Visual Impact

6.1 Introduction

This section analyses the existing landscape character and significance of the site. It also provides an evaluation of the potential for landscape and visual impacts associated with the proposed development. The assessment is made having regard to the vulnerability of the landscape to change and to the location of visual receptors relative to the proposed development.

6.2 Proposed Development

The project involves the augmentation and extension of an existing installation. It is important to note that the final design cannot be described at this time because the Design Build Operate Contract will include the provision of a final design by the successful tenderer. The design process sought to minimize the visibility of the proposed plant and went through a number of iterations utilising various building shapes, skylines, finishes and landscaping schemes in order to help achieve this. For the purposes of evaluation a 'worst case' design has been prepared which would occupy a larger footprint than any other acceptable plant which may be proposed.

The works which could give rise to impacts on the landscape will include:

- treatment facility which will be located adjacent to the existing Pumping Station
- Clear Water Tank/ Raw Water Blending Tank
- High Lift Pumping Station
- Sludge Dewatering Building and associated sludge buildings
- existing site road and hardstanding would be expanded to facilitate access to the various plant installation
- site fencing, lighting and other miscellaneous site works.

6.3 Existing Landscape

6.3.1 Introduction

This section provides the baseline description of the character and significance of the existing landscape to be used in the assessment of the effects on the appearance and character of the area.

6.3.2 Context

The following extracts from the current and Draft Kerry County Development Plans provide a context for this assessment:

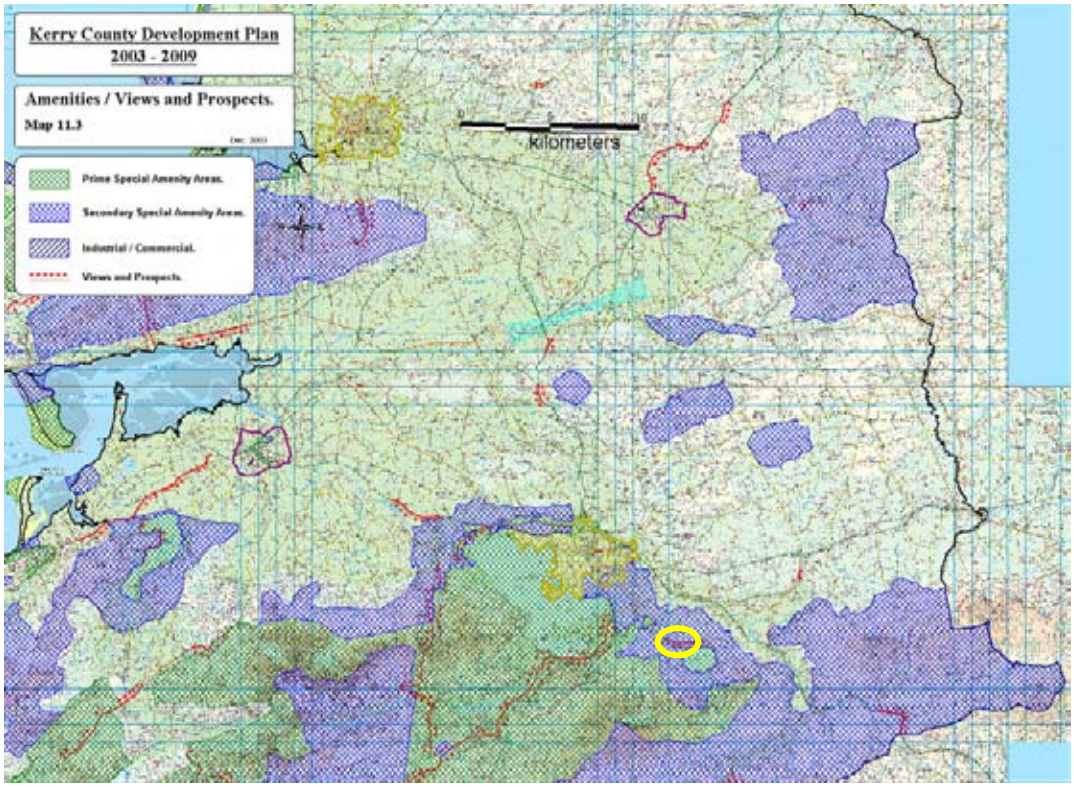


Figure 6.1 Extract from the current Kerry County Development Plan 2003 – 2009
(Approximate site location is circled in yellow)

The Site is shown to be in a Secondary Special Amenity Area while the lake is a Prime Special Amenity Area. The road facing the site is shown to be one of the designated Views and Prospects of the Plan.

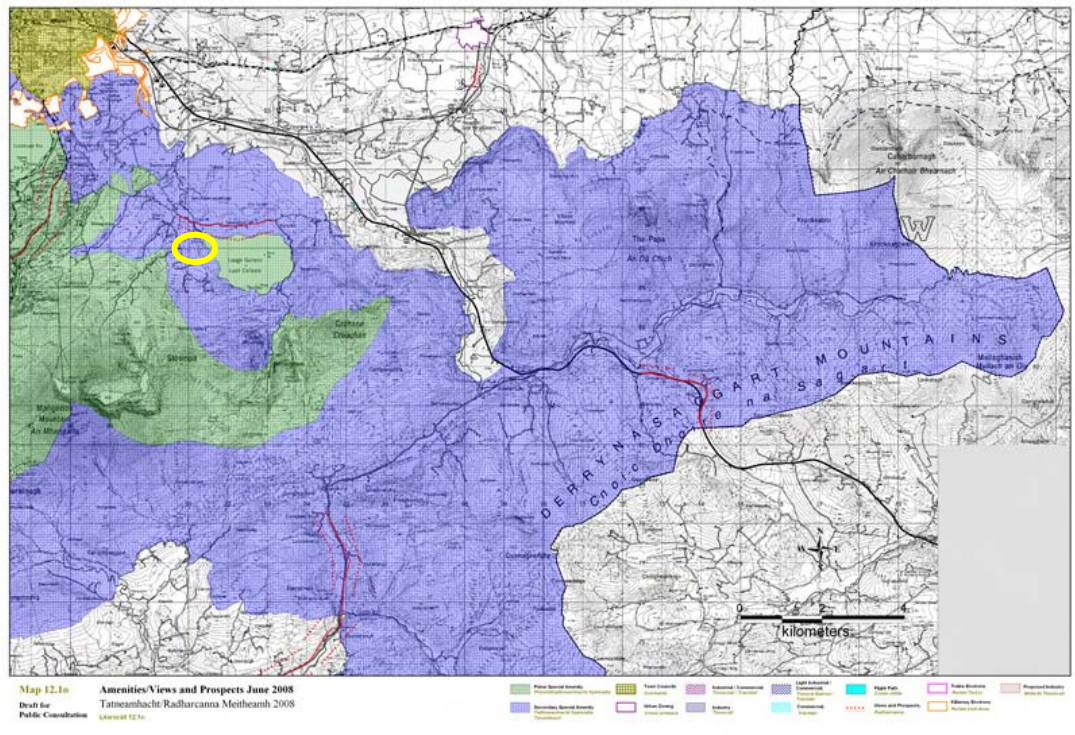


Figure 6.2 Extract from Kerry County Draft Development Plan 2009 – 2015[14]

This shows that the site is in an area designated for Rural Secondary Special Amenity.

[14] Map 12.10

Relevant Extract from the current 2003 – 2009 Plan:

Rural Secondary Special Amenity

11.2.8. The landscape of areas in this designation is generally sensitive to development. Accordingly, development in these areas must be designed so as to minimise the effect on the landscape. Proposal designs should take account of the topography, vegetation, existing boundaries and features of the area. Permission will not be granted for development which cannot be integrated into its surroundings. Residential development will be considered for people wishing to establish a primary place of residence in accordance with the provisions of Section 3.3.7 of this Plan.

Relevant extracts from the Draft 2009 – 2015 Plan:

b) Rural Secondary Special Amenity

12.2.8 The landscape of areas in this designation is generally sensitive to development. Accordingly, development in these areas must be designed so as to minimise the effect on the landscape. Proposed developments should in their designs take account of the topography, vegetation, existing boundaries and features of the area. Permission will not be granted for development which cannot be integrated into its surroundings.

12.3 View and Prospects

12.3.1 County Kerry contains areas of outstanding natural beauty which are recognised internationally. There is a need to protect and conserve views and prospects adjoining public roads throughout the county for future generations. In assessing views and prospects it is not proposed that this should give rise to the prohibition of development along these routes, but development, where permitted, should not seriously hinder or obstruct these views and should be designed and located to minimise their impact.

6.3.3 Character

The upland scenery around Killarney is a nationally significant scenic resource. It is valued both as scenery to admired from a distance and, increasingly, as an area to be visited by hill walkers and mountaineers who move through the uplands. The latter is recognised by the numerous designated (way-marked) trails throughout the area while the former is best established by the existence of the Killarney National Park – centred on Muckross House – the borders of which lie less that 5 kms from the site.

6.3.4 Sensitivity

Changes of appearance that would impinge on either the wilderness quality of the areas above the cultivation line or changes that would significantly (prominently) impinge upon the existing character of the shoreline of the lake would be likely to be widely perceived as significant and adverse effects.

6.3.5 Significance

The designations described in section 6.3.2 above confirm the popular perception that these are highly valued landscapes. This significance is heightened by the contribution that this scenery generally makes to the tourism industry which is the economic mainstay of nearby Killarney.

6.4 Likely Landscape effects

6.4.1 Introduction

This section describes the likely effects on the appearance and character of the landscape. It does so by reference to two technical documents. An estimation of the potential Zone of Visual Influence (ZVI) which estimates the extent of the area from where the development may be visible (Figure 6.4) and a series of simulated 'Visualisations' compared by computer to illustrate how the project might appear from a series of representative viewing points (Section 6.6 below). This analysis was directed and the results assessed by a chartered landscape architect who specializes in the assessment of landscape and visual impacts. The evaluation is limited to the effects of the development structures. It does not take account of the visual effects of operation – specifically the rise and fall of waters and the related exposure of more of or less shoreline. The latter is an established pattern, highly analogous to natural variation and is most unlikely to be otherwise perceived.

6.4.2 Methodology

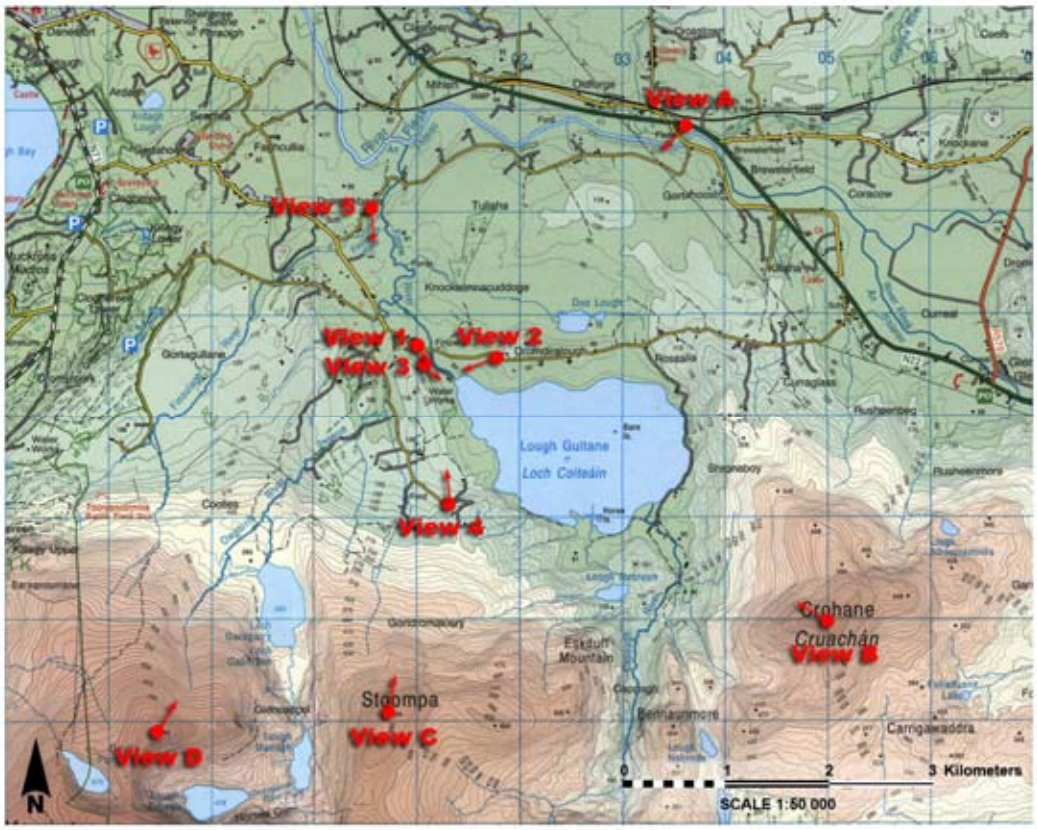


Figure 6.3 Location for Photographic Views

Views No 1 – 5 from the locations shown in Figure 6.3 have been subject to detailed analysis using computer-generated perspective simulations superimposed on photographs (photomontages). Four further views A – D have been provided to show the context. Locations for Views 1- 5 were selected on the basis of the ZVI (see Figure 6.4 below).

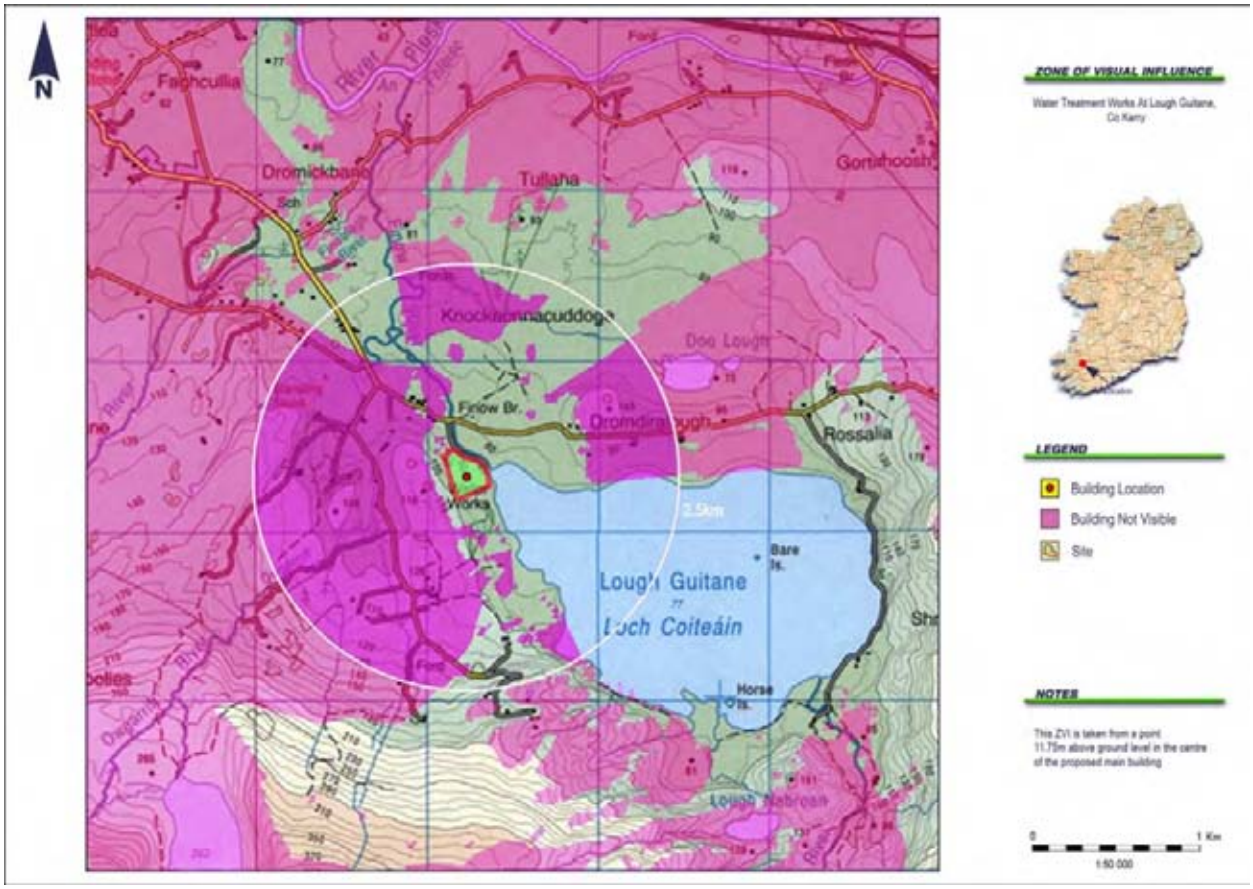


Figure 6.4 Zone of Potential Visual Impact

Figure 6.4 shows the theoretical extent of the visibility of some or all of the building based solely on topography. Actual visibility may be significantly less on account of vegetation.

A comparison between the zone of no potential visual impact shown in blue (above) with the mapping of the areas of visual sensitivities shown in blue (Figure 6.5) indicates that the proposed development has a very localised effect. Visibility from the upland areas occurs at distances of over 2km. At such distances the building will be difficult to discern. This is confirmed by examination of the Views A – D.

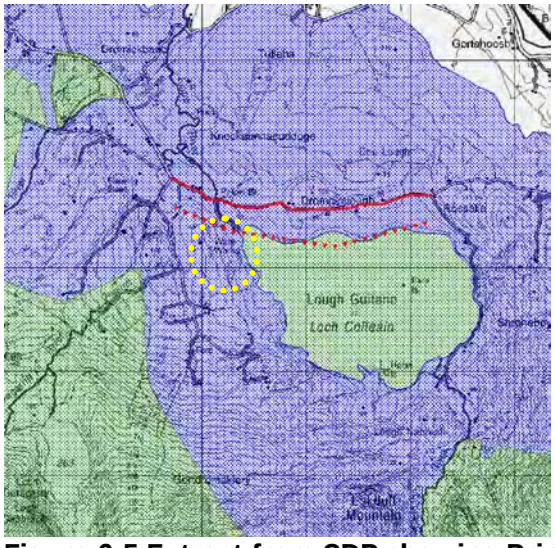


Figure 6.5 Extract from CDP showing Primary and Secondary Amenity Areas
Secondary Amenity Areas are shown in blue and Primary Areas in green. The site location is circled by yellow dots.

6.5 Landscape and Visual Effects

6.5.1 Conclusions

6.5.1.1 Visibility of project

Having regard to the evidence presented in the analysis of the extent of the area of potential visibility it is apparent – from Figure 6.4– that the proposed development will be visible over a limited area on account of existing topography and mature scrub and woodland vegetation. From distances in excess of 2km the site will be visible from elevated areas to the south. This is beyond the distance at which significant visual impacts occur.

6.5.1.2 Effects on Character

Where visible, the proposed development will usually be partially visible and always seen in the context of an established development, namely the existing treatment works as well as the pattern of fields, houses and other structures in the vicinity.

6.5.1.3 Residual Impact

Having regard to the selected forms, layout, configuration, finishes, colours and to the proposed mounding and planting as well as the mitigation measures set out in this report the proposed development will not give rise to significant, adverse or disproportionate contrasts of colour, scale, form or character. Accordingly it is concluded that there will be a permanent, slight localised effect on the appearance and character of the landscape. This is unlikely to be perceived as adverse.

6.6 Photomontages

6.6.1 Introduction

The following pages contain an analysis of how five views in the vicinity of the proposed development are likely to be affected by the proposed development. The methodology and rationale for the selection of these view locations are described in more detail at Section 6.4.2 and Figure 6.4 above.

Each view contains two images. The upper one illustrates the existing view while the lower shows the appearance after the construction of the works. Where the project will be fully screened by either topography or mature vegetation then the image contains an outline in red of the location and size of the development if it were to be visible from the location.

The views were prepared by a specialist consultant who carried also out the photography and the necessary positioning measurements to ensure that the photographs and the digital imagery would be correctly aligned.

Appendix VI contains a series of four additional distant views. These do not contain any modelling – because of the inability to either model or perceive the development at such distances. To confirm this statement note the very small size of the red outline contained in Views 4 and 5 (Figure 6.10 and Figure 6.11) – which are both less than 2km from the project. Views A – D are all located at distances of between 3 and 5km away from the works.

Figure 6.6 View 1
(Existing view on top - proposed view below)

The new works are visible at the center and right of center in the lower image.

Figure 6.7 View 2
(Existing view on top - proposed view below)
This is one of the most important locations on account of the designation of views from this road in the County Development Plan. The new works discernable behind the existing treatment buildings near the centre of the lower image.

Figure 6.8 View 3
(Existing view on top - proposed view below)
This view immediately north of the site boundary shows, in the lower image, how the proposed buildings will be screened by existing and new planting within five to ten years of the works.

Figure 6.9 View 4
(Existing view on top - proposed view below)

This view from an elevated location to the south shows how topography and existing woodlands obscure any views towards the works (outlined in red in the center of the lower image)

Figure 6.10 View 5
(Existing view on top - proposed view below)

View from a location to the north showing how woodland as well as topography obscure views from public roads approaching the site. Works are outlined in red left of centre in the lower image.

6.7 Mitigation Measures

Having regard to the fact that the site has a high level of visual sensitivity on account of it's proximity to, and overlooking by, nationally significant upland recreational areas, it's location within a designated landscape of significance as well as it's conspicuous location across a lake in a location that is directly visible from a designated view in the County Development Plan; the following mitigation measures will be included as a condition of contract to any tender for a Design Build Operate Contract

1. The site plan shall incorporate earth mounding to the south and east of the proposed structure.
2. All perimeters shall be planted in a mixture of trees and shrubs of similar species to that exist beyond the existing perimeter. Planting material shall be managed – and replaced if necessary - until it is suitably established.
3. The design shall be modified so that all fencing and signs – with the exception of entrance gates – shall be located within a planted perimeter.
4. All site lighting shall be located on the lowest practicable mountings; shall be equipped with cut-off shields to prevent light from falling outside the perimeter of the site and shall be operated so as to be used for minimum periods during site occupation.
5. The cross section of the structure shall conform with the design shown in this application – in terms of height and general shape. It shall not be higher, nor owing to the materials and details employed, shall it give rise to greater visual contrast or prominence than those created by the proposed design.
6. No extraneous details, openings, eaves, ridge, soffit or gable features shall be introduced that would give rise any visual contrast or intrusion by way of colour, finish or form, greater than that proposed by the current design. No trim, logos, lettering or any other focal visual material shall be introduced.
7. The locations, forms, dimensions and levels of all developments shall broadly conform to those indicated in this application.
8. No additional developments or activities – including storage or parking – shall take place that would be likely to give rise to any additional visibility of the site from the protected vistas or from the recreational activities overhead.
9. Where any modification or variation is proposed to the design that departs significantly from that illustrated in this application it shall be subject to rigorous, objective visual impact assessment based upon photographic simulations based employing the same views and methods used in this report. All such studies shall include a superimposed 'wire-frame' projection showing both the structures and the site plane to enable the accuracy of the assessment to be independently verified.

APPENDIX I

TO

ENVIRONMENTAL REPORT

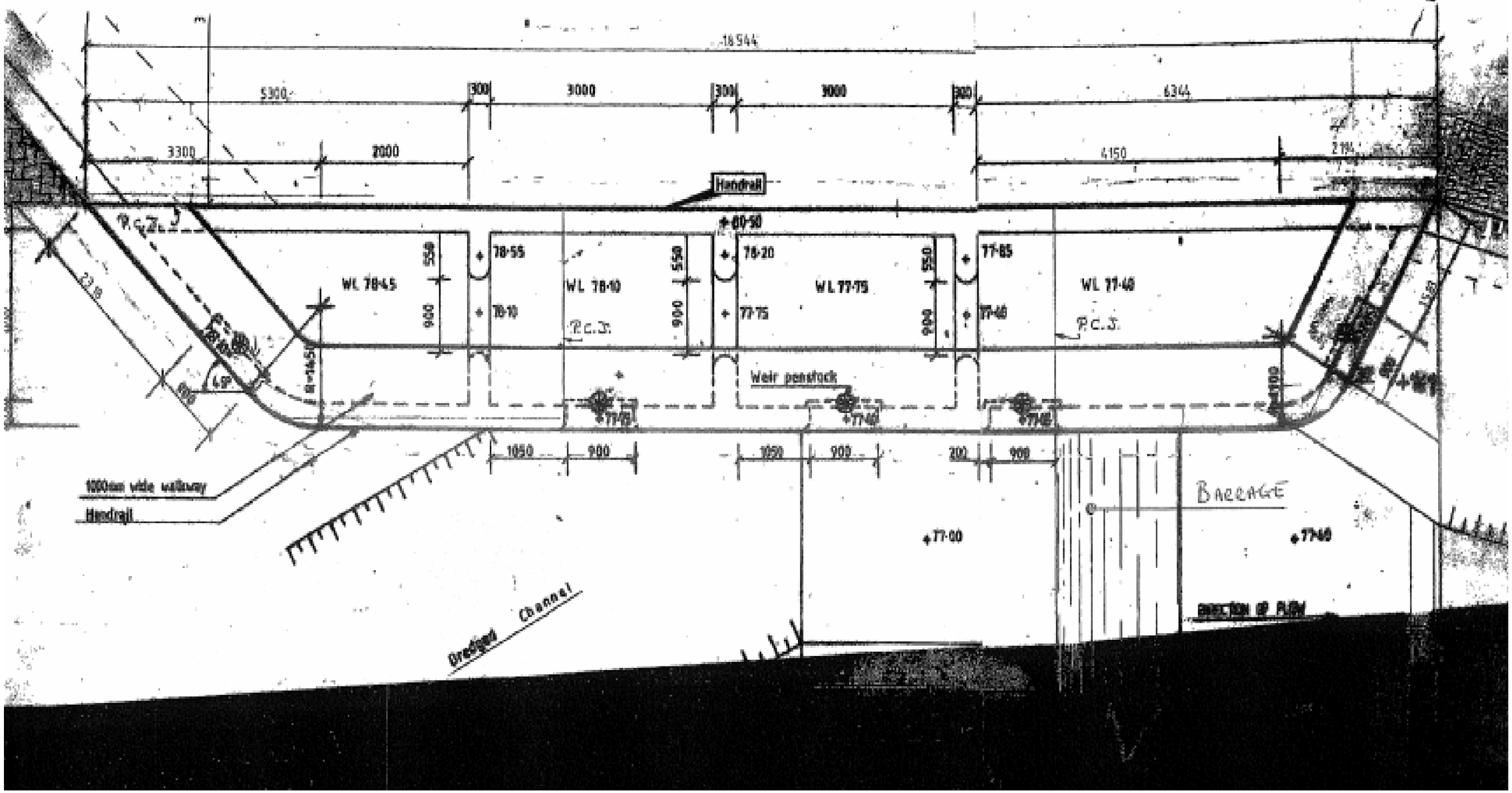
ON THE

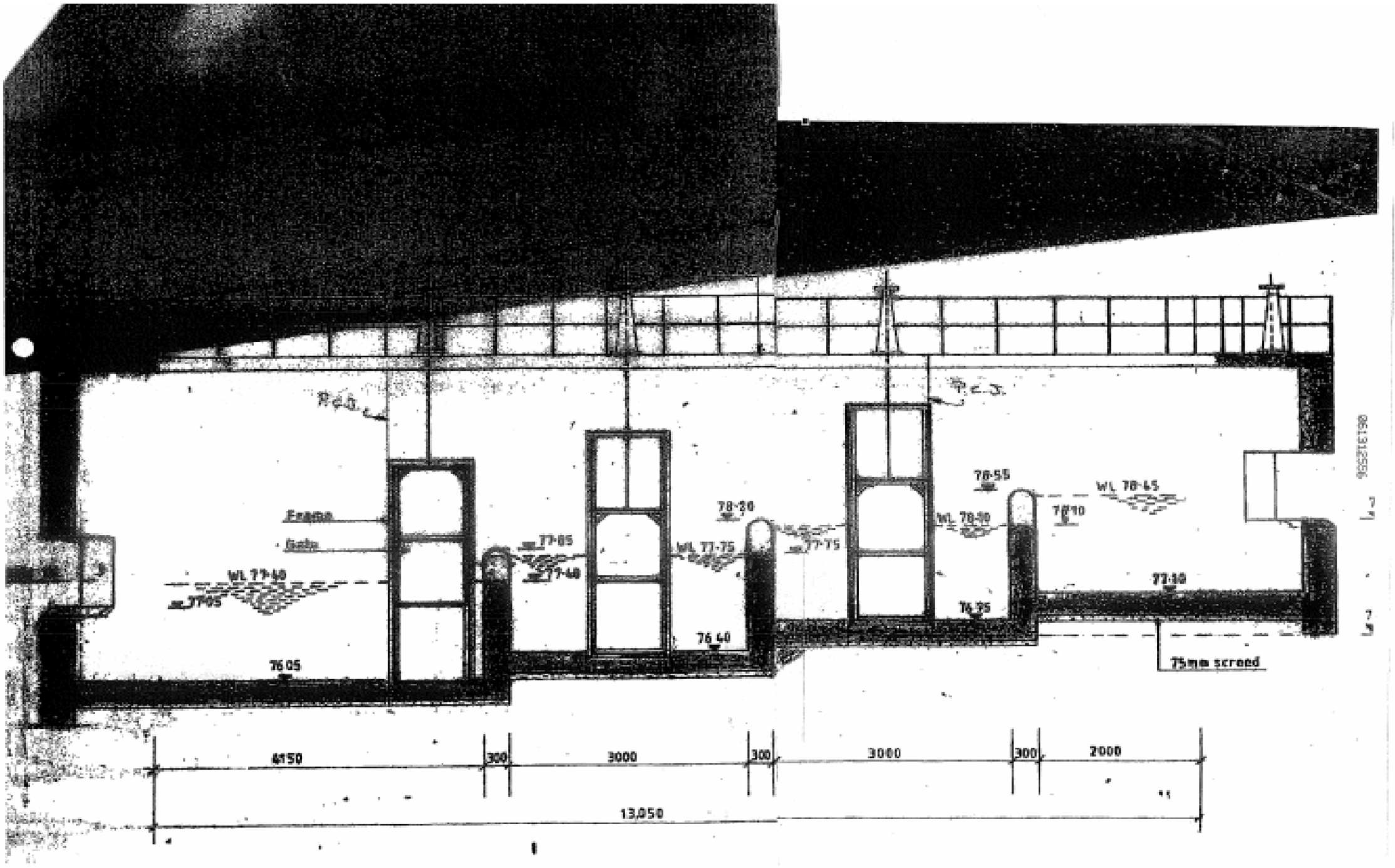
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

B

Plan of Lough Gowlane.

BARRAGE & FISH PASS





SECTION THROUGH LOUGH GUITANE FISH PASS.

APPENDIX II

TO

ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

REGINI GUIDELINES FOR ECOLOGICAL EVALUATION AND IMPACT ASSESSMENT

Outline of decision-making framework within the Regini (2000) *Guidelines for Ecological Evaluation and Impact Assessment.*

Table A. Impact Magnitude

High magnitude Loss of most of the site (i.e. >50% of the site area). Other effects (e.g. disturbance or damage arising from pollution) including indirect impacts having an adverse impact equivalent in nature conservation terms to a loss of >50% of the site area
Medium magnitude Loss affecting 20-49% of the site area. Other effects (e.g. disturbance or damage arising from pollution) including indirect impacts having an adverse impact equivalent in nature conservation terms to a loss of 20-49% of the site area.
Low magnitude Loss affecting 4-19% of the site area. Other effects (e.g. disturbance or damage arising from pollution) including indirect impacts having an adverse impact equivalent in nature conservation terms to a loss of 5-19%% of the site area
Very low magnitude Loss affecting 4% of the site area. Other effects (e.g. disturbance or damage arising from pollution) including indirect impacts having an adverse impact equivalent in nature conservation terms to a loss of 4%% of the site area

Table B. Impact Significance Matrix

Impact Magnitude	**Value of Feature**					
	International	**National**	**Regional**	**High Local**	**Moderate Local**	**Low Local**
High	Critical	Major	Major or Moderate	Moderate or Major	Minor or Moderate	Minor
Medium	Critical	Major	Major or Moderate	Moderate	Minor or Moderate	Minor
Low	Critical	Major or Moderate	Moderate	Moderate or Minor	Minor	Negligible or Minor
Very low	Critical	Moderate	Moderate	Moderate or Minor	Negligible	Negligible

APPENDIX III

TO

ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

DESCRIPTIONS OF DESIGNATED ECOLOGICAL SITES

SITE SYNOPSIS

SITE NAME: KILLARNEY NATIONAL PARK, MACGILLYCUDDY'S REEKS AND CARAGH RIVER CATCHMENT SAC/NHA
SITE CODE: 000365

This very large site encompasses the mountains, rivers and lakes of the Iveragh peninsula, and the Paps Mountains which stretch eastward from Killarney towards Millstreet. It is the most mountainous region in Ireland and includes Carrauntoohil (1039m), the highest peak in the country.

The underlying geology is almost entirely Old Red Sandstone, although Carboniferous Limestone occurs on the eastern shores of Lough Leane and rhyolitic lavas occur above Lough Guitane. The dramatic sandstone ridges and valleys have been shaped by glacial processes and many of the lakes are impounded by glacial moraines. Located close to the Atlantic in the south-west of Ireland, the site is subject to strong oceanic influences. Generally, the Lusitanian flora and fauna is well represented, while the high peaks and cliffs support arctic-alpine relicts.

The site is of great ecological interest, with at least ten habitats which are listed on Annex I of the EU Habitats Directive. The site is a candidate SAC selected for blanket bog, Yew wood and alluvial woodlands, priority habitats on Annex I of the E.U. Habitats Directive. The site is also selected as a candidate SAC for lowland oligotrophic lakes, upland oligotrophic lakes, floating river vegetation, alpine heath, dry heath, wet heath, *Molinia* meadows, old Oak woodlands, Rhynchosporion, Calaminarian grassland and Juniper scrub, 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 – Killarney Fern, Slender Naiad, Freshwater Pearl Mussel, Kerry Slug, Marsh Fritillary, Killarney Shad, Atlantic Salmon, Brook Lamprey, River Lamprey, Sea Lamprey, Lesser Horseshoe Bat and Otter.

The Oak woodlands, occurring mostly around the Killarney lakes, are the habitat for which the area is perhaps best known. They form the most extensive area of native woodland remaining in Ireland and include Derrycunihy Wood, described as perhaps the most natural Sessile Oak wood in the country. The woods are typically dominated by Sessile Oak (*Quercus petraea*) with an understorey of Holly (*Ilex aquifolium*). The Strawberry Tree (*Arbutus unedo*) is a notable component of the woods and there are scattered Yew (*Taxus baccata*). The herb layer is not particularly species-rich, but the woods support perhaps the best developed Atlantic bryophyte community in Europe. Several rare species are present including *Lejeunea flava, Cyclodictyon laetivirens, Daltonia splachnoides, Sematophyllum demissum* and *Radula carringtonii*.

Yew, which favours the limestone of Muckross peninsula, forms the only sizeable Yew woodland in Ireland and some of the trees are up to 200 years old. The dense shade beneath the tree results in few herbs in the ground flora, but the bryophyte layer is almost continuous. Wet woodland or carr, occurring on the low-lying limestone areas within the flood plain of Lough Leane, forms one of the most extensive areas of this woodland type in Ireland. The dominant canopy species are Alder (*Alnus glutinosa*), willows (*Salix* spp.), Ash (*Fraxinus excelsior*) and Downy Birch (*Betula pubescens*), while the field layer is dominated by Remote Sedge (*Carex remota*) and Creeping Bent (*Agrostis stolonifera*). Adding to the diversity of the woodland component of the site are a number of mixed woodlands, including those of Ross Island which support one of the richest herb layers of the Killarney woods.

The dominant habitat types within the overall site are blanket bog, heath and upland grassland. The heath and grassland generally occur on areas with shallow peat and on the mineral soils of the steep mountain sides, while the blanket bog occurs on the more gentle slopes, plateaux and other level ground. Often the habitats occur in a mosaic, with exposed rock frequently occurring. A variety of blanket bog types are represented from lowland valley to mountain blanket bog. Some of the best include: Cummeragh River Bog Nature Reserve, a domed bog which is perhaps the most southerly intact blanket bog in the country; Ballygisheen, which contains one of the most extensive areas of intact lowland blanket bog in Co. Kerry; Coomacheo / Caherbarnagh, which combine to form the largest mountain blanket bog in the south-west; Eirk Bog Nature Reserve, a classic example of a bog intermediate between a raised and blanket bog; Mangerton Bog, an upland bog which grades into an unusual lichen heath seen at no other site; and Oolagh East, a quaking basin mire. Generally, the

bogs have a characteristic flora. The Lusitanian species, Large-flowered Butterwort (*Pinguicula grandiflora*) is common. The bogs also support a number of unusual species, including mosses (*Sphagnum pulchrum, S. fuscum, S. platyphyllum, S. strictum, S. contortum* and *Calliergon stramineum*), liverworts (*Cladopodiella francisci* and *Calypogeia azurea*) and lichens (*Cladonia mediterranea, C. macilenta, C. rangiferina, C. arbuscula* and *Cetraria islandica*).

Rhynchosporion vegetation is confined to wet areas within the lowland blanket bogs, with one of the best areas for the habitat being to the north-east of the Ballygisheen Pass. On a portion of this bog there is an extensive area of quaking flats and pools dominated by *Sphagnum cuspidatum* and *Sphagnum auriculatum*. These areas have a typically species-poor flora which includes Bogbean (*Menyanthes trifoliata),* White Beak-sedge *(Rhynchospora alba),* Bog Asphodel *(Narthecium ossifragum),* Bog Cotton *(Eriophorum angustifolium)* and Great Sundew (*Drosera anglica)*. Brown Beak-sedge (*Rhynchospora fusca)*, a locally rare plant of wet bog pools, is occasional within the site. Although the habitat is best developed in very wet areas of intact bog it may also occur in wet areas of regenerating cutover blanket bog.

Wet heath often occurs in association with blanket bog and features Cross-leaved Heath (*Erica tetralix*). Dry heath is more frequent and is dominated by Heather (*Calluna vulgaris*), Bell Heather (*Erica cinerea*) and Western Gorse (*Ulex gallii*), with occasional Bilberry (*Vaccinium myrtillus*). This habitat is well developed on the Paps. Elsewhere it is often overgrazed, with upland grassland becoming more frequent. Some of the highest ridges support alpine heath (referable to the Lycopodium alpinum - Racomitrium lanuginosum association). Widespread plant species of the alpine heath include Bog Myrtle (*Vaccinium myrtillus),* Crowberry *(Empetrum nigrum)* and Fir Clubmoss (*Huperzia selago),* while species such as Juniper (*Juniperus communis* subsp. n*ana*) and Dwarf Willow *(Salix herbacea)* have a much more restricted distribution.

The site contains many lakes, but these can be broadly divided into two types: small upland corrie lakes and larger lowland lakes. Examples of the first type are Lough Murtagh and Lough Gortavehy in the Paps. They are oligotrophic and typically species-poor, with Quillwort (*Isoetes lacustris*), Water Lobelia (*Lobelia dortmanna*) and Shoreweed (*Littorella uniflora*) occurring most commonly. The lowland lakes are mostly oligotrophic, although Lough Leane, the largest fresh water body in the region, has become somewhat mesotrophic as a result of pollution from Killarney town. These lowland lakes tend to be more species-rich than those at higher altitudes, with additional species such as Awlwort (*Subularia aquatica*), Six-stamened Waterwort (*Elatine hexandra*) and Alternate Water-milfoil (*Myriophyllum alterniflorum*). Good examples include Lough Caragh, Upper Lake and Muckross Lake.

The rivers associated with these lakes are also of importance. The Caragh is relatively unpolluted from headwater to estuary, a rare phenomenon in Europe. The Flesk runs over Old Red Sandstone in its upper reaches and limestone as it nears Lough Leane. Both rivers support floating and submerged vegetation and rare invertebrates. Rocks around the smaller mountain streams often support a lush vegetation of ferns and bryophytes, most notably at Torc Waterfall.

Other habitats of note include: Juniper (*Juniperus communis*) scrub found on islands in the Upper Lake and on dry ridges in nearby Newfoundland Bog; damp meadows, with Purple Moor-grass (*Molinia caerulea*), supporting scarce species such as Whorled Caraway (*Carum verticillatum*) and Ivy-leaved Bellflower (*Wahlenbergia hederacea*); and Calaminarian grasslands, associated with the old copper mines on Ross Island, with species such as Sea Campion (*Silene vulgaris* subsp. *maritima*) and Thrift (*Armeria maritima*).

A large number of plant and animal species of interest occur within the site: There are two plant species listed on Annex II of the EU Habitats Directive: Slender Naiad (*Najas flexilis*) which is found in some of the lakes; and, most famous of all, the Killarney Fern (*Trichomanes speciosum*). An additional twenty-two Red Data Book plant species have been recorded, but only twelve of these have been seen recently. These are Pillwort (*Pilularia globulifera*), Kerry Lily (*Simethis planifolia*), Irish Lady's Tresses (*Spiranthes romanzoffiana*), Slender Cottongrass (*Eriophorum gracile*), Slender Cudweed (*Logfia minima*), Betony (*Stachys officinalis*), Heath Cudweed (*Omalotheca sylvatica*), Alder Buckthorn (*Frangula alnus*), Alpine Saw-wort (*Saussurea alpina*), Hoary Whitlowgrass (*Draba incana*), Smooth Brome (*Bromus racemosus*) and Holly Fern (*Polystichum lonchitis*). The first seven of these species are legally protected (Flora Protection Order, 1999).

The site is very important for oceanic bryophytes, particularly the woodland species. It also contains good representative examples of the Northern Atlantic Hepatic Mat community and other oceanic montane communities. Killarney Oak woods and mountains have been nominated as a site of international importance for bryophytes. Additional plant species of interest include a fern (*Dryopteris affinis* subsp. *stilluppensis*) and a Whitebeam (*Sorbus anglica*), both at their only Irish locations.

The Killarney Woods are notable for the number of rare species of Myxomycete fungus that have been recorded, namely *Collaria arcyrionema*, *Craterium muscorum*, *Cribraria microcarpa* (only known Irish site), *C. rufa*, *C. violacea*, *Diderma chondrioderma*, *D. lucidum*, *D. ochraceum*, *Fuligomuscorum*, *Licea marginata*.

The site has six bird species which are listed on Annex I of the EU Birds Directive. A small flock of Greenland White-fronted Geese, which winters on the boglands within the National Park, is now the only regular flock in the south-west. The site has one of the highest concentrations of breeding Peregrines in the country, as well as some breeding Merlin. Chough is found both in the coastal areas and inland areas of the site, with possibly up to 30 pairs breeding. Kingfisher is a species associated with the lakes and rivers, especially in the National Park and probably breeds. Finally, a few pairs of Common Tern breed within the site. The woodlands provide habitat for a variety of breeding birds, most notably Garden Warbler, Blackcap, and probably a few pairs each of the rare Redstart and Wood Warbler. Lough Leane is a site for wintering wildfowl with the following the average counts for the two winters 1995/96 and 1996/97: Teal (208), Mallard (350), Pochard (81), Tufted Duck (323) and Coot (169).

The site supports most of the Irish mammal species. Of particular note is the occurrence of two EU Habitats Directive Annex II species: Lesser Horseshoe Bat, with a total population of about 300 individuals distributed at several locations, including both nursery and hibernation sites, and Otter. Perhaps the best known mammals of the Killarney National Park are the Red Deer, which form the only remaining native herd in Ireland, comprised of around 600 animals. Sika Deer also occur. Pine Marten is another notable species.

The site is valuable for its rare fish species, five of which are listed on Annex II of the EU Habitats Directive: Brook Lamprey (*Lampetra planeri*), River Lamprey (*Lampetra fluviatilis*), Sea Lamprey (*Petromyzon marinus*), Atlantic Salmon (*Salmo salar*) and Killarney Shad (*Alosa fallax killarnensis*). The Killarney Shad is a unique land-locked subspecies confined to the Killarney lakes. Also of note is the glacial relict, Arctic Charr (*Salvelinus alpinus*), a Red Data Book species, a unique form of which is found in Lough Coomasaharn.

There are numerous rare invertebrates within the site. These include three EU Habitats Directive Annex II species: Kerry Slug (*Geomalacus maculosus*), the Freshwater Pearl-mussel (*Margaritifera margaritifera*) and the Marsh Fritillary (*Euphydryas aurinia*). The Kerry Slug and Pearl-mussel populations are of particular importance in a national context. Other species of note include: three chironomids of international importance found in the River Flesk; a wood ant (*Formica lugubris*) at one of only four Irish sites; a snail (*Limnaea involuta*), in Lough Crincaum, at its only known location; two dragonflies (*Cordulea aenea* and *Somatochlora arctica*), the former at one of only two known sites in Ireland and the latter at its only known Irish location; and several other aquatic and woodland species at their only known Irish locations.

The main land-use within the site is grazing by sheep. In and around the National Park deer grazing is also common. The extensive grazing has caused damage to many of the terrestrial habitats, resulting in degradation of heath and blanket bogs and prevention of woodland regeneration. In the upland habitats the erosion caused by grazing is exacerbated by the exposed nature of the terrain. Apart from grazing, the woodlands are particularly threatened by Rhododendron (*Rhododendron ponticum*) invasion: approximately two thirds of the Oak woodlands are affected, although a Rhododendron removal programme is underway in the National Park. The Yew wood has been adversely affected by heavy grazing for many years, but it is intended to control this in the near future by erection of a deer fence. The bogs are sensitive to grazing and are also threatened by turbary, burning and afforestation. Most of the lakes are very acid sensitive and therefore vulnerable to afforestation within the catchment

areas. Lough Leane has been subject to some eutrophication, although water quality appears to have improved since phosphates were removed from the sewage in 1985.

A management plan was drawn up for the Killarney National Park in 1991. The park is managed primarily for conservation purposes although recreation is also provided for. Overall, the site is of high ecological value because of the diversity, quality and extensiveness of many of the habitats and impressive list of rare species of flora and fauna. In recognition of its importance the Killarney National Park has been designated a World Biosphere Reserve.

5.12.2005

SITE SYNOPSIS
SITE NAME: SHEHEREE (ARDAGH) BOG SAC
SITE CODE: 000382

Sheheree Bog lies 2 km south-east of Killarney in a depression within a high ridge (103 m). It has developed by succession from a small lake to a ridge basin bog with similarities to a raised bog. The vegetation is dominated by Heather (*Calluna vulgaris*) up to 0.5m high with frequent Autumn Gorse (*Ulex gallii*) and Bog Myrtle (*Myrica gale*) while Purple Moor-grass (*Molinia caerulea*), Bog Cottons (*Eriophorum* spp.) and Cross-leaved Heath (*Erica tetralix*) are also found, and to a lesser extent Bog Asphodel (*Narthecium ossifragum*), Deergrass (*Scirpus cespitosus*) and Round-leaved Sundew (*Drosera rotundifolia*). A range of *Sphagnum* species are found, forming thick, cushiony carpets in places, while occasional hummocks of the moss *Leucobryum glaucum* also occur.

A concentration of Downy Birch (*Betula pubescens*) and Scots Pine (*Pinus sylvestris*) trees grow towards the north-east of the site beneath which abundant *Sphagnum* grows. The open bog adjacent to this is quite wet and Cranberry (*Vaccinium oxycoccos*) grows abundantly here. Surrounding the bog is a wet lagg area. Here more base-demanding species occur, such as Bogbean (*Menyanthes trifoliata*), Marsh Cinquefoil (*Potentilla palustris*), Marsh-marigold (*Caltha palustris*), Water Horsetail (*Equisetum fluviatile*), Marsh Pennywort (*Hydrocotyle vulgaris*), Yellow Iris (*Iris pseudacorus*), Bulrush (*Typha latifolia*), Bulbous Rush (*Juncus bulbosus*), Bottle Sedge (*Carex rostrata*) and Cuckooflower (*Cardamine pratensis*). To the north and north-west, the lagg is vegetated by wet woodland of Alder (*Alnus glutinosa*) and Willow (*Salix* sp.) with some Hawthorn (*Crataegus monogyna*), Hazel (*Corylus avellana*), Ash (*Fraxinus excelsior*) and Holly (*Ilex aquifolium*) in the drier outer margins. The site also includes dry grassland fields which slope down to, and adjoin, the bog.

The Rare and legally protected Slender Cottongrass (*Eriophorum gracile*) occurs at this site, while a rare invertebrate has also been noted.

The bog itself is not substantially used, owing to its wetness and the wetness of the surrounding lagg. The high bog is being invaded by Rhododendron (*Rhododendron ponticum*) and Scots Pine, which may indicate drying of the mire. The abundance of *Cladonia* lichen in places may be a result of burning in previous years. Adjoining fields are grazed by cattle and sheep and fertilised to varying degrees. Landuse practices here would impact on the bog habitat.

Sheheree Bog is a statutory Nature Reserve and is internationally important as a substantially intact example of a bog type uncommon in the region. The site hosts the Rare Slender Cottongrass while the abundance of Cranberry in places is exceptional. Additionally the presence of Alder and Downy Birch woodland and a well-developed lagg are of interest.

9.1.1997

SITE SYNOPSIS
SITE NAME: KILLARNEY NATIONAL PARK SPA
SITE CODE: 004038

This large site encompasses the lakes and part of the Macgillycuddy's Reeks in the vicinity of town of Killarney. The underlying geology is Old Red Sandstone, although Carboniferous limestone occurs on the eastern shores of Lough Leane. Lough Leane is the largest (8.6 km along its long axis) of the lakes in the site, and is classified as a mesotrophic system. Muckross Lake and the Upper Lake are both high quality oligotrophic systems. Aquatic vegetation in the lakes is diverse and includes such species as Quillwort (*Isoetes lacustris*), Water Lobelia (*Lobelia dortmanna*) and Shoreweed (*Littorella uniflora*).

The site is of ornithological importance as it supports a good diversity of upland and woodland birds, as well as wintering waterfowl. It is a traditional site for a Greenland White-fronted Goose population - while the numbers are now low (less than 20 birds), the population is still of importance as it is the most southerly in the country and also one of the few remaining populations that feed entirely on bogland. Upland species which breed within the site include Peregrine (at least 1 pair), Merlin (up to 5 pairs), Red Grouse and Ring Ouzel (1-2 pairs). Both Red Grouse and Ring Ouzel are Red-listed species in Ireland. The extensive woodlands support some scarce breeding birds, notably Redstart (1-2 pairs), Wood Warbler (1-2 pairs) and Garden Warbler (possibly up to 10 pairs). Lough Leane, and to a lesser extent the other lakes, support a variety of wintering waterfowl species, though all in relatively low numbers. The following counts are the average peaks for three of the five winters in the period 1995/96-1999/00: Cormorant (86), Teal (184), Mallard (361), Pochard (54), Tufted Duck (271), Goldeneye (23) and Coot (124). Other species using the site include Black-headed Gull (84), Mute Swan (38) and Little Grebe (11).

Several research programmes have been carried out on the birds in the site, including studies on the communities associated with the Yew woodlands, and the wildfowl associated with the lakes.

A large number of plant and animal species of interest occur within the site, including most of the native Irish mammal species, several important fish species including Arctic Char, and a range of rare or scarce plant species.

The main land-use within the site is grazing by sheep and deer. The extensive grazing has caused damage to some of the habitats, resulting in degradation of heath and blanket bogs and prevention of woodland regeneration. In the upland habitats the erosion caused by grazing is exacerbated by the exposed nature of the terrain. Apart from grazing, the woodlands are particularly threatened by Rhododendron (*Rhododendron ponticum*) invasion, although a Rhododendron removal programme is underway in the National Park. Lough Leane has been subject to eutrophication (mainly from sewage) in the past and remains vulnerable. A management plan was drawn up for the Killarney National Park in 1991. The park is managed primarily for conservation purposes although recreation is also provided for.

The site is of ornithological importance because it supports good diversities of birds typical of upland and woodland habitats. Several nationally rare woodland species are present, notably Redstart. Two species, Red Grouse and Ring Ouzel, are Red-listed species of high conservation concern. Of note is that three of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Peregrine, Merlin and Greenland White-fronted Goose. The goose population is also of significance as it is the most southerly in the country.

1.4.2005

Derrycunihy Wood Nature Reserve
Co. Kerry

Location: situated in Killarney valley adjoining and surrounding Killarney National park.
Area (ha.): 136
Owned by Coillte, this Nature Reserve consists of old native oak woodlands with some patches of bog and lakeshore. It is the best example of a damp-climate oceanic wood with luxuriant growth of mosses and ferns high up in the trees.
Animals and Plants of Interest: The wood is grazed by two kinds of deer; all year round by the Japanese Sika Deer—introduced in the 19th century—and in winter by the native Red Deer from the open hills. This results in a slight "Brown line" under which many of the palatable leaves and twigs have been eaten, and in lawn-like patches on the ground.

Sheheree Bog Nature Reserve
Co. Kerry
Location: situated in the Killarney district of Kerry.
Area (ha.): 8.9
This bog is the only raised bog in the Killarney district of Kerry. It has a well-developed lagg or marginal drainage system, a very rare feature in this country. It is the habitat of the plant slender cotton grass protected under the Wildlife Act. The bog is considered to be very valuable for comparative studies with the intermediate and blanket bog of the Killarney and Owenreagh valleys.
Established 1990. State owned.

Cummeragh River Bog Nature Reserve
Co. Kerry
Location: Situated 8 kilometres north east of Waterville.
Area (ha.): 45.55
The bog is the most southerly intact lowland blanket bog in Ireland and is of international importance. It is almost completely encircled by the Cummeragh River and tributary. It is in excellent condition and actively growing, has a well developed pattern of hummocks and pools and has a mature and luxuriant vegetation cover. The bog, which is now owned by the National Parks and Wildlife Service, was originally purchased with donations from the Dutch Foundation for the Conservation of Irish Bogs.
Established 1984. State owned.

Animals and Plants of Interest: Curlews nest on the bog. Their long bills are adapted to probing for worms deep in the soft soil of surrounding farmland. The two rivers that border the Nature Reserve contain spawning beds for Sea Trout. There is insufficient lime in bogs for snails to form shells but you can find slugs here, including the spectacular Black Slug.

Eirk Bog Nature Reserve
Co. Kerry
Location: Situated in the Owenreagh valley, Killarney, 1 km. north of Moll's Gap.
Area (ha.): 16
Part of a very well developed and little disturbed example of an intermediate bog with associated poor fen and blanket bog/wet heath communities.
Established 1986. State owned.

APPENDIX IV

TO

ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

BIOLOGICAL WATER QUALITY SURVEY

Biological Water Quality Assessment of the Finow River

November 2007

Prepared by:
Pascal Sweeney M.Sc., MIEEM,
Consultant Ecologist
Rahan,
Mallow
Co. Cork.
Tel. 022/26780

TABLE OF CONTENTS

1. INTRODUCTION

The purpose of the present report by Pascal Sweeney, Consultant Ecologist, is the biological assessment of water quality of the Finow River in the vicinity of the proposed discharge of an upgrade of an existing Kerry County Council water treatment plant. The survey was designed to assess the current biological water quality, based on macroinvertebrate communities, and to provide baseline information against which future data could be compared.

---

2. SAMPLING SITES

Two biological sampling sites were first established. Site co-ordinates and other site information are presented in Table 1.

Site 1. Upstream of the discharge point. Due to the layout of existing structures at the outflow of the Finow River from Lough Guitane, there is no area of river upstream of the discharge point that is well suited for assessment of biological water quality. At the time of the field visit, there was no flow over the weir across the lake outflow, resulting in a back-currant from the discharge point. The flow from the channel on the eastern side of the weir (left bank of the river) does not mix with this back-flow for the first few metres. However the flow in this channel is strong and deep, with a substratum dominated by large stones. A sample was taken at this location for the purpose of establishing baseline biological data upstream of the discharge.

Site 2. Downstream of the point. Approximately 50m downstream of the discharge point, there is a stretch of riffle that is ideal for the assessment of biological water quality by the EPA methodology.

3. METHODOLOGY

3.1 Habitat Assessment.

Field work was carried out on 23 November, 2007.

Habitat assessment was carried out at each of the sites. The sites were assessed in terms of:

- Width and depth
- Substrate type, listing substrate fractions in order of dominance.
- Flow type, listing percentage of riffle, glide and pool in the sampling area
- Instream vegetation, listing plant species occurring and their percentage coverage of the substratum at the sampling site
- Dominant bankside vegetation, listing the main overhanging species
- Estimated summer cover by bankside vegetation

Grid references were recorded at all sites using a GARMIN eTrex GPS handset.

To illustrate habitat quality, photographs were taken using an Olympus µ300 digital camera.

3.2 Invertebrate Sampling and Biological Water Quality Assessment.

At Site 1, suitable stones were kicked into a pond net and washed to dislodge invertebrates. Larger stones were turned over in front the net so that drifting invertebrates were caught. At Site 2, a kick and stone wash invertebrate sample was taken (ISO 7828:1985) using standard methodology employed by the EPA. Each sample was retained in a clip-top sample bucket (Eolas BS 7320 standard). Sample processing and preservation was carried out within 24 hours of sampling. Samples were live sorted for 30 minutes in a white plastic sorting tray. Macroinvertebrates were stored in 70% alcohol. Preserved invertebrates were identified to at least the level required for the EPA Q-scheme method (Toner *et al*, 2005) using high-power and low-power binocular microscopes when necessary. The preserved samples were archived for future examination or verification. Based on the relative abundance of indicator species, a biotic index (Q-value) was determined for Site 2 in accordance with the biological assessment procedure used by the Environmental Protection Agency (Statutory Instruments No. 258 of 1998).

4. RESULTS

4.1 Physical Data

The physical data recorded at each site are presented in Table 1.

TABLE 1

	Site 1	**Site 2**
Location	1m upstream of discharge point in channel on LHS of river.	c. 50m downstream of discharge point
Grid Reference	W0131 8543	W0127 8546
Photograph No.	1	2
Width of flow(m.)	4	8
Depth (cm.)	70	20
Substrate Composition (in order of occurrence)	1. Large stones. 2. Cobble 3. Gravel 4. Sand	1. Cobble 2. Gravel 3. Sand
Flow Type	Run: 100%	Riffle: 100%
Shade	Light	Heavy
Dominant Bankside Vegetation	Fuchsia, Willow, Birch	Willow
Instream vegetation	None	Moss: 15%

4.3 Macroinvertebrate Community Analysis by Site.

The numbers of individuals of each macroinvertebrate taxon sorted in 30 minutes from samples taken at the two sites are given in Tables 2 and 3.

TABLE 2: SITE 1

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	None Recorded	
B	Moderately Pollution Sensitive	*Sericostoma personatum*	2
		Lepidostoma hirtum	2
C	Moderately Pollution Tolerant	*Potamopyrgus antipodarum*	2
		Gammarus duebeni	16
		Baetis rhodani	3
		Caenis sp.	28
		Polycentropodidae	1
		Limnephilidae	1
		Hydroptilidae	25
		Elmidae	10
		Dytiscidae	2
D	Very Pollution Tolerant	*Glossiphonia sp.*	1
		Pisidium sp.	1
E	Most Pollution Tolerant	None recorded	
Taxa not assigned to any Indicator Group		Lumbriculidae	9

At this site, the physical conditions are not very suitable for use of the Q-scheme methodology. In addition, because the site is so close to the lake outflow, with no shallow area, it is not possible for a normal river fauna to establish. Consequently, a Q-value obtained from the above data misleading. This data would, however, be useful in interpreting any future changes at Site 2.

TABLE 3: SITE 2

INDICATOR GROUP	POLLUTION SENSITIVITY/TOLERANCE	TAXON	NUMBER
A	Very Pollution Sensitive	Perlodidae	6
		Ecdyonurus sp.	30
B	Moderately Pollution Sensitive	Nemouridae	3
		Taenopterygidae	5
		Leuctra sp.	12
		Sericostomatidae	10
C	Moderately Pollution Tolerant	Hydracarina	1
		Gammarus duebeni	14
		Baetis rhodani	10
		Hydropsychidae	9
		Elmidae	8
		Tipulidae	1
		Chironomidae (ex. *Chironomus*)	3
D	Very Pollution Tolerant	None recorded	
E	Most Pollution Tolerant	None recorded	
Taxa not assigned to any Indicator Group		Lumbriculidae	10
		Naididae	2
		Ceratopogonidae	1

The composition of the macroinvertebrate community at Site 2 warrants a Q-value of **Q4-5,** indicating unpolluted conditions.

5. CONCLUSIONS

The Finow River, in the vicinity of the Kerry County Council water treatment plant is unpolluted (Q4-5).

---

6. REFERENCES

Toner *et al* (2002) *Water quality in Ireland 2001 – 20003*. Environmental Protection Agency.

APPENDIX I

Photo 1, Site 1

Photo 2, Site 2

APPENDIX V

TO

ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

FRESHWATER PEARL MUSSEL SURVEY

Report on a preliminary "Rapid Assessment" of the *Margaritifera margaritifera* (L.) population in the Finow River and in the Flesk River for 1km downstream of its confluence with the Finow River.

Report prepared by: Dr. Eugene Ross,

Chestnut Drive, Killeen, Oakpark, Tralee, Co. Kerry.
Telephone 066 7127096, E-mail eugeneross@eircom.net

Report Date: May 12th, 2008.

Introduction.

The freshwater pearl mussel, *Margaritifera margaritifera* (L.) is one of three species of large Unionacean bivalves found in Irish freshwaters. The species may occur in fast-flowing, oligotrophic, calcium deficient streams and rivers, where it can grow to lengths of 159mm (Jackson 1925) and live to ages well in excess of 100 years (Ross 1984). *Margaritifera* has been recorded in most parts of Ireland with the exception of the central limestone plain but several studies have confirmed that a significant decline has occurred in some Irish populations, notably in northern and eastern areas (Ross 1988, Moorkens and Costello 1994, Beasley and Roberts 1996). Such declining populations are usually characterised by a predominance of older mussels and an absence of juvenile recruitment (Bauer 1983).

Although previously very widely distributed across northern Europe, Eurasia and North America, *Margaritifera* is declining throughout its range and is extinct or seriously threatened in many parts of Europe (Wells et al. 1983). The main cause of this decline is deteriorating river water quality although a variety of other factors are also implicated (Moorkens 1999).

Both *Margaritifera margaritifera* and *Margaritifera durrovensis* are listed on Annex II and Annex V of the Habitats and Species Directive (92/43/EEC), under the modified list published in 1997 (97/62/EEC). *Margaritifera* is protected under Irish Law by the Wildlife Act 1976 and Wildlife (Amendment) Act 2000 (added to fifth schedule under Statutory Instrument No. 112, 1990). The species are also listed as “Protected fauna species” under Appendix III of the Bern Convention (Council of Europe’s Convention on the Conservation of European Wildlife and Natural Habitats, 1979). *Margaritifera margaritifera* is listed on the most recent International Union for Conservation of Nature and Natural Resources (IUCN) Red Data List as "Endangered", while *Margaritifera durrovensis* is listed as “ Critically endangered” (IUCN, 1996).

The 2007 assessment of *Margaritifera margaritifera*, completed for the purposes of Habitats Directive reporting, concluded that the species is in unfavourable – bad conservation status in Ireland.

Arising from the proposed upgrading of the water treatment plant on the Finow River, and the proposed increase in water drawdown from Lough Guitane, the Department of the Environment, Heritage and Local Government recommended, inter alia, that the distribution, size and status of the *Margaritifera margaritifera* population in the Finow and parts of the Flesk rivers be established.

Although *Margaritifera* was known to be present in both the Finow and Flesk rivers, no detailed information exists on the distribution, size and status of the populations present. This report describes preliminary rapid assessments of the distribution and size of the *Margaritifera* populations in the Finow and that part of the Flesk River immediately downstream of the Finow confluence.

Methods.

Survey methods were adapted from those used in National Parks and Wildlife Service monitoring projects 2004-2007 (Moorkens, 2004 a; 2005 a to d; 2006 a to c; Ross, 2004 a & b; 2005 a & b; 2006 a to e; 2007).

Mussel searches were carried out in an upstream direction. Due to the generally shallow and rocky nature of the Finow River, all searches were conducted using a viewing device while wading. Three kilometres of the Finow River from its confluence with the Flesk, to a point 150m upstream of Finow Bridge was assessed. As the Flesk river was a substantially larger and deeper river, a series of nineteen 1m wide transects along a stretch of 1.16km downstream of the Finow River confluence, was investigated while snorkelling.

Using a hand-held Garmin GPS60C global positioning device, ten figure grid references were recorded at the upstream and downstream limits of each stretch investigated. Positional and descriptive photographs were taken at each site investigated.

All river field work was conducted in accordance with the weather and visibility guidelines of the Irish Pearl Mussel Standard Methods Survey Techniques (Anon., 2004), under Licence No. C85/2007 issued by the National Parks and Wildlife Service.

Results.

Fieldwork was carried out on the Finow and Flesk Rivers on April 17th and May 8th, 2008, respectively.

Finow River: The numbers of mussels observed during preliminary searches of 19 stretches, comprising the 3.0km of the Finow River assessed, are indicated in Figure 1. A total of 119 mussels was observed. Mussels observed were generally large adults. The smallest live mussel recorded was 54.7mm in length. A dead shell measuring 37mm was recorded on a gravel bank at the confluence of the Finow and Flesk, but it is not known which from which river this mussel originated. Mussels were present upstream from the Flesk confluence to a point 167m downstream of Finow Bridge. Mussel densities observed were generally very low.

Habitat suitable for *Margaritifera* was present along most of the 3.0km assessed, with the exception of some torrential sections with boulder substrates, and some sections where the substrate consisted predominantly of mobile gravels. The boulder/cobble type substrate encountered in much of the Finow was difficult to search and mussels were often obscured by heavy growths of moss covering the substrate. Light growths of filamentous green algae were observed in unshaded areas of substrate along much of the stretch examined.

Flesk River: Figure 2 indicates the locations of the nineteen 1m wide transects searched for *Margaritifera*, in the 1.16km of the Flesk River immediately downstream of the Finow confluence. Mussels were recorded in all but four of the nineteen transects examined, and *Margaritifera* was observed to be present along the entire 1.16km stretch examined. Mussel densities were relatively low, ranging from 0 to 15m^{-1} of river length. A total of 52 mussels was observed in the 19 transects examined. These transects appeared to be representative of the 1.16km of river channel examined.

The habitat was generally suitable for *Margaritifera* along the entire stretch examined, although siltation and growth of filamentous green algae were observed along most of the stretch. Significant growths of macophytes, mainly crowsfoot (*Ranunculus*) were present at most of the transect locations.

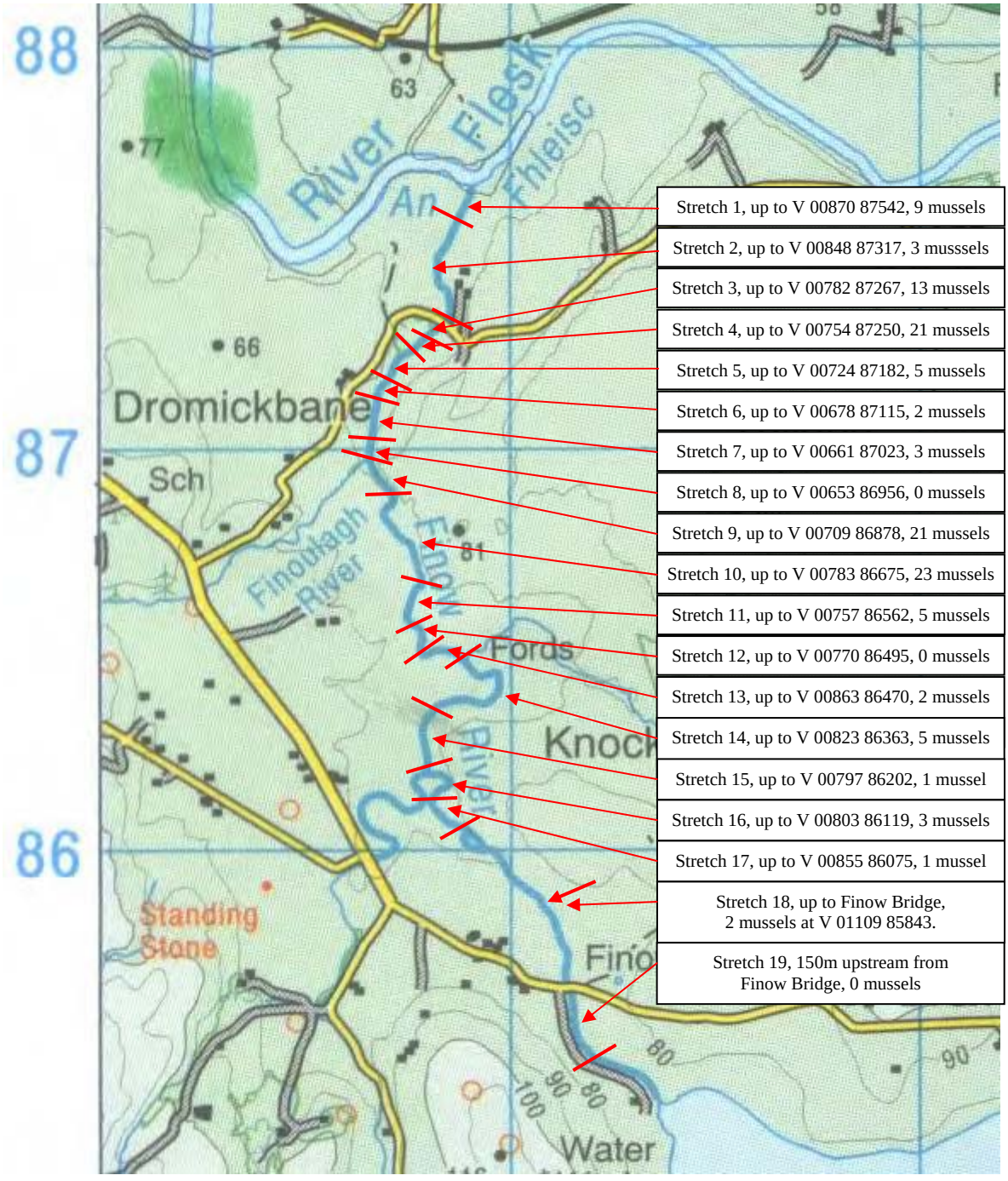


Figure 1. A map of the Finow River indicating locations and limits of the stretches searched for *Margaritifera margaritifera*, together with the numbers of mussels recorded n each stretch.

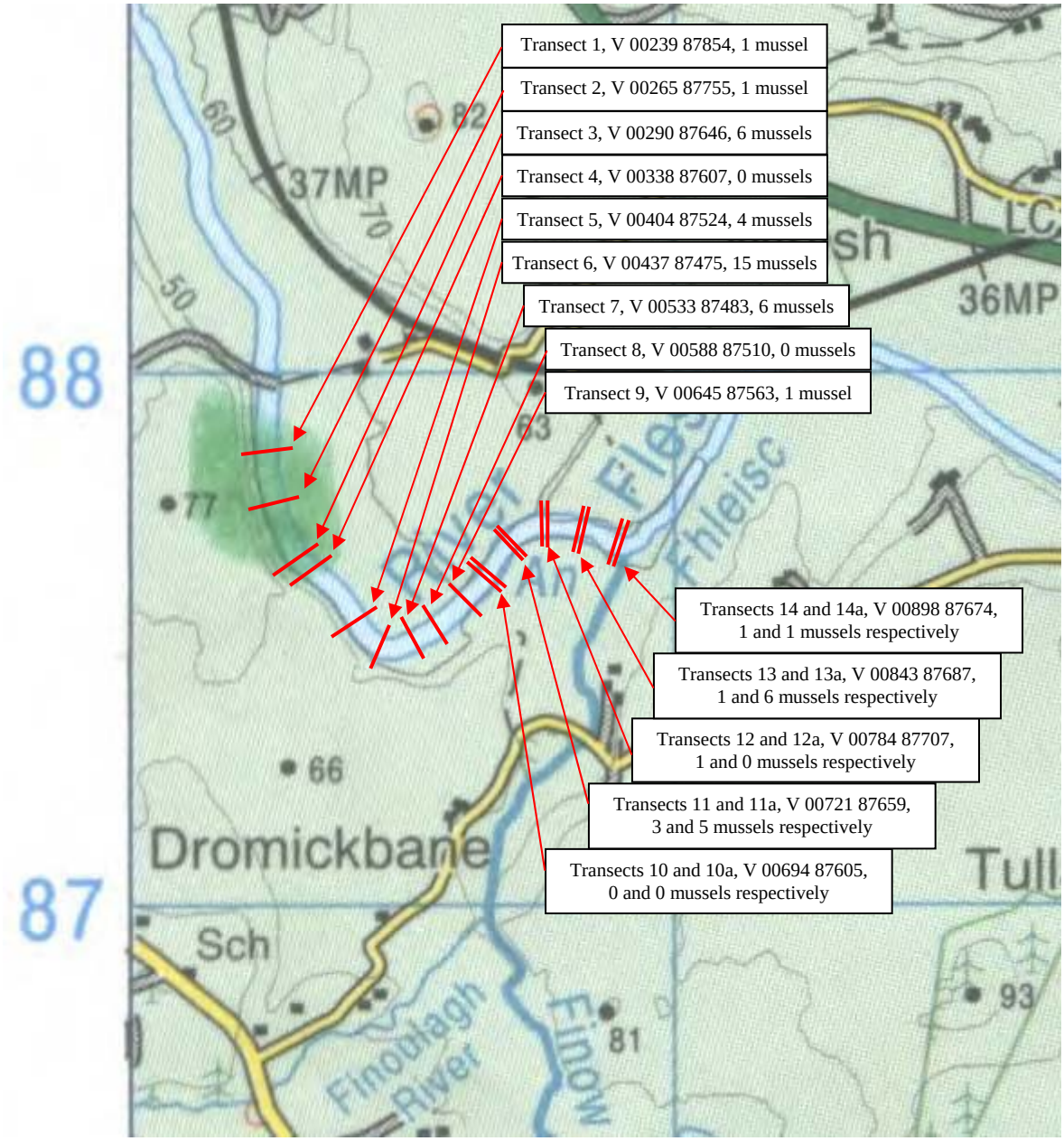


Figure 2. A map of a section of the Flesk River downstream of the Finow confluence, indicating locations of the 19 1m wide transects searched for *Margaritifera margaritifera*, together with the numbers of mussels recorded in each transect.

Discussion.

Finow River: Results of this preliminary rapid assessment indicate the presence of a small population of *Margaritifera* in the Finow River. Mussels are distributed along most of the Finow channel, from the Flesk confluence to a point 167m downstream of Finow Bridge. The presence of a relatively small mussel, 54.7mm in length, indicates that some level of recruitment has occurred within the last ten years in the Finow River.

No major concentrations of mussels were observed at any locations on the Finow River. However, although only 119 mussels were observed along the 3km assessed during this

initial rapid assessment, this must be viewed as an extremely conservative indication of the numbers of mussels actually present.

Due to the rocky nature of substrate observed along much of the river channel, and the growth of moss covering much of the substrate, it is likely that the majority of mussels present were not visible to an observer rapidly scanning the substrate with a viewing device, but were obscured from view in the substrate interstices and cavities between and under moss covered cobbles and boulders. Hastie et al. (2000) found that up to 77% of mussels can remain undetected under the substrate in normal mussel habitat. In the type of rocky moss covered habitat common in the Finow it is probable that many mussels remained undetected by a rapid scanning of the substrate surface, and consequently, the actual number of mussels present is likely to be a number of times greater than that recorded.

In order to calculate a reliable estimate of the population present in the Finow River, a full Stage 2 *Margaritifera* Survey is necessary. This would involve a much slower and more detailed examination of those stretches where the habitat consisted of moss covered rocks and boulders, particularly between Grid References V 00870 87542 to V 00757 86562. This would require a minimum of a further two days Stage 2 Survey work.

Based on growth data from other Irish populations of *Margaritifera* (Ross, 1988), the 54.7mm mussel recorded is between 7 and 12 years of age, indicating that some level of recruitment occurred in the Finow up to 7-12 years ago. Consequently, juvenile searches should be undertaken in areas of suitable habitat to confirm whether recruitment is still occurring, and to obtain quantitative data on the demographic structure of the Finow River population. This would require a further one day Stage 3 Survey work.

Flesk River: Results of this preliminary rapid assessment indicate the stretch of the River Flesk examined contains a significant population of *Margaritifera*. Mussels were distributed along most of the 1.16km stretch assessed, with the majority located close to the banks.

The average number of mussels recorded in the transects examined was 2.74, and based on the assumption that these transects were approximately representative of that part of the Flesk, a minimum population estimate of 2,740 mussels per kilometre could be extrapolated. However, this rough estimate is indicative only, and a proper Stage 2 Survey is necessary to calculate a more accurate population estimate. Due to the width of the river (c.35m), such a survey would be most efficiently carried out by counting mussels in a series of transects (10m of river length in every 100m stretch) while snorkelling. On the basis of the mussel densities observed during this rapid assessment, it is likely that a thorough Stage 2 Survey of a 1km stretch could be completed in approximately five days, assuming suitable weather conditions.

Although mussel densities were relatively low (compared to some other mussel rivers in Kerry), it is likely that densities sufficient for successful reproduction are present. Valovirta (1990) has estimated that a density of 500 adults per 100m of river is required for successful recruitment to take place. Such densities were recorded in five of the nineteen transects examined. The presence of a dead shell measuring 37mm at the confluence of the Finow and Flesk rivers also indicates that recruitment of juvenile mussels ($\leq$30mm) to the population has occurred very recently. Consequently, juvenile searches should be

undertaken in areas of suitable habitat to ascertain if recruitment is occurring, and to obtain quantitative data on the demographic structure of the Flesk River population. This would require a further two days Stage 3 Survey work.

Recommendations.

Finow River:

1. Complete a Stage 2 Survey of the Finow River. Estimated (minimum) duration of two days.

2. Carry out juvenile searches to ascertain if recruitment is occurring, and to obtain quantitative data on the demographic structure of the Finow River population. Estimated (minimum) duration of one day.

Flesk River:

1. Complete a Stage 2 Survey of the Flesk River for a minimum of 1km downstream of the Finow confluence or any other proposed discharge point associated with the upgrading of the Lough Guitane WTP. Estimated (minimum) duration of five days per kilometre of river to be surveyed.

2. In conjunction with the above Stage 2 Survey, carry out Stage 3 Survey (juvenile searches) to ascertain if recruitment is occurring, and to obtain quantitative data on the demographic structure of the Flesk River population. Estimated (minimum) duration of two days per kilometre of river to be surveyed.

3. Consideration should be given to an extension of the rapid assessment of the Flesk River to ascertain if concentrations of *Margaritifera* are present downstream of the stretch where the Stage 2 and Stage 3 Surveys are proposed (in 1. above).

4. Consideration should be given to the establishment of a monitoring program (Stage 4 Survey), combining survey techniques used in Stages 2 and 3 with recording of water quality parameters and detailed river channel character data, at prescribed intervals in time and space. Stage 4 surveys are designed in accordance with the specific requirements of the population to be monitored and in consultation with NPWS staff.

References.

Anonymous (2004). *Margaritifera margaritifera*: Stage 1 and Stage 2 survey guidelines. Irish Wildlife Manuals No. 12. Series Editor: F. Marnell.

Bauer, G. (1983). "Age structure, age specific mortality rates and population trend of the freshwater pearl mussel (*Margaritifera margaritifera*) in North Bavaria." *Archiv fur Hydrobiologie* **98**, 523-532.

Beasley, C.R., Roberts. D. (1996). "The current distribution of the freshwater pearl mussel *Margaritifera margaritifera* L. 1758 in north-west Ireland." *Aquatic Conservation: Marine and Freshwater Ecosystems* **6**, 169-177.

Hastie, L.C., Young, M.R., Boon, P.J., Cosgrove, P.J. and Henninger, B. (2000a). "Sizes, densities and age structures of Scottish *Margaritifera margaritifera* (L.) populations." *Aquatic Conservation: Marine and Freshwater Ecosystems* **10**, 229-247.

Jackson, J.W. (1925). "The distribution of *Margaritifera margaritifera* in the British Isles." *Journal of Conchology* **17**, 195-211.

Moorkens, E.A. and Costello, M.J. (1994). Imminent extinction of the Nore freshwater pearl mussel *Margaritifera durrovensis* Phillips: a species unique to Ireland. *Aquatic Conservation: Marine and Freshwater Ecosystems* **4**, 363-365.

Moorkens, E. A. (1996). Studies on the Biology and Ecology of *Margaritifera* in Ireland. Unpublished Ph.D. Thesis, Trinity College, Dublin.

Moorkens, E.A. (1999). "Conservation Management of the Freshwater Pearl Mussel *Margaritifera margaritifera.* Part 1: Biology of the species and its present situation in Ireland". Irish Wildlife Manuals No. 8. Series Editor: F. Marnell.

Moorkens, E. A. (2004). Pilot Project for Monitoring Populations of the Freshwater Pearl Mussel. Baseline survey of the Owenriff River SAC, County Galway. Unpublished report for NPWS.

Moorkens, E. A. (2005a). Monitoring Populations of the Freshwater Pearl Mussel. Baseline survey of the Newport River cSAC, County Mayo. Unpublished report for NPWS.

Moorkens, E. A. (2005b). Monitoring Populations of the Freshwater Pearl Mussel. Baseline survey of the Bundorragha River cSAC, County Mayo. Unpublished report for NPWS.

Moorkens, E. A. (2005c). Monitoring Populations of the Freshwater Pearl Mussel. Repeat survey of the Owenriff River SAC, County Galway. Unpublished report for NPWS.

Moorkens, E. A. (2005d). *Margaritifera margaritifera* survey of the River Owenea in the vicinity of Glenties, County Donegal. Unpublished report for Donegal County Council.

Moorkens, E. A. (2006a). Monitoring Populations of the Freshwater Pearl Mussel. Baseline survey of the Eske River cSAC, County Donegal. Unpublished report for the National Parks and Wildlife Service.

Moorkens, E. A. (2006b). Monitoring Populations of the Freshwater Pearl Mussel. Baseline survey of the Clady River cSAC, County Donegal. Unpublished report for the National Parks and Wildlife Service.

Moorkens, E. A. (2006c). Monitoring Populations of the Freshwater Pearl Mussel. 2006 repeat survey of the Owenriff River cSAC, County Mayo. Unpublished report for the National Parks and Wildlife Service.

Ross, E.D. (1984). Studies on the biology of freshwater mussels (Lamellibranchia: Unionacea) in Ireland. M.Sc. Thesis, UCG, National University of Ireland.

Ross, E.D. (1988). The reproductive biology of freshwater mussels in Ireland, with observations on their distribution and demography. Ph.D. Thesis, UCG, National University of Ireland.

Ross, E.D. (2004a). A Pilot Project to Develop a Monitoring Protocol for the Freshwater Pearl Mussel *Margaritifera margaritifera* (L.) in the Blackwater River, County Kerry, Ireland. Internal National Parks and Wildlife Service Report.

Ross, E.D. (2004b). A Pilot Project to Develop a Monitoring Protocol for the Freshwater Pearl Mussel *Margaritifera margaritifera* (L.) in the Caragh River, County Kerry, Ireland. Internal National Parks and Wildlife Service Report.

Ross, E.D. (2005a). Initiation of a monitoring program for the freshwater pearl mussel, *Margaritifera margaritifera* (L.) in the Licky River. Internal National Parks and Wildlife Service Report.

Ross, E.D. (2005b). Initiation of a monitoring program for the freshwater pearl mussel, *Margaritifera margaritifera* (L.) in the Ownagappul River. Internal National Parks and Wildlife Service Report.

Ross, E. (2006a). Initiation of a monitoring program for the freshwater pearl mussel, *Margaritifera margaritifera* (L.) in the Clodiagh River (Suir). Report to the National Parks and Wildlife Service.

Ross, E. (2006b). Initiation of a monitoring program for the freshwater pearl mussel, *Margaritifera margaritifera* (L.) in the Mountain River (Barrow). Internal National Parks and Wildlife Service Report.

Ross, E.D. (2006c). Report on searches for juvenile *Margaritifera margaritifera* (L.) in the Blackwater River (Co. Kerry). Internal National Parks and Wildlife Service Report.

Ross, E.D. (2006d). Report on searches for juvenile *Margaritifera margaritifera* (L.) in the Caragh River, Co. Kerry. Internal National Parks and Wildlife Service Report.

Ross, E.D. (2006e). Report on searches for juvenile *Margaritifera margaritifera* (L.) in the Dereen River (Co. Carlow). Internal National Parks and Wildlife Service Report.

Valovirta, I. (1990). Conservation of *Margaritifera margaritifera* in Finland. Environmental encounters, Council of Europe, 10:59-63.

Wells, S.M., Pyle, R.M. and Collins, N.M. (1983). The IUCN Invertebrate red data book. International Union for the Conservation of Nature and Natural Resources, Gland (Switzerland), pp145-156.

APPENDIX VI

TO

ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

DISTANT LANDSCAPE VIEWS

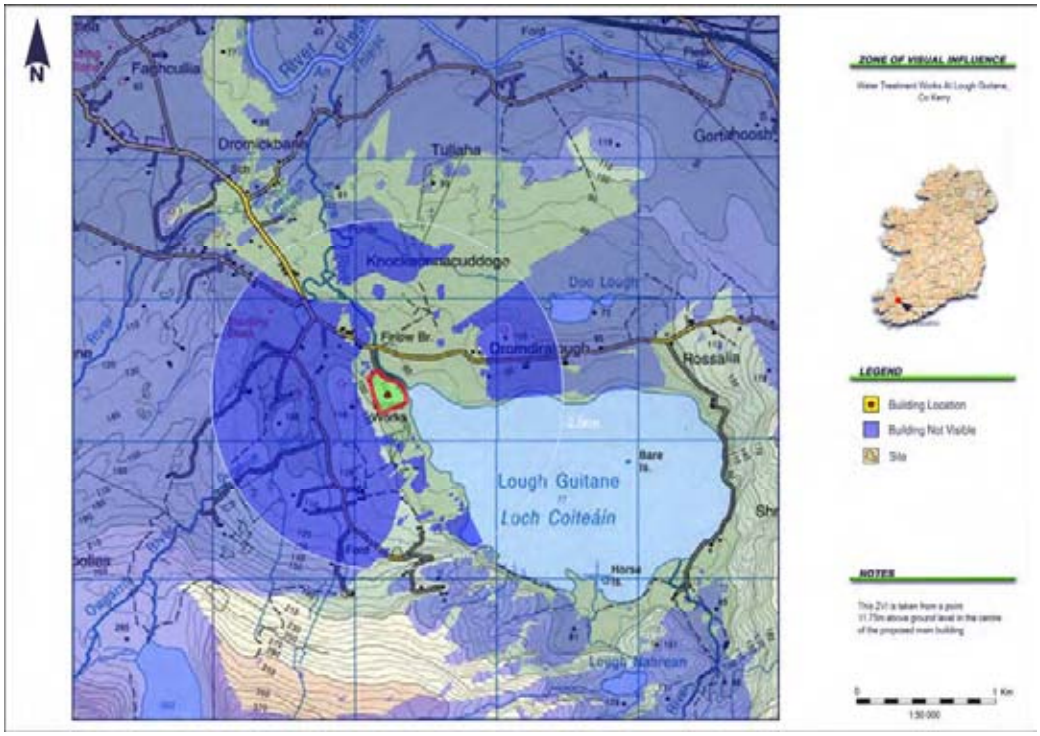


Figure 1 Potential Zone of Visual Influence

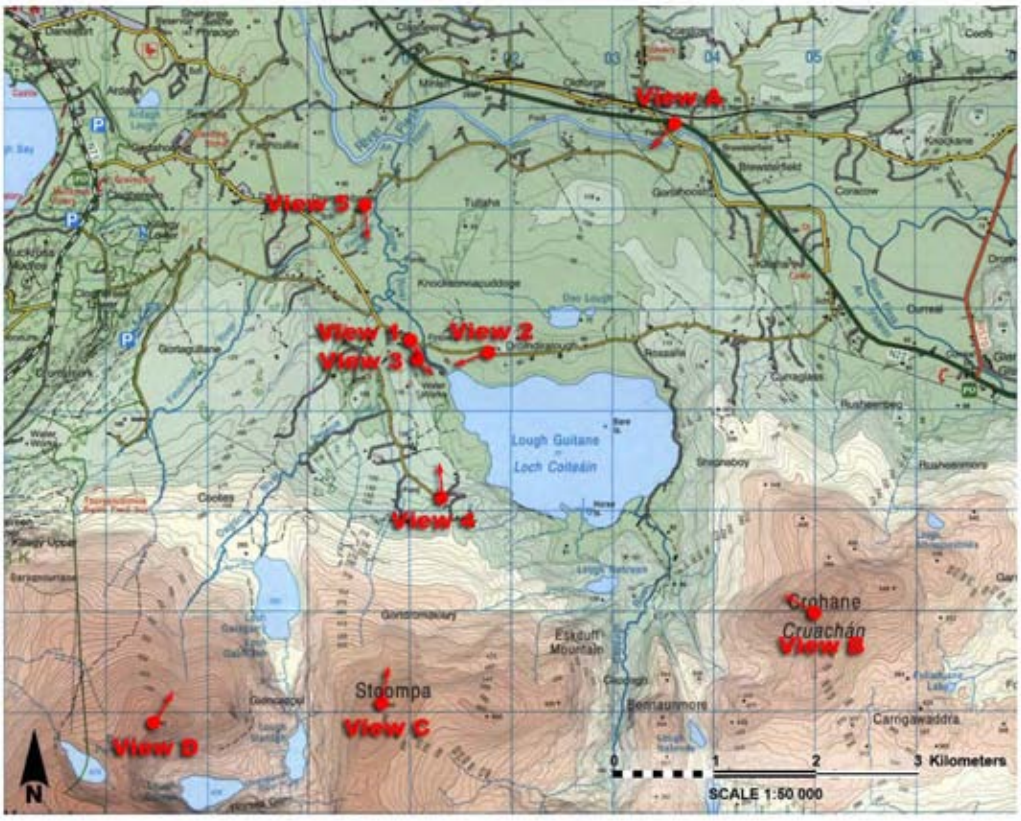


Figure 2 Viewing Position Locations

Note Views A – D are all at distances in excess of 3km from the development site. Development can be discerned – through careful observation or using binocular or telescope magnification – as confirmed by the Potential Zone of Visual Influence shown in Figure 13 above – however this does not constitute functional 'visibility' as used to determine landscape and visual impacts. In all instances note that the development site is seen in the context existing structures and agricultural development.

Figure 3 View A
From the N 22 near Flesk Bridge - Views towards the site are blocked by intervening topography

Figure 4 View B
From Crohane Mountain

Figure 5 View C
From Stoompa Mountain

Figure 6 View D
From ridge above (West of) Glencappul

APPENDIX VII

TO

ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

ARCHAEOLOGICAL IMPACT STATEMENT

An Archaeological Impact Statement On the Proposed Water Treatment Plant Gortdromakiery, Co. Kerry

Kerry County Archaeologist
Arts, Culture & Heritage Division
Kerry County Council

August 2007

COPIES OF THIS REPORT HAVE BEEN PRESENTED TO:

STATUTORY BODIES:

LOCAL AUTHORITY: Mr. Paul Cremin, EE, Water Services

PLEASE NOTE…

That the archaeological recommendations, mitigation proposals and suggested methodology followed in this report were first formulated and approved by the National Monuments Section, DoEHLG, Dun Sceine, Harcourt Lane, Dublin 2, prior to the commencement of the archaeological dimension of the project.

Every effort has been taken in the preparation and submission of this report to provide as complete an assessment as possible within the terms of the brief, and all statements and opinions are offered in good faith.

Contents

I. List of Figures and Plates

FIGURES

PLATES

1. Scope of Study

This report assesses the impact on the potential archaeological environment of a proposed new water treatment plant at Gortdromakiery, Killarney, adjacent to Lough Guitane.

The site was inspected on the 20th August 2007and this report details the results of this inspection of the site of the treatment plant (the existing environment), as well as a comprehensive historical background to the site, in order to consider it in its proper archaeological context.

No intrusive archaeological investigations (test trenching or excavation), have been undertaken at this stage. Suggested further archaeological investigation (if appropriate) is stated at end of the report.

2. Method of Study

The following resources and methods of establishing the archaeological status of the site of the proposed development were used:

- The proposed site area and the upstanding remains on the site were examined.
- The Record of Monuments and Places constraint maps were consulted;
- All available cartographic sources were consulted;
- A wide range of historical and archaeological records relevant to the study area were consulted
- Available Aerial Photography was consulted

3. The Existing Environment

3.1 The Site at Present

The townland of Gortdromakiery is located in the NNE facing foothills of Mangerton and Stoompa mountains, which rise to the south and south-west respectively, on the western shore of Lough Guitane.

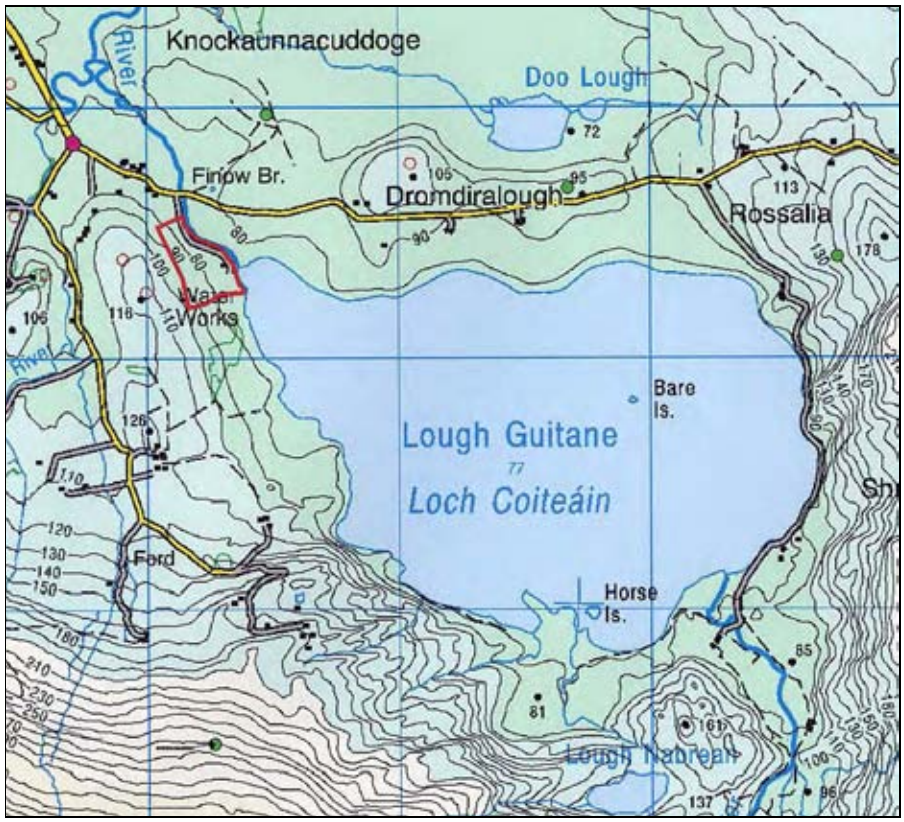


Figure 1: General location map after Discovery Series 71 with reservoir site marked in red

The townland affords good views to all points of the compass, particularly over the lake to the east. Lough Guitane is the main water reservoir for the Central Regional Water Supply scheme serving Killarney, Tralee, Castleisland and surrounding areas.

The existing plant and pumping station is located adjacent to the lake on the eastern side of the proposed enlarged site where the Finow River enters the lake from the north.

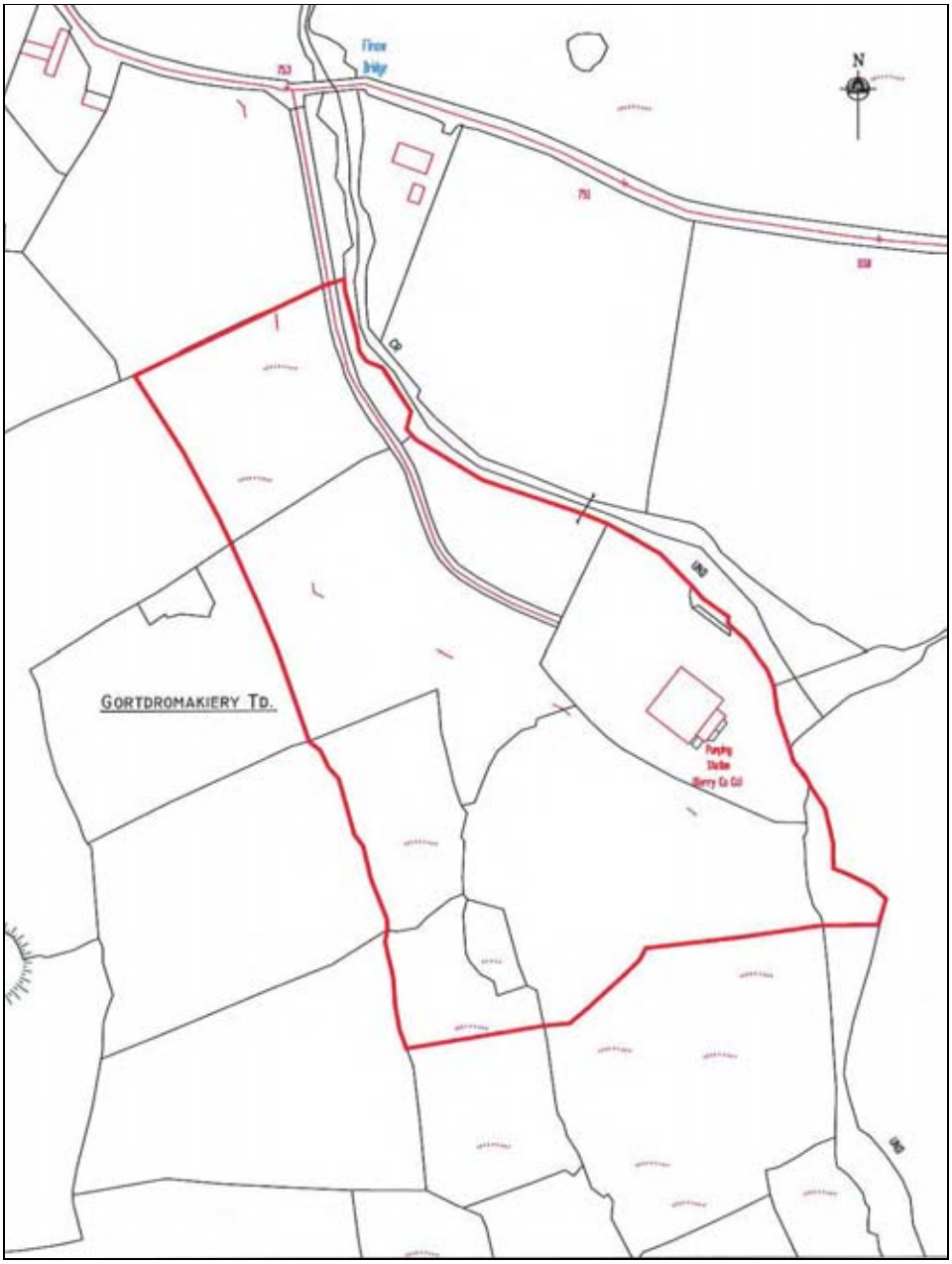


Figure 2: The proposed treatment plant site showing existing structures and site boundary

It is proposed to construct a new treatment plant to service the reservoir and supply scheme within the site boundaries as outlined above. The new plant will be a substantial building which, along with out offices etc., will take up around one third of the

development site as outlined. The plant will most likely be located at the south-eastern end of the site around the existing plant, where it will be better screened from the surrounding countryside. The existing intakes from Lough Guitane will be retained as will the main pipe-work on the site.

Plate 1: Aerial view of treatment plant site at Gortdromakiery

The site consists of a north-west – south-east running plot of land that would formerly have comprised five separate fields, though now many of the field boundaries are fully or partially removed. The plot widens from north to south, onto the lake shore. The more south-westerly third of the plot slopes sharply upwards to a low plateau while the remainder of the plot slopes gently down to the lake at the south and south-east.

There are a number of modern clearance cairns in evidence containing many large boulders and smaller rocks cleared from the land by machine in relatively recent times. The more westerly third of the plot is heavily overgrown with gorse and ferns in particular, making assessment of this sloping part of the site difficult, though the main body of the plot adjacent to the existing plant is relatively clear.

Plate 2: Existing maintenance and control buildings on eastern side of plot

Plate 3: Southern expanse of plot

Plate 4: The southern end of the plot with Lough Guitane in the background

Plate 5: South-westerly corner of plot showing overgrown sloping ground

Plate 6: Westerly side of plot showing gorse scrubland.

Plate 7: Partial, disturbed field boundary

Plate 8:Large clearance cairn

Plate 9: Northern end of site showing overgrowth

Plate 10: Roadway running to treatment plant, plot on right.

4. History of the Site & Vicinity

4.1 Killarney Parish

The townland of Gortdromakiery is located in Killarney parish which was recorded by O'Donovan in 1840, as follows:

SITUATION: This parish is bounded on the north by the parishes of Aghadoe and Kilcummin, on the east by a detached portion of the parish of Aghadoe and by the parish of Killaha, on the south by the parishes of Kilgarvan and Kenmare, and on the west by that of Knockaun.

NAME: Is pronounced in Irish as if written Cill Airne, which would, seem to signify cell or church of Saint Airne or Athairhe, but I cannot find any saint of this name mentioned in the Irish Calendar nor is there any traditional recollection of such in the parish. Windele explains the name as signifying the church near the sloe trees, but this will not do, as the Irish never call the sloe tree any name but *droighean*; its fruit is what they call airne.

No part of the old church called Cill Airne now remains, but its site is known and should be shown on the Ordnance map. In the townland of Killeegy Lower near the small village of Clohereen in the parish is a part of the ruins of a church formed into a burial vault by the family of Hussey, but it is so re-modeled that no idea can be formed of its original extent or form. The east window is original, being formed of chiselled brown sandstone and round-headed on both sides. It measures on the inside four feet seven inches in height and two feet seven and a half inches in width, and on the outside where it is placed at the height of six feet seven inches from the level of the ground, two feet in height and nine and a half inches in width. The walls are two feet six inches thick and eight feet high but all modernised except the east gable and a small portion of the' north wall connected with it. This little building is

now stone-roofed and measures nineteen feet two inches in length and ten feet ten inches m breadth, but it was originally much more extensive. It is probably the choir of an original Irish church. The doorway is on the west end but modern and not worth description.

In this parish is situated the much celebrated abbey of lrrelagh or Muckross, said to have been erected by Donnell, son of Teige Mainistreach MacCarthy More, in the year 1340. A description of this abbey has been attempted by several but none of them have given measurements except Windele, who is, however, incorrect in many instances. The whole building consists of two principal parts, the convent and the church, the former standing at the north side of the latter. The church consists of nave, choir and south transept, at the inter-section of which stands a square steeple 'of heavy and graceless pro-portions'. The entire length of the church as measured by a tape (which is perhaps a few inches incorrect) is one hundred and ten feet two inches (not one hundred as Windele makes it); the nave is fifty-two feet in length and twenty-three feet seven inches in breadth; the tower is sixteen feet eight inches in extent (i.e. occupies so much of the length of the church) and by deducting fifty-two feet plus sixteen feet eight inches= sixty-eight feet eight inches from one hundred and ten feet two inches, we have forty-one feet six inches the length of the choir, which is the same breadth with the nave.

The walls of nave are four feet two inches to four feet five and a half inches in thickness and about twenty-four feet in height. The transept is thirty-five feet nine inches in length and twenty-four feet four inches in breadth. The principal entrance or doorway is on the west end; it is a beautiful pointed doorway deeply moulded and surrounded by a weather cornice; it is nine feet four inches high and five feet five inches wide. Above this is the western window which consists of two lights with a horizontal drip. The interior of the nave has a few tombs of modern erection, one of which has been lately put up against the south wall 'To the memory of Mrs Christopher Galway'. Facing this on the north wall is a white marble slab surmounted by an urn, commemorating Mrs Christina Cronan of the Park. From the nave a large pointed arch thirteen feet two inches in breadth and about seventeen and a half feet in height, opens into the transept at the south side opposite to which, in the north wall, is a small door-way seven feet two inches in height and four feet two inches in width, which communicates with the cloister.

The transept has also a few tombs, but none of any antiquity. Its south gable is lighted by a large pointed window of three lights the head of which is diversed by plain intersecting tracery. The entire width of this window on the outside is four feet

eight inches, each light one foot two inches in width and ten feet in height. Over the three lights or days are six compartments. The entire height of this window is about fifteen feet. On the south wall of this transept are two windows round-headed on the inside and pointed and divided into two lights on the outside, where they measure eight feet seven and a half inches in height and two feet eight and a half inches in width, each light one foot one inch.

The steeple is a square tower of graceless proportions, dividing the nave from the choir and resting on four narrow high lancet arches six feet ten inches in width, and about twenty-five feet in height. The groining of the central vault is still perfect. Within the northern arch a small doorway leads into the eastern gallery of the cloister. The choir is a plain oblong chamber of the same breadth with the nave.

Its great eastern window consists of four (not five as Windele writes) lights with a head of similar tracery to that in the transept already described; each light is pointed and one foot nine and three quarters inches in width and about nineteen feet in height. The entire width of this window is nine feet three inches on the outside. Its mullions, which are of cut limestone, are ramified above and form six compartments.

At the distance of four feet four inches from the east gable there is a pointed window on the south wall nine feet eight inches high and two feet ten and a half inches wide, and divided into two lights, each one foot and three quarter inches, in width. At the distance of four feet four inches from this to the west there is a window of similar construction and dimensions on the same wall; and four feet four inches still farther to the west is a third window of the same height with the other two, but wider and divided into three lights.

The inscriptions on the tombs etc. in this choir have been already published in the Dublin Penny Journal of 1833, and by Windele in his Historical and Descriptive Notices of Cork and Killarney. 1 therefore deem it unnecessary to transcribe them here. 1 have requested Mr. Wakeman to sketch the arms of MacCarthy More, Earl of Clancare.

The choir has at the south side a small chantry or oratory which is entered by a handsome doorway. Of the convent, the dormitories, kitchen, refectory, cellars, infirmary, etc., the walls are yet in tolerable preservation; the upper chambers are unroofed and overgrown, as might be expected, with grass; but the under chambers are generally roofed with stone arches. The great fireplace in the refectory is very curious from its ample and hospitable dimensions.

The cloister, which is a quadrangle of small dimensions, is situated on the north side of the abbey church; round the sides of tis area, the offices and apartments above mentioned are arranged, and with these as well as with the abbey church, it communicates by several doorways. It consists of an arcade of twenty-two arches, ten of them semi-circular and twelve pointed, the former occupying the south and west sides, the latter the east and north. The arches spring from short double pillars; and are separated from each other by plain slender buttresses. The cloister measures thirty-two feet six and a half inches from east to west and exactly the same from north to south so that it is a perfect square enclosing an area of twenty-nine feet four inches square.

The pointed arches are six feet nine inches in height and four feet ten and a quarter inches in width and one foot nine inches in thickness, and the round ones are five feet six inches high, three feet ten and a half inches wide and one foot nine and a half inches thick. The corridors are six feet eleven and a half inches in width and eleven feet eight inches in height. At opposite angles are flights of stone stairs leading to the apartments above and adjoining the cloister. A parapeted walk is carried round above the arches from which some glimpses of the lake are obtained through breaks in the surrounding foliage. In the centre of the area is a great yew tree, which extends its aged arms and picturesque branches so as to cover the whole cloister. Its trunk measures nine feet nine inches in circumference (not thirteen feet as Windele writes) at the base, and the height of its trunk to the lowest branch is fourteen feet eleven inches. It is highly probable that this tree is coeval with the abbey.

In this parish is also situated the castle of Ross so celebrated by the writer of guide books etc. It is a tall, square embattled building based upon a limestone rock. At the north-west side it is supported by a massive buttress and two machicolated defences project from the south-east and north-west angles near the top. The interior of this castle is arched at about two thirds of its height. It consisted of four floors, viz. the ground one, two wooden ones of which the supporting beams still remain and the one resting on the stone arch above mentioned. This upper apartment, which is now usually called O'Donohoe's dining room measures on the inside thirty-six feet five and a half inches from north to south and twenty-one feet from east to west and the walls are four feet ten inches in thickness.

The north walls is lighted by rectangular windows of small dimensions, and the east wall by a large square (oblong) one, which was divided into six square compartments by limestone mullions; but it is now filled up with rude masonwork. It is five feet seven inches in height and four feet six inches in width. There was another similar window on the west side near the south-west comer, but is also built up.

There is a capacious fireplace with a plain marble chimney piece on the west side; it is five feet five inches high and seven feet two inches wide, and the chimney piece which is formed of two limestone marble flags plainly chiselled, each measuring four feet seven and a half inches in length and one foot seven inches in height. The staircase is spiral and of rudely cut stone (many of the steps now injured and roughened); all the (the two) timber floors to which it led have been removed except the oak beams already referred to.

I shall not attempt a description of the lofty peaks, desert isles forlorn and musical echoes of this neighbourhood, because they have been already pretty well described by Dr Smith and others, and because it is more the business of the poetical tourist than of an antiquarian orthographer to do so. 1 shall therefore speak not another word about Killarney of the 'surrounding scenery', but shall express my admiration of Eoganacht Locha Lein by a hackneyed quotation from Ovid:

Non illa plura Caiistros
Carmina cignorum labentibus audit in undis,
Silva coronat aquas, cingenslatus omne; suisque
Frondibus, ut velo, Phaebeos submovet ignes
Fngora dant rami, Tyrios humus humida flores,

5. Archaeology of the Area

There are two monuments listed in the Record of Monuments & Places for County Kerry, located within 200m of the proposed development site boundary – Ke075 012 and Ke075 013 - both recorded as enclosures. Ke075 012 is located over 180m to the west of the boundary and Ke075 013 is over 150m to the west – south-west.

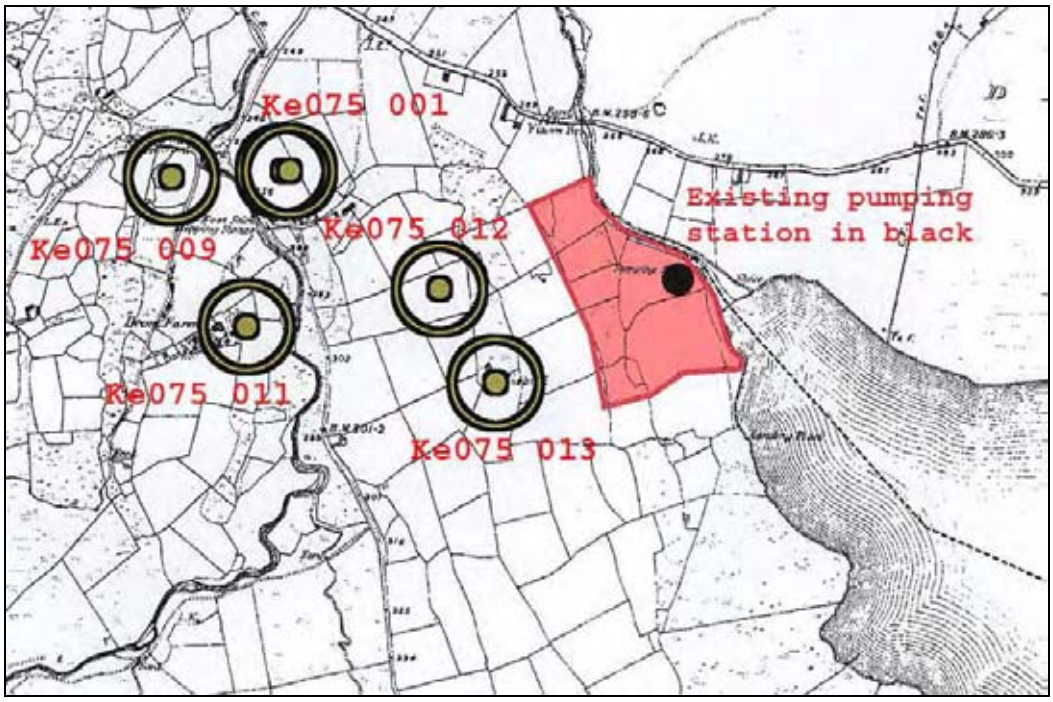


Figure 3: The RMP constraint map for the Gortdromakiery area (Sheet 75) with treatment plant development site shaded in red.

The line of the enclosure Ke075 012 is preserved in the field boundaries to the west, south and partially to the north but no above ground remains are visible to the east. The monument has been impacted by agriculture over the years but was originally an enclosure of around 35m in internal diameter, based on the extant remains.

The enclosure Ke075 013 is heavily overgrown with bushes and trees and is located in a large improved/reclaimed field. This enclosure appears to be quite small, c. 16m

in diameter. Both monuments are located in rising ground above the proposed development site, effectively screening them from the treatment plant. Neither monument will be impacted by the proposed works.

No previously unrecorded monuments, features or strata were noted during the course of a walkover of the site, though much of the western side, south-western corner and northern end of the plot is heavily overgrown. There is also a small area of marsh in the south-east corner.

It is clear from the presence of modern clearance cairns, that much of the plot has been cleared by machine in recent times, these cairns subsequently becoming overgrown. This has effectively removed any above ground archaeological monuments or features that may have existed.

However, the location adjacent to a lake and river in an upland area with evidence of settlement from the prehistory to modern times would suggest that there is a high potential for sub-surface archaeological features and/or strata to occur beneath the existing ground surface. As such all ground works associated with the construction of the new treatment plant should be archaeologically monitored, under license from DoEHLG.

6. Impact of Proposed Development

This section might be more accurately described as the prediction of impacts on the cultural heritage, including archaeology, since the impacts by definition have not yet occurred (EPA 1995a, 23).

6.1 The "Do-Nothing" Impacts

If nothing is done in this area potential archaeological deposits on site will remain undisturbed.

6.2 The Predicted Impacts

From the evidence put forward in this report there is a possibility that sub-surface archaeological features and/or strata could be encountered in the proposed development site.

6.3 The 'Worst Case' Scenario

Should the proposed works be carried out with no archaeological mitigation measures, it is possible that archaeological material and data may be destroyed with no record of those remains being made.

6.4 Interaction of Impacts

It is important to realise that the proposed development's impacts relating to different disciplines (such as the ones listed above for archaeology), may have parallel impacts in other disciplines, which have not been specifically addressed here.

7. Conclusions and Suggested Mitigation

No previously unrecorded archaeological sites or features were noted during this assessment, nor are there any recorded monuments in close proximity to the proposed development site. However it was noted that there is a possibility that previously unrecorded archaeological strata may be preserved, sub-surface, at the southern end of the site.

As such, it is recommended that all soil stripping/ground disturbance associated with the proposed development of a new treatment plant be archaeologically monitored, under license from the Dept. Environment, Heritage & Local Government, by a suitably qualified archaeologist.

Reports on the monitoring of the above works should be forwarded to the Dept. Environment, Heritage & Local Government and to the County Archaeologist, Kerry County Council.

8. Non-Technical Summary

8.1 SCOPE OF STUDY
This is a desk-top study to assess the architecture and archaeology of the existing site, the potential impact of the proposed development and to propose appropriate mitigation measures, where necessary.

8.2 METHOD OF STUDY
The site was visited by a qualified archaeologist and recorded in the proper fashion. A comprehensive desk-top study was undertaken which consulted all available material relating to the site.

8.3 EXISTING ENVIRONMENT
The existing environment of the site is the environs of the existing water treatment plant in Gortdromakiery townland on the western side of Lough Guitane Co. Kerry. No recorded or previously unrecorded archaeological features or monuments were identified in the areas of the proposed works.

8.4 IMPACT OF THE PROPOSED WORKS
There is a possibility that the proposed development may impact on potential unrecorded archaeological deposits, features and/or artefacts which at present may be subsurface.

8.5 CONCLUSIONS AND SUGGESTED MITIGATION
It is suggested that all ground disturbance associated with the proposed development be archaeologically monitored by a qualified archaeologist, under license from Dept. Environment, Heritage & Local Government

8.6 FURTHER INFORMATION AND ENQUIRIES
Any enquiries regarding the above or the archaeological mitigation on the proposed restoration, should it be required, may be directed to:

Ms.Catherine Desmond,
Archaeologist,
National Monuments Section,
Department of Environment, Heritage & Local Government,
***Dun Sceine*, Harcourt Lane,**
Dublin 2.

9. Project References

1982. *Alphabetical Index to the Townlands, Towns, Parishes and Baronies of Ireland*. Dublin. Genealogical Pub. Ltd.

Aalen, F.H.A. *ET AL. 1997* Atlas of the Irish Rural Landscape. Cork: University Press.

Archaeological Survey of Ireland, **1997** *RMP Constraint Maps and Inventory for County Kerry.* Dublin.

Barrington, T.J. 1976 *Discovering Kerry*. Mount Salus Press. Dublin

Environmental Protection Agency 1995a *Draft guidelines on the information to be contained in Environmental Impact Statements.* Dublin: environmental Publications.

Environmental Protection Agency 1995b *Advice Notes on current practice.* Dublin: Environmental Publications

Harbison, P. 1992 *Guide to the National & Historic Monuments of Ireland*. Gill & Macmillan. Dublin

Lewis, S. 1837 *A Topographical Dictionary of Ireland*, London: Lewis & Sons.

O'Donovan, J. 1840a *OS Letters for County Kerry, three vols.* Bray

O'Donovan, J. 1840b *OS Name Books County Kerry, three volumes*. Bray.

Oxbow.

Various Local Histories of the Area were also consulted

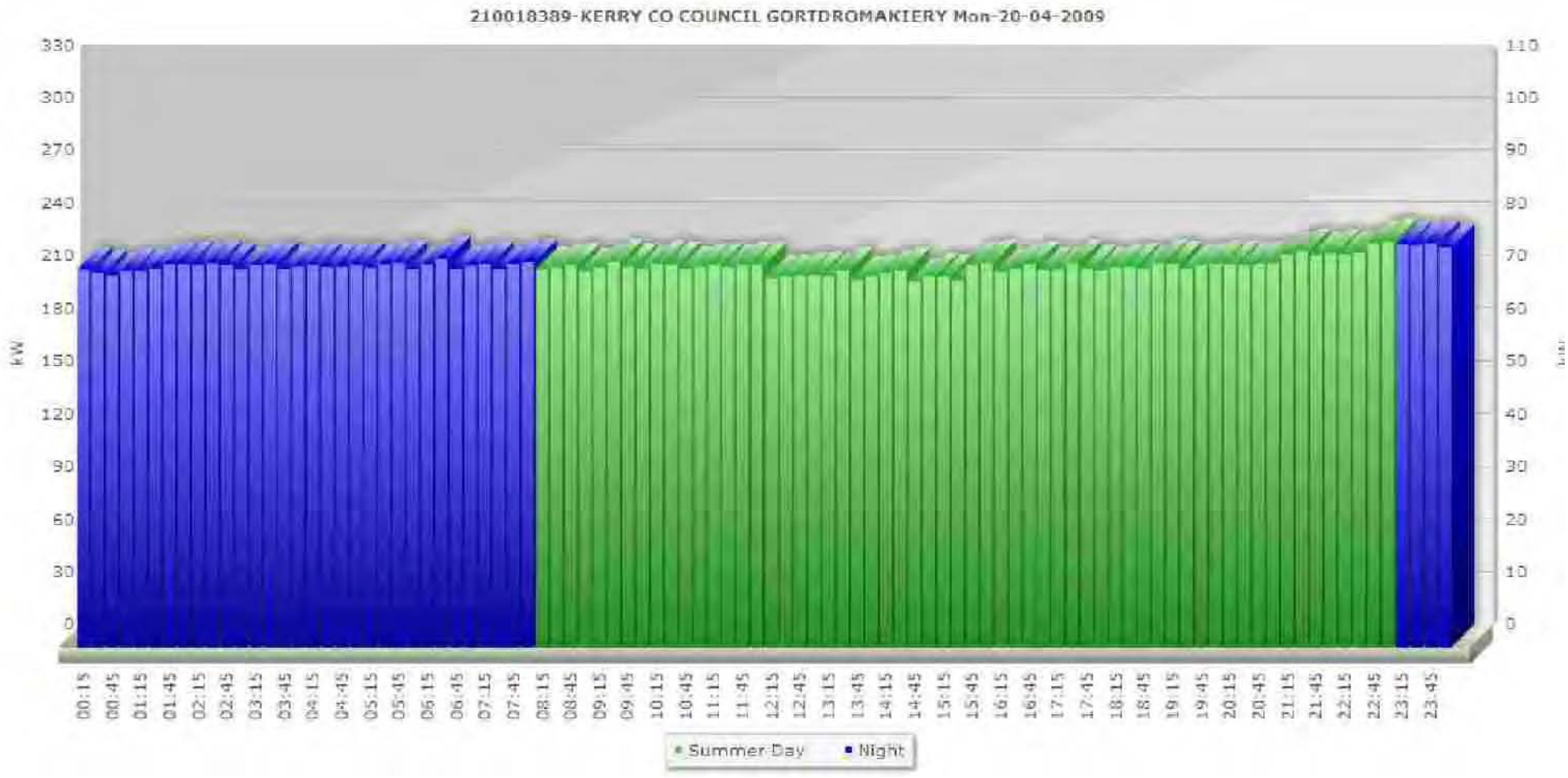
APPENDIX VIII

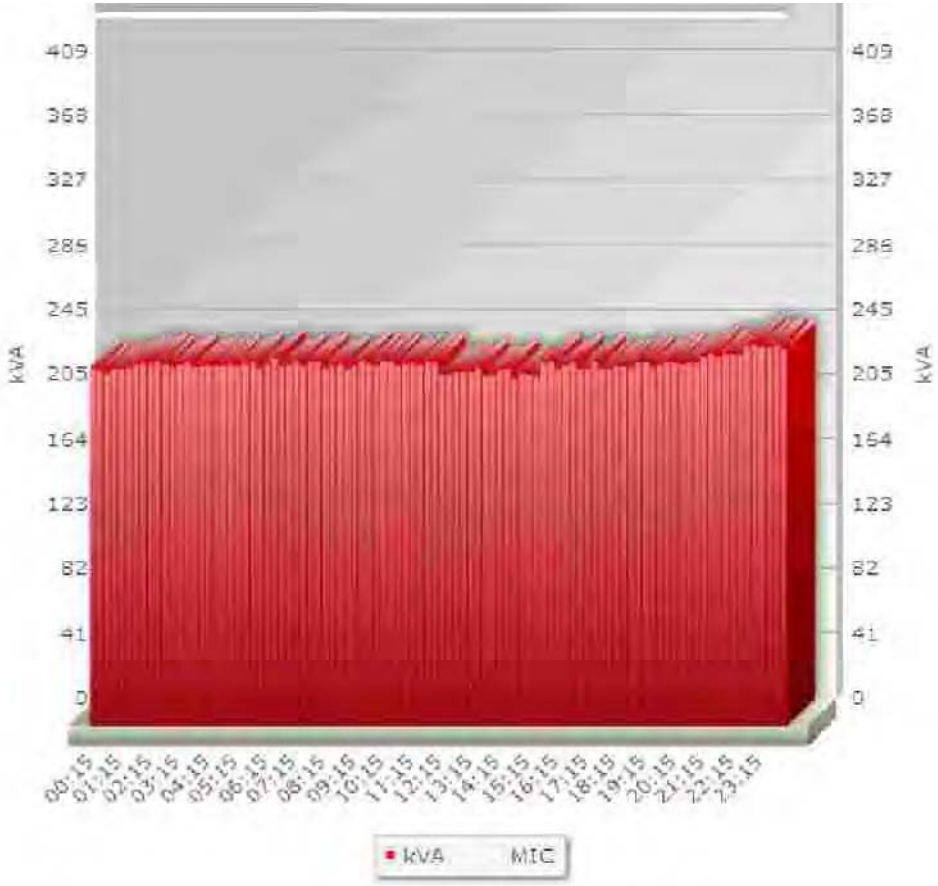
TO

ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

ELECTRICAL POWER CONSUMPTION DATA

Daily Report





Max Date & Time
20/04/2009 @ 23:00

Max Value
241.83

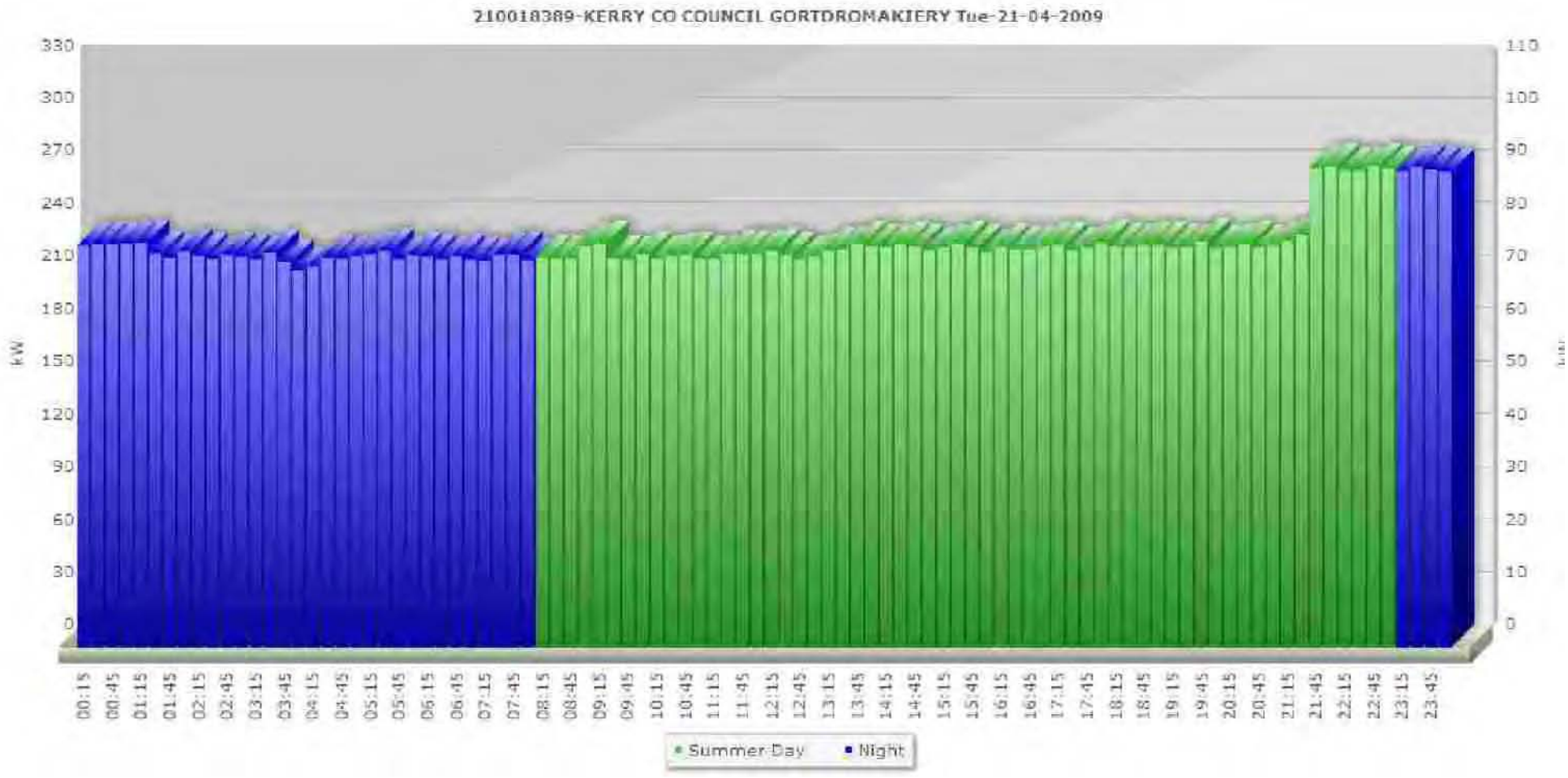
Max Date & Time
20/04/2009 @ 10:15

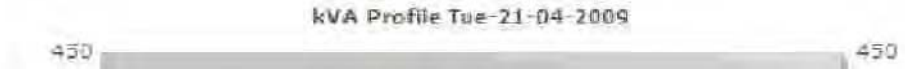
Max Value
75.46

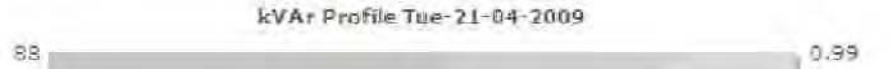
Tariff	Total kWh	Percent	Max kW Value	Date & Time	Cost
Summer Day	3252.05	62.37%	231	Mon-20-04-2009 @ 23:00	349.6
Night	1962.26	37.63%	229.88	Mon-20-04-2009 @ 23:45	104.98

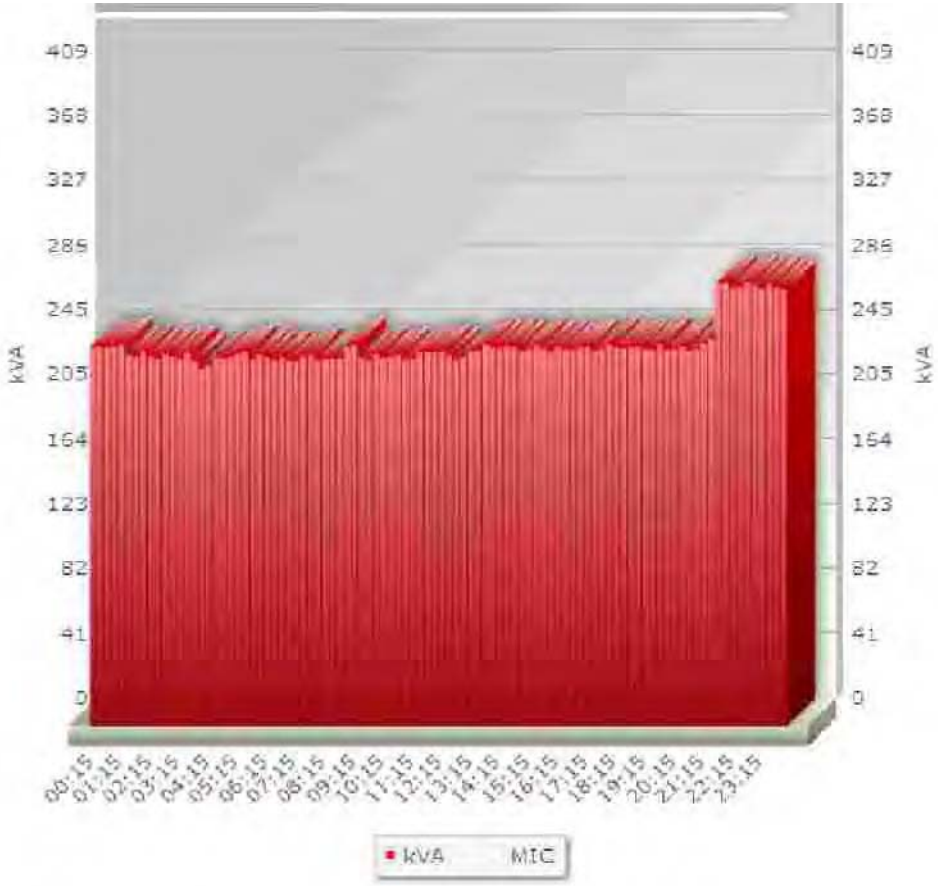
Result	5214.31	100%	231	Mon-20-04-2009 @ 23:00	454.58

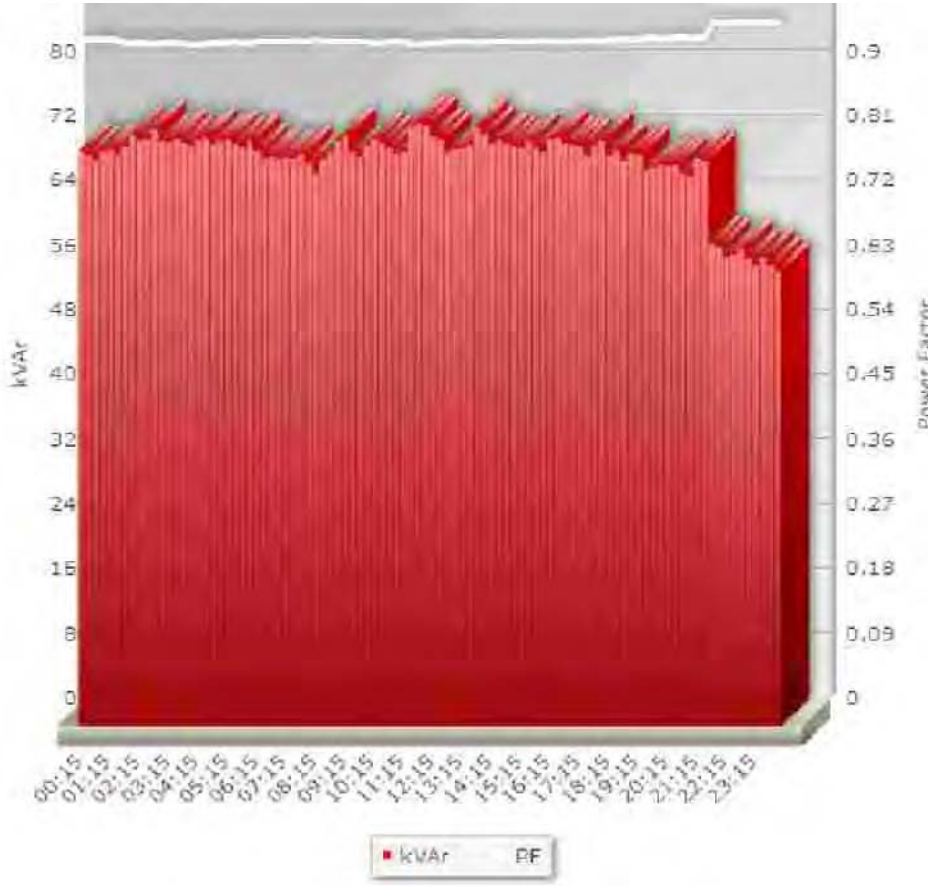
Daily Report











Max Date & Time	Max Value
21/04/2009 @ 22:45	280.6

Max Date & Time	Max Value
21/04/2009 @ 11:45	74.59

Tariff	Total kWh	Percent	Max kW Value	Date & Time	Cost
Summer Day	3466.77	62.77%	274.32	Tue-21-04-2009 @ 22:45	372.68
Night	2055.99	37.23%	273.4	Tue-21-04-2009 @ 23:30	110

Result	5522.76	100%	274.32	Tue-21-04-2009 @ 22:45	482.68

APPENDIX IX

TO

ENVIRONMENTAL REPORT
ON THE
PROPOSED UPGRADE AND EXPANSION OF WATER TREATMENT PLANT AND ABSTRACTION WORKS AT LOUGH GUITANE, COUNTY KERRY

UNATTENDED NOISE SURVEY RESULTS

Period (hrs)	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
	L_{Aeq}	L_{AMax}	L_{AMin}	L_{A10}	L_{A90}
21:00 – 21:15	44	77	35	42	36
21:15 – 21:30	38	61	35	38	36
21:30 – 21:45	37	49	35	37	36
21:45 – 22:00	37	43	35	37	36
22:00 – 22:15	37	51	35	37	36
22:15 – 22:30	37	43	36	37	36
22:30 – 22:45	37	47	35	37	36
22:45 – 23:00	37	41	35	37	36
23:00 – 23:15	41	65	35	38	36
23:15 – 23:30	36	40	35	36	35
23:30 – 23:45	36	43	35	37	36
23:45 – 00:00	36	39	35	36	35
00:00 – 00:15	36	38	35	37	36
00:15 – 00:30	37	39	35	37	36
00:30 – 00:45	37	48	35	37	36
00:45 – 01:00	37	41	35	37	36
01:00 – 01:15	38	45	36	39	36
01:15 – 01:30	40	45	37	41	39
01:30 – 01:45	41	48	37	44	38
01:45 – 02:00	37	39	35	37	36
02:00 – 02:15	37	43	35	39	36
02:15 – 02:30	39	46	36	40	37
02:30 – 02:45	36	45	35	37	36
02:45 – 03:00	37	43	35	38	36
03:00 – 03:15	39	51	36	41	37
03:15 – 03:30	37	50	36	38	36
03:30 – 03:45	37	38	35	37	36
03:45 – 04:00	37	40	35	37	36
04:00 – 04:15	37	41	35	37	36
04:15 – 04:30	36	38	35	37	36
04:30 – 04:45	37	48	35	37	36
04:45 – 05:00	36	42	35	37	36
05:00 – 05:15	37	43	35	37	36
05:15 – 05:30	46	57	35	50	37
05:30 – 05:45	59	73	38	63	47
05:45 – 06:00	59	78	36	63	37
06:00 – 06:15	45	62	36	49	37
06:15 – 06:30	45	61	36	49	37
06:30 – 06:45	52	72	36	53	37
06:45 – 07:00	45	58	36	49	37
07:00 – 07:15	46	66	36	46	37
07:15 – 07:30	48	67	36	51	37
07:30 – 07:45	46	68	36	49	37
07:45 – 08:00	50	79	36	48	37
08:00 – 08:15	44	64	36	47	37
08:15 – 08:30	44	56	36	49	37
08:30 – 08:45	44	68	35	48	36
08:45 – 09:00	47	67	36	50	37

Period (hrs)	Measured Noise Levels (dB re. $2x10^{-5}$ Pa)				
	L_{Aeq}	L_{AMax}	L_{AMin}	L_{A10}	L_{A90}
09:00 – 09:15	45	69	35	47	37
09:15 – 09:30	45	69	35	44	36
09:30 – 09:45	48	78	35	49	36
09:45 – 10:00	50	70	35	50	36
10:00 – 10:15	44	65	35	46	36
10:15 – 10:30	45	68	35	45	36
10:30 – 10:45	42	64	35	45	36
10:45 – 11:00	56	87	35	47	36
11:00 – 11:15	53	71	35	52	36
11:15 – 11:30	42	58	35	44	36
11:30 – 11:45	50	77	35	47	36
11:45 – 12:00	44	66	35	45	36
12:00 – 12:15	50	81	35	47	36
12:15 – 12:30	43	63	35	46	36
12:30 – 12:45	47	72	35	45	36
12:45 – 13:00	42	56	35	45	36
13:00 – 13:15	42	66	35	43	36
13:15 – 13:30	42	59	34	45	36
13:30 – 13:45	42	60	35	45	36
13:45 – 14:00	41	54	35	43	36
14:00 – 14:15	41	57	34	43	35
14:15 – 14:30	54	88	34	44	36
14:30 – 14:45	59	85	34	44	36
14:45 – 15:00	43	63	35	45	36
15:00 – 15:15	45	76	34	44	35
15:15 – 15:30	43	64	35	45	36
15:30 – 15:45	40	53	34	43	36
15:45 – 16:00	42	55	34	46	36
16:00 – 16:15	38	53	34	39	35
16:15 – 16:30	42	56	34	45	36
16:30 – 16:45	43	62	34	45	35
16:45 – 17:00	43	68	34	44	35
17:00 – 17:15	40	53	34	42	36
17:15 – 17:30	47	76	34	40	35
17:30 – 17:45	42	72	34	41	36
17:45 – 18:00	38	54	34	39	35
18:00 – 18:15	45	68	35	43	36
18:15 – 18:30	39	55	35	41	36
18:30 – 18:45	40	55	35	43	36
18:45 – 19:00	48	76	35	44	36
19:00 – 19:15	47	66	35	50	37
19:15 – 19:30	39	55	35	41	36
19:30 – 19:45	38	49	35	41	36
19:45 – 20:00	40	58	35	43	36
20:00 – 20:15	40	59	35	43	36
20:15 – 20:30	44	68	35	41	36
20:30 – 20:45	38	56	35	39	36
20:45 – 21:00	41	58	35	43	36

Unattended Noise Level Measurements