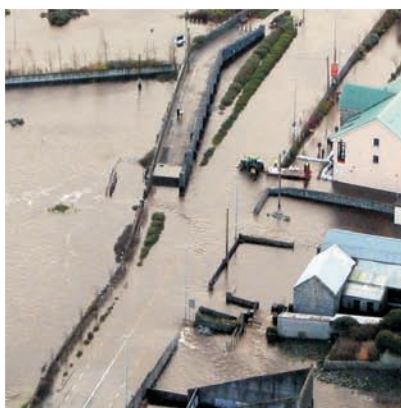


Clare River (Claregalway) Flood Relief Scheme

Natura Impact Statement

November 2012



MGE0262CR0025



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Natura Impact Statement

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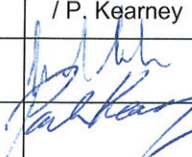
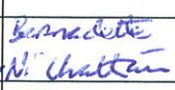
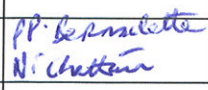
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1 INTRODUCTION

1.1 SCOPE

RPS has been commissioned by the Office of Public Works (OPW) to prepare a Natura Impact Statement (NIS) for the Clare River (Claregalway) Flood Relief Scheme and a proposed Footbridge for Claregalway. The assessment has been conducted in line with the Habitats Directive 92/43/EEC, Article 6(3).

In March 2010 the OPW commissioned two studies. The first related to the Clare River and its main tributary, the Abbert River, within a study area from Corofin to Lough Corrib (Ryan Hanley, 2010a). The study was commissioned as a result of severe damage and disruption caused by flooding in the area in November 2009. The second study related to the townlands of Carnmore East and Cashla on the R339 Galway to Monivea Regional Road, which was also affected by flooding in November 2009 (Ryan Hanley, 2010b). These studies should be read together, and are referred to as the 2010 Flood Studies from this point forward.

In May 2011 the OPW appointed RPS as design and environmental consultants for the Clare River (Claregalway) Flood Relief Scheme. As part of the engineering design contract, the 2010 Flood Studies were reviewed and results documented (RPS, 2011a), an Environmental Constraints Study (RPS, 2011b) and an Environmental Assessment of Viable Options Study (RPS, 2011c) were undertaken, and the proposed flood relief measures were amended and a preferred Flood Relief Scheme option identified.

The preferred scheme option was then assessed based on the refined measures identified as part of this Natura Impact Statement (NIS), in parallel with an Environmental Impact Assessment (EIA).

Between 1945 and 1995 the OPW completed 34 Arterial Drainage Schemes on river catchments, and maintenance has been ongoing on all schemes since their completion. The Clare River forms part of the Corrib-Clare Arterial Drainage Scheme, which commenced in 1954 and was completed in 1964. The OPW have a statutory responsibility for the maintenance of completed Arterial Drainage Schemes and completed Flood Relief Schemes. No maintenance of the main Clare River channel, other than tree management has been carried out within the study area since construction, as no significant siltation has occurred in the channel (OPW, *pers.comm.*). However, the tributaries are generally maintained every five to six years as needed, by suitably rigged hydraulic excavators operated by highly experience staff (OPW Fleet). These maintenance works are undertaken with strict adherence to the OPW's Arterial Drainage Maintenance Service Environmental Management Protocols and Standard Operating Procedures (OPW, April 2011 – see **Appendix A**; hereafter referred to as 'OPW EMPs and SOPs').

The OPW commenced an Environmental River Enhancement Programme (EREP) in 2008. The programme is funded by the OPW, coordinated and managed jointly with Inland Fisheries Ireland (IFI). The main objective of the EREP is to assist in the achievement of 'Good Ecological Status' under the Water Framework Directive (WFD), by enhancing the biodiversity and hydromorphology of arterially drained channels and river corridors in Ireland, while retaining their drainage function. The programme focuses primarily on the enhancement of selected drained salmonid rivers. Over 100km of OPW channel have been enhanced across all OPW regions, through the EREP in 2011, and a similar target has been set for 2012. The Clare River was selected for targeted capital enhancement works under the EREP. Elements of these enhancement works will be carried out in conjunction with the Clare River Flood Relief Scheme.

Given the extent of public concerns relating to a potential repeat of the November 2009 flood event, it was decided that key elements of the Flood Relief Scheme would be brought forward as emergency works. Two elements of the Scheme were progressed as 'advance works', namely;

1. Flood conveyance works at Claregalway Bridge. The installation of the flood eye at Claregalway Bridge was undertaken and the handball alley demolished as part of advanced works by the OPW and completed in June 2011.
2. Crusheeny Bridge replacement completed in April 2012.

A Natura Impact Statement was prepared for the advance works at Claregalway Bridge (McCarthy Keville O'Sullivan, 2010), and a Screening for Appropriate Assessment and Natura Impact Statement were prepared for the advance works at Crusheeny Bridge (RPS, 2011d & e). Both advance works are considered as part of this NIS in terms of cumulative impact assessment.

In addition to the Flood Relief Scheme, a proposed footbridge for Claregalway has also been assessed as part of this NIS. RPS was appointed by Galway County Council in June 2010 to undertake a Feasibility Study in connection with a possible pedestrian footbridge over the Clare River at Claregalway (RPS, 2010).

1.2 STUDY AREA

The Clare River and its tributaries form part of the Corrib catchment, located within Hydrometric Area 30, and within the Western River Basin District (WRBD). The Clare River rises above the town of Ballyhaunis, County Mayo, and the main tributaries are the Dalgan and the Sinking Rivers, north east of Milltown, Co. Galway. On its southerly course towards Lough Corrib, the Clare River flows through Milltown; it then continues to flow west of Tuam where the River Nanny confluences with the Clare River at Weir Bridge; next it flows through Corofin, and south of Corofin, the Abbert River confluences with the Clare River; the next largest town is Claregalway which the Clare flows through before entering Lough Corrib at Coarsefield.

The principal study area for the proposed Flood Relief Scheme will be the channel, floodplain, and immediate surrounding areas of the Clare River extending along the main channel from its outfall in Lough Corrib to 1.3km upstream of Crusheeny Bridge, and including existing tributaries and flood paths where flood mitigation measures have been identified. **Figure 1.1** shows the extent of the study area.

In total 11 Natura 2000 Sites (candidate Special Areas of Conservation (cSAC's) and Special Protected Areas (SPA's)) lie within a 15km radius of the proposed works (**Figure 1.2**). These are listed below:

1. Lough Corrib **cSAC**/pNHA (Site Code: 000297)
2. Lough Corrib **SPA** (Site Code: 004042)
3. Monivea Bog **cSAC**/pNHA (Site Code: 002352)
4. Galway Bay Complex **cSAC**/pNHA (Site Code: 000268)
5. Inner Galway Bay **SPA** (Site Code: 004031)
6. Cregganna Marsh **SPA**/pNHA (Site Code: 004142) and pNHA (Site Code: 000253)
7. Rahasane Turlough (**cSAC**/pNHA Site Code: 000322)/ **SPA** (Site Code: 004089)
8. Lough Fingall Complex **cSAC**/pNHA (Site Code: 000606)
9. Castletaylor Complex **cSAC**/pNHA (Site Code: 000242)
10. Ross Lake and Woods **cSAC** (Site Code: 001312)
11. Gortnandarragh Limestone Pavement **cSAC** (Site Code: 001271)

Given that sites 5-11 do not lie within either the Clare River surface water catchment or the Clare/Corrib Groundwater catchment, a reasonable determination was made at the Appropriate Assessment Screening Stage that the proposed works will not have any direct, indirect or cumulative impacts on these sites either alone or in combination with other plans or projects. Monivea Bog lies

approximately 15km upstream of the proposed works, and so it is also determined that this site will not be affected. In addition, the Appropriate Assessment Screening Stage determined that no significant impacts are expected on Galway Bay Complex cSAC. Therefore, an Appropriate Assessment was deemed not required for this Natura 2000 site in relation to the proposed flood relief works.

Therefore, all but two of the above Natura 2000 sites were considered as unlikely to suffer significant impacts as a result of the proposed Flood Relief Scheme and so were excluded from further consideration at Appropriate Assessment Screening Stage.

The overall finding from the Appropriate Assessment Screening Stage was that the scale and magnitude of impacts on Lough Corrib cSAC/SPA were uncertain. It was considered likely that the construction phase of the proposed works may result in the release of contaminants to the cSAC/SPA. As the scale and magnitude of impacts were not known for certain but were considered likely, it was recommended that a full Appropriate Assessment be carried out in order to determine the impacts of the proposed Flood Relief Scheme on Lough Corrib cSAC/SPA. The preparation of a Natura Impact Statement was therefore recommended.

The two Natura 2000 sites considered further in this Appropriate Assessment Natura Impact Statement are:

- Lough Corrib cSAC, and
- Lough Corrib SPA.

This document comprises the 'Natura Impact Statement' to facilitate the Appropriate Assessment of the project by the Competent Authority.

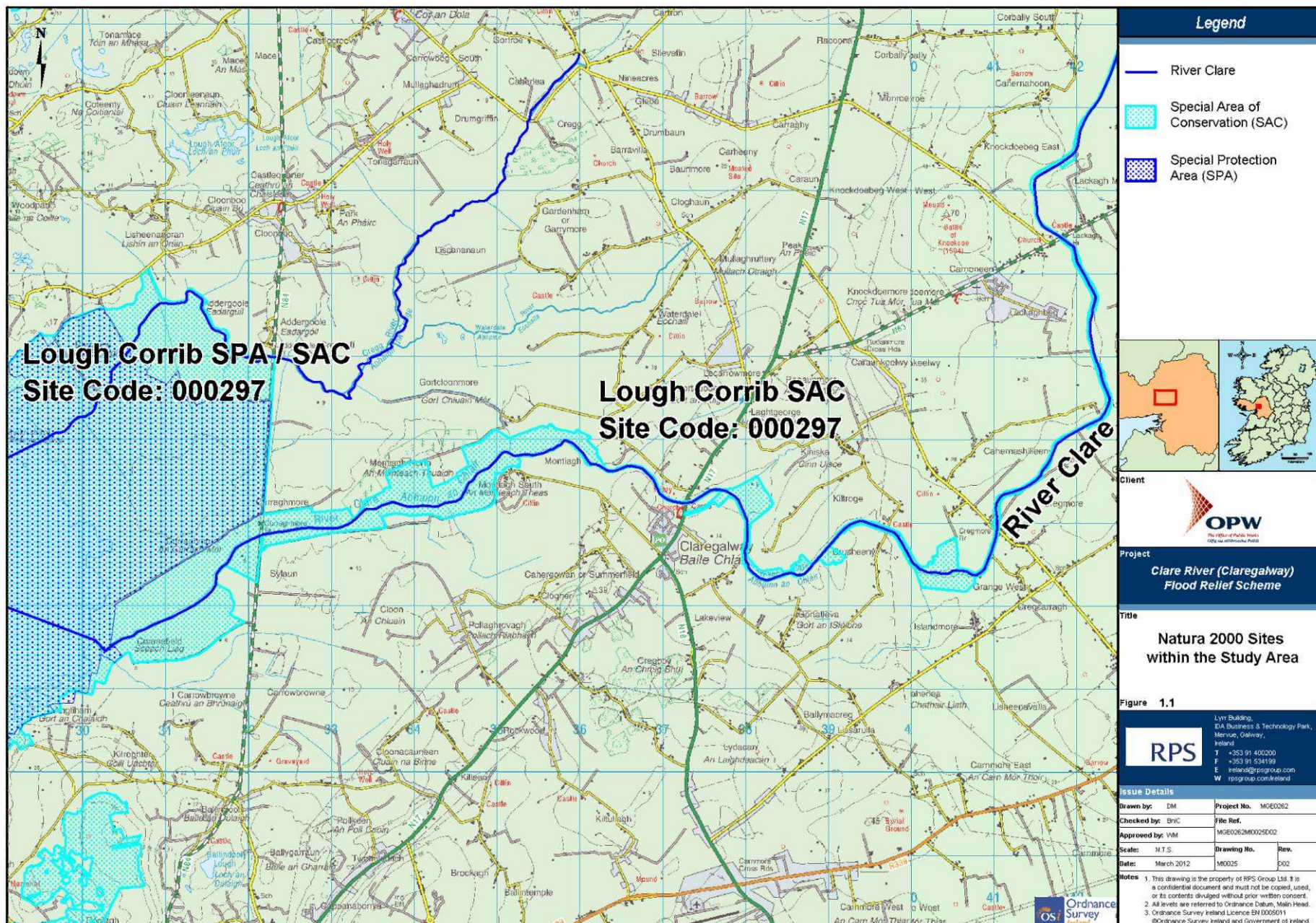


Figure 1.1 Location of Natura 2000 sites within Study Area



Figure 1.2 Clare River Study Area and Designated Sites within a 15km Radius

1.3 METHODOLOGY

1.3.1 General

The assessment was prepared in accordance with the following guidelines;

- DoEHLG (2010) *Appropriate Assessment of Plans and Projects in Ireland Guidance for Planning Authorities*. Department of the Environment, Heritage and Local Government,
- European Communities (2000) *Managing Natura 2000 Sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*, Office for Official Publications of the European Communities, Luxembourg. European Commission,
- EC (2002) *Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC*, Office for Official Publications of the European Communities, Luxembourg. European Commission,
- EC (2007) *Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC – Clarification of the concepts of: alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission*. European Commission,
- EC (2007) *Interpretation Manual of European Union Habitats*. Version EUR 27. European Commission,
- EPA (2002) *Guidelines on the information to be contained in Environmental Impact Statements*. Environmental Protection Agency,
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- Fossitt, J., 2000. *A Guide to Habitats in Ireland*. The Heritage Council, Kilkenny,
- HA (2001) DMRB Volume 10 Section 4 Part 4 - Ha 81/99 - *Nature Conservation Advice In Relation To Otters*. The Highways Agency,
- IEEM (2006) *Institute of Ecology and Environmental Management Guidelines for Ecological Impact Assessment*,
- NPWS (2008) *The Status of EU Protected Habitats and Species in Ireland*. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland,
- Smith, G. F., O'Donoghue, P., O'Hara, K., Delaney, E., 2011. *Best Practice Guidance for Habitat Survey and Mapping*. The Heritage Council, Kilkenny, and
- Consultation with the Public, Statutory and other bodies/ individuals.

The requirements of the following legislation informed the scope of the studies carried out;

- Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (Habitats Directive) and Directive 2009/147/EC (codified version of Directive (79/409/EEC) as amended) (Birds Directive) – transposed into Irish law as European Communities (Birds and Natural Habitats) Regulations 2011 and the Planning and Development Act 2000 (as amended),
- European Communities (Environmental Impact Assessment) Regulations, 1989 to 2006,
- European Communities (Environmental Liability) Regulations, 2008 (S.I. No. 547 of 2008),
- European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 84 of 1988),
- The European Communities Environmental Objectives (Freshwater Pearl Mussel) Regulations 2009,
- Planning and Development Act, 2000 (as amended), and
- Arterial Drainage Act, 1945 and 1995

A full desktop study of available biological information pertaining to the study area was carried out. In addition, a number of ecological assessments have been completed within the study area.

These studies include:

- Habitat Mapping,
- Botanical Surveys,
- Mammal Surveys, and
- Aquatic Ecology and Fisheries Habitat Surveys.

The data collected during these surveys provides detailed information on the existing environment. For this assessment the data relating to the aquatic environment is most valuable for assessing the potential impacts of the works on these receptors. The habitat mapping information and aquatic ecology assessments are used for assessing the impacts of the proposed Flood Relief Scheme works on the terrestrial and aquatic environment.

1.4 APPROPRIATE ASSESSMENT METHODOLOGY

1.4.1 Introduction

The Department of the Environment, Heritage and Local Government guidelines (DEHLG, 2009) outline the European Commission's methodological guidance (EC, 2002) promoting a four-stage process to complete the Appropriate Assessment (AA), and outlines the issues and tests at each stage. An important aspect of the process is that the outcome at each successive stage determines whether a further stage in the process is required.

The four stages are summarised diagrammatically in **Figure 1.3** below, and an outline of the steps and procedures involved in completing each stage follows. Stages 1 - 2 deal with the main requirements for assessment under Article 6(3). Stage 3 may be part of the Article 6(3) Assessment or may be a necessary precursor to Stage 4. Stage 4 is the main derogation step of Article 6(4), Imperative Reasons of Overriding Public Interest (IROPI).

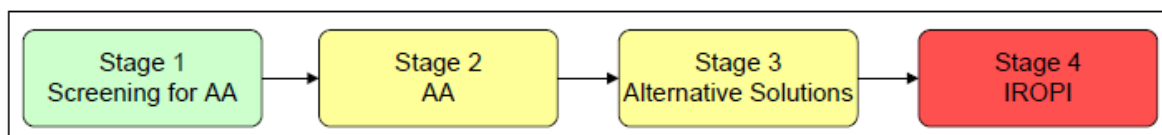


Figure 1.3 Four Stages of Appropriate Assessment

Stage 1: Screening for Appropriate Assessment

Screening is the process that addresses and records the reasoning and conclusions in relation to the first two tests of Article 6(3):

- whether a plan or project is directly connected to or necessary for the management of the site, and
- whether a plan or project, alone or in combination with other plans and projects, is likely to have significant effects on a Natura 2000 site in view of its conservation objectives.

If the effects are deemed to be significant, potentially significant, or uncertain, or if the screening process becomes overly complicated, then the process must proceed to Stage 2 (AA). Screening should be undertaken without the inclusion of mitigation, unless potential impacts clearly can be avoided through the modification or redesign of the plan or project, in which case the screening process is repeated on the altered plan or project. The greatest level of evidence and justification will be needed in circumstances when the process ends at screening stage on grounds of no impact.

Stage 2: Appropriate Assessment

This stage considers whether the plan or project, alone or in combination with other projects or plans, will have adverse effects on the integrity of a Natura 2000 site, and includes any mitigation measures necessary to avoid, reduce or offset negative effects. The proponent of the plan or project will be required to submit a Natura Impact Statement, i.e. the report of a targeted professional scientific examination of the plan or project and the relevant Natura 2000 sites, to identify and characterise any possible implications for the site in view of the site's conservation objectives, taking account of in-combination effects. This should provide information to enable the competent authority to carry out the appropriate assessment. If the assessment is negative, i.e. adverse effects on the integrity of a site

cannot be excluded, then the process must proceed to Stage 3, or the plan or project should be abandoned. The AA is carried out by the Competent Authority, and is supported by the Natura Impact Statement. **Figure 1.4** sets out the main steps for Stage 2: Appropriate Assessment.

Stage 3: Alternative Solutions

This stage examines any alternative solutions or options that could enable the plan or project to proceed without adverse effects on the integrity of a Natura 2000 site. The process must return to Stage 2, as any alternative proposal must be subject to a Stage 2 Appropriate Assessment before it can be subject to the Article 6(4) test. If it can be demonstrated that all reasonable alternatives have been considered and assessed, the AA progresses to Stage 4.

Stage 4: Imperative Reasons of Overriding Public Interest (IROPI)/Derogation

Stage 4 is the main derogation process of Article 6(4), which examines whether there are imperative reasons of overriding public interest (IROPI) for allowing a plan or project that will have adverse effects on the integrity of a Natura 2000 site. The extra protection measures for Annex I priority habitats come into effect when making the IROPI case¹. Compensatory measures must be proposed and assessed. The Commission must be informed of the compensatory measures. Compensatory measures must be practical, implementable, likely to succeed, proportionate and enforceable, and they must be approved by the Minister.

¹ IROPI reasons that may be raised for sites hosting priority habitats are those relating to human health, public safety or beneficial consequences of primary importance to the environment. In the case of other IROPI, the opinion of the Commission is necessary and should be included in the AA

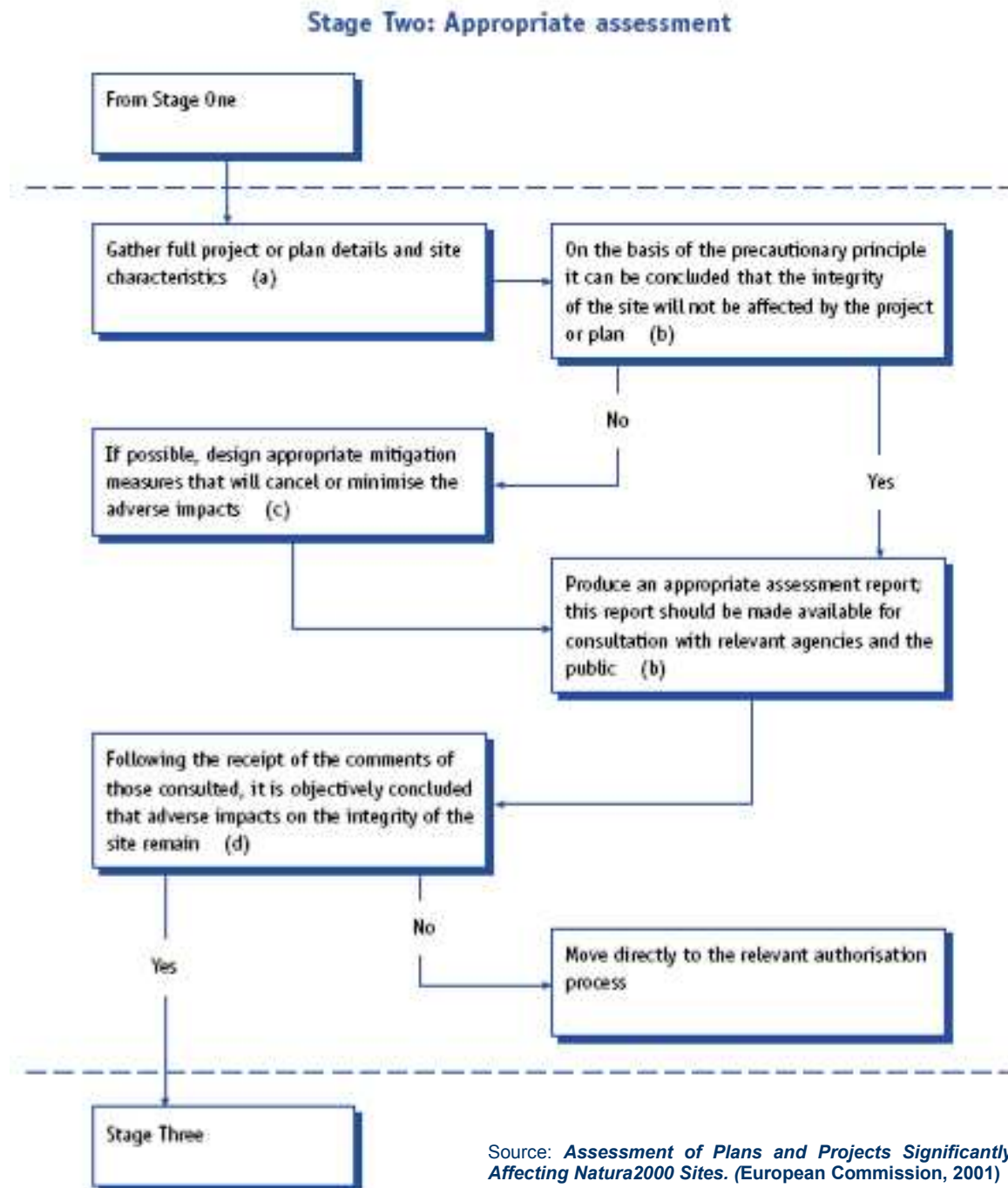


Figure 1.4 Stage Two: Appropriate Assessment

1.5 CONSULTATION RESPONSES

The Development Applications Unit (DAU) of the Department of Arts, Heritage and the Gaeltacht (DAHG) and Inland Fisheries Ireland (IFI) were consulted with regard to the Clare River (Claregalway) Flood Relief Scheme. The DAU reference number for this project is G2011/214. The following reports were issued to both the DAU and IFI prior to this NIS:

- Screening for Appropriate Assessment Advance Works Crusheeney Bridge;
- Natura Impact Statement Advance Works Crusheeney Bridge, and Appropriate Assessment Conclusion Statement; and
- Clare River (Claregalway) Flood Relief Scheme - Screening for Appropriate Assessment.

Consultation responses are provided in full in **Appendix B**, and are summarised below in **Table 1.1**.

Table 1.1 Summary of Consultations and Responses for the Clare River (Claregalway) FRS

Consultation Method	Details
Written Consultation	EIS Scoping letter issued to DAU, NPWS Regional Ecologist and IFI on 11 th May 2011
	Scope of NIS and EIS Surveys for the Clare River (Claregalway) Flood Relief Scheme Report issued to NPWS Regional Manager and Divisional Ecologist. Issued on the 26 th September 2011.
	Proposed scope of EIS issued via email to DAU, NPWS Divisional Ecologist and IFI on 18 th November 2011
Meetings held	Meeting with IFI inspector in the catchment of the Clare River on the 20 th July 2011
	Meeting with IFI on the 22 nd August 2011
	Meeting with NPWS on 16 th September 2011
Response to written consultations	
Stakeholder	Response Received
Development Applications Unit, Department of the Arts, Heritage and the Gaeltacht	<p>Main constraints/issues summarised for Crusheeney Bridge as:</p> <ul style="list-style-type: none"> • Acknowledged that a full Natura Impact Statement is in preparation for the proposed flood alleviation works on the River Clare at Crusheeney Bridge, NPWS ref. G pre 00026/2011. • This NIS is to be provided to DAU, together with all associated information, before any decision is made to proceed, • Screening for a sub-threshold EIS should also be undertaken and recorded for this project, • Surveys required include; upstream and downstream surveys for Lamprey (all three species), White-clawed Crayfish and Salmon, Otter and Bats, • Need to consider changes to the structure and function of the river, to in stream habitats, and to the hydrology of the river as a result of the works proposed, including removal of the central footing of the bridge, • Mitigation measures should be specified in detail, where necessary, to ensure that adverse effects will be avoided or reduced, • The NIS, and associated ecological impact assessment, should cover all impacts associated with the project, including demolition of the existing bridge, construction of the new bridge and all associated works. This should include the development footprint; all works areas, site compounds, parking and storage areas; access points and routes; temporary crossing structures; surface water management and silt control measures, etc., and • If any licences are required for disturbing strictly protected species, or their key habitats, these should be secured from NPWS in advance of any works commencing. <p>Main constraints/issues summarised for FRS as (NPWS Ref: G2011/214):</p>

	<ul style="list-style-type: none"> Confirmed that the overall project and any advanced works will require an Appropriate Assessment. Outlined the Natura 2000 sites of relevance to the FRS – Lough Corrib cSAC and Lough Corrib SPA. Confirmed that an EIS would be required to assess the ecological issues of relevance to proper planning and sustainable development, and to address all legal requirements in relation to the conservation and protection of ecological sites, habitats and species. All aspects of the project at site preparation (including advance works); construction and operation stages should be taken into account in undertaking assessments. <p>The following projects were identified which may give rise to in combination effects: Claregalway Local Area Plan 2005-2011; existing flood relief and flood prevention measures; new wastewater treatment plant (Cahergowan) (permitted); M17/N18 Gort to Tuam road (permitted); Claregalway riverside walkway (proposed); Claregalway bypass road (proposed).</p>
Inland Fisheries Ireland	<p>Main constraints/issues for Crusheeny Bridge summarised as:</p> <ul style="list-style-type: none"> IFI are committed to engaging with the OPW with regard to flooding issues while ensuring environmental assets are safeguarded, the river and riparian zone fully remediated and angler access accommodated. Ensure that any hydromorphological alterations support the ecological functioning of the river, are WFD compliant and are designed to ensure that at least good status is maintained. No objections to the bridge structure, there is a need for elaboration of the rationale for the choice of O.D. level of the base of the flood berm. <p>Main constraints/issues for FRS summarised as:</p> <ul style="list-style-type: none"> Impact on resident/migratory fish populations. Establishment and mapping of existing baseline conditions, identification of existing pools/glide and riffle zones. Timing to avoid impacting salmonid ova, smolt or elvers or other fish species. Disruption of angling. Access to the river from the main road and access to the proposed low bank and flood berm. Impact of sediment release and transport. Changes to low flow regimes as a result of the level at which the base of the flood berm is set in relation to the new proposed river bed level. Car parking for anglers. Plan for remediation of channel and riparian zone. Integration with Clare River walkway project. <p>Assumed that works will be undertaken in accordance with the OPWs Environmental River Enhancement Programme (E.R.E.P.), which aims to enhance all water dependent habitats and species.</p> <p>The creation of a fish holding pool at a suitable location downstream of Claregalway bridge adjacent to the proposed angling platform to be integrated into the river walkway project was indicated as having been discussed with the OPW. The existing pool previously selected was indicated as being too far downstream for disabled anglers to traverse (maps provided illustrating the Clare River Catchment water bodies and the original location proposed for disabled anglers stand).</p>

2 PROJECT DESCRIPTION

2.1 LOCATION

The Clare River and its tributaries form part of the Corrib catchment, located within Hydrometric Area 30, and within the Western River Basin District (WRBD). The Clare River rises above the town of Ballyhaunis, County Mayo, and the main tributaries are the Dalgan and the Sinking Rivers, north east of Milltown, Co. Galway. On its southerly course towards Lough Corrib, the Clare River flows through Milltown; it then continues to flow west of Tuam where the River Nanny confluences with the Clare River at Weir Bridge; next it flows through Corofin, and south of Corofin, the Abbert River confluences with the Clare River; the next largest town is Claregalway which the Clare flows through before entering Lough Corrib at Coarsefield.

The principal study area for the proposed Flood Relief Scheme will be the channel, floodplain, and immediate surrounding areas of the Clare River extending along the main channel from its outfall in Lough Corrib to approximately 1.3km upstream of Crusheeny Bridge, and including existing tributaries and flood paths where flood mitigation measures have been identified. The proposed footbridge is to be located at the Claregalway N17 roadbridge over the Clare River. **Figure 2.1** shows the extent of the study area.

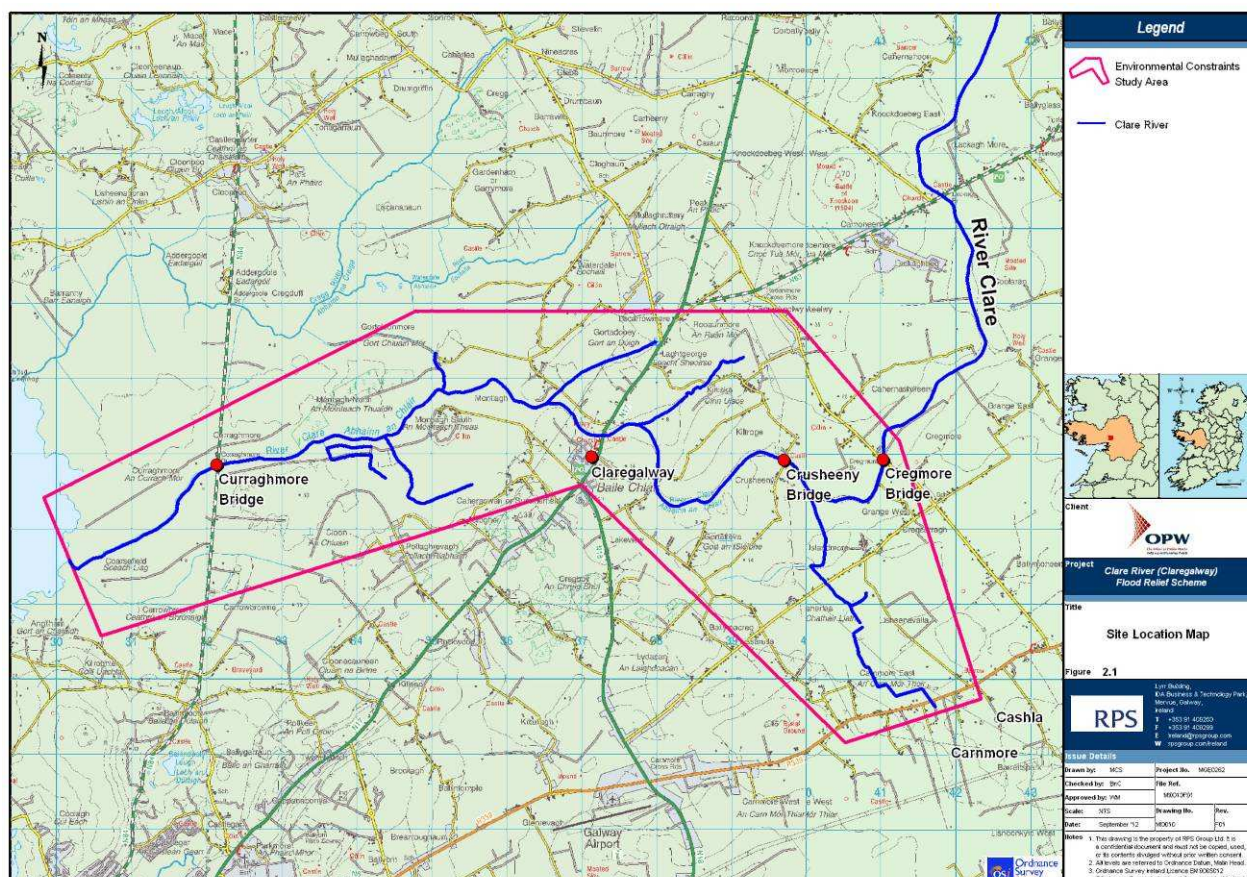


Figure 2.1 Extent of Study Area

2.2 NATURE AND EXTENT OF PROPOSED WORKS

In May 2011 the OPW appointed RPS as environmental and design consultants for the Clare River (Claregalway) Flood Relief Scheme. The Clare River and main tributaries form part of the Corrib Clare Arterial Drainage Scheme, which commenced in 1954 and was completed in 1964, for which the OPW have a statutory maintenance responsibility. These original Arterial Drainage Scheme works involved substantial widening and deepening of the existing channel and tributaries with the purpose of providing an outfall for the drainage of agricultural lands (OPW, 1954). The proposed Flood Relief Scheme is divided into nine geographical areas for which a set of ten flood alleviation measures are proposed. These measures are outlined in **Table 2.1** and a detailed description is provided in **Section 2.2.1** (see Drawings in **Appendix C**).

Table 2.1 Summary of Flood Relief Measures

Area		Proposed Measures	Watercourse directly affected
1	Lough Corrib to Curraghmore Bridge	No channel alteration measures proposed. See Item 10 for Channel Maintenance requirements.	
2	Montiagh South	2a Raise approx. 1km of road 2b Upsize existing road culvert 2c Clean/Regrade Drains	Un-named drain (1) Un-named drain (1) Western Drain Series (2) Un-named wide tributary (3)
3	Montiagh North	3a Raise approx. 0.430 km of road 3b Raise approx. 0.830 km of road	Gortadooey tributary Gortcloonmore tributary and Un-named drain (4)
4	Claregalway Village	4a Install flood eye at Claregalway Bridge (complete) 4b Regrade Clare River channel upstream of and under the Claregalway bridge, and regrade flood eye 4c Address gap in wall at An Mhainistir housing estate 4d Provide local embankment at Nine Arches bridge, and infill old Clare River Channel	Clare River
5	Kiniska	5a Increase capacity of culverts on OPW C3/5 stream 5b Clean OPW stream C3/5	Kiniska tributary
6	Lakeview	6a Provide surface water outlet through fields (open channel and piped culvert) to Clare River at Claregalway Bridge	Clare River
7	Gortatleva	No additional measures proposed (Measures for Area 4 apply)	
8	Caherlea/Lisheenavalla	8a Replace Crusheeney Bridge (complete) 8b Channel widening from 1.3km upstream of Crusheeney Bridge to immediately downstream of Crusheeney Bridge to form a two-stage channel 8c Cleaning and regrading of Islandmore OPW C3/7 and F.799/1 arterial drains 8d Raise local road in Caherlea/Lisheenavalla (Future Measure) 8e Construction of an embankment along the southern bank of the Clare River from 1.3km upstream of	Clare River Clare River + Islandmore /Caherlea arterial drainage network (5) Islandmore /Caherlea arterial drainage network (5) Islandmore /Caherlea arterial drainage network (5) Clare River + Islandmore /Caherlea arterial drainage network (5)

Area		Proposed Measures	Watercourse affected directly
		Crusheeny Bridge to the Islandmore Drain and the installation of a non-return valve on the discharge from the Islandmore Drain	
9	Carnmore/Cashla	Drainage of floodwater from the affected area via a new drainage pipeline/open drain to a local surface water stream at Islandmore	Islandmore /Caherlea arterial drainage network (5)
10	Channel Maintenance	Selective Channel Maintenance along the Clare River from Lough Corrib to Cregmore Bridge including localised rock removal downstream of Curraghmore Bridge	Clare River

A summary of the additional elements are provided in **Table 2.2** below.

Table 2.2 Additional Elements Assessed in this NIS

Footbridge
In addition to the flood relief measures proposed above, a proposed footbridge at Claregalway, is also included within this assessment. Figure 2.17 illustrates a preliminary design for this footbridge.

2.3 DETAILED DESCRIPTION OF THE PROPOSED FLOOD RELIEF MEASURES

2.3.1 Area 1 – Lough Corrib to Curraghmore Bridge

No measures are proposed for this section of the Clare River.

2.3.2 Area 2 – Montiagh South

The works proposed at Montiagh South include the raising of a section of road, upsizing of a culvert and cleaning of drains. **Images 2.1** and **2.2** below show the proposed road section to be raised and the existing culvert to be upsized.



Image 2.1 Montiagh South Road to be Raised



Image 2.2 Montiagh South existing culvert to be upsized

2.3.2.1 Preferred Measures

The work will involve the following measures;

Measure 2a - Raise existing local road to a minimum level of 8.60m OD.

This will lead to the raising of approximately 1,075m of road by up to 0.9m in height.

Measure 2b - Increase size of culvert in conjunction with road works.

It is proposed to replace the existing culvert which is currently 1.2m x 0.8 m with a culvert of up to 3.5m x 1.2m.

Measure 2c - Clean out drains in vicinity.

The OPW have a maintenance responsibility for the drain downstream of the road and this drain will be cleaned on a regular basis as part of the OPW's drainage maintenance works and using OPW's EMPs and SOPs (see **Appendix A**). Drains upstream of the road are generally in private ownership.

It is proposed to use suitable material excavated from the channel widening (Measure 8b) works to facilitate the road raising measure. Raising the existing road will mean that it will be substantially higher than surrounding lands and the width of the road corridor will need to be widened to accommodate the raised road. Existing drains along the road will need to be re-routed or piped. Access to fields will need to be modified to tie into the new road levels. Crash barriers or railings will be required along sections of the road. The extent of works required is shown in **Figure 2.2**.

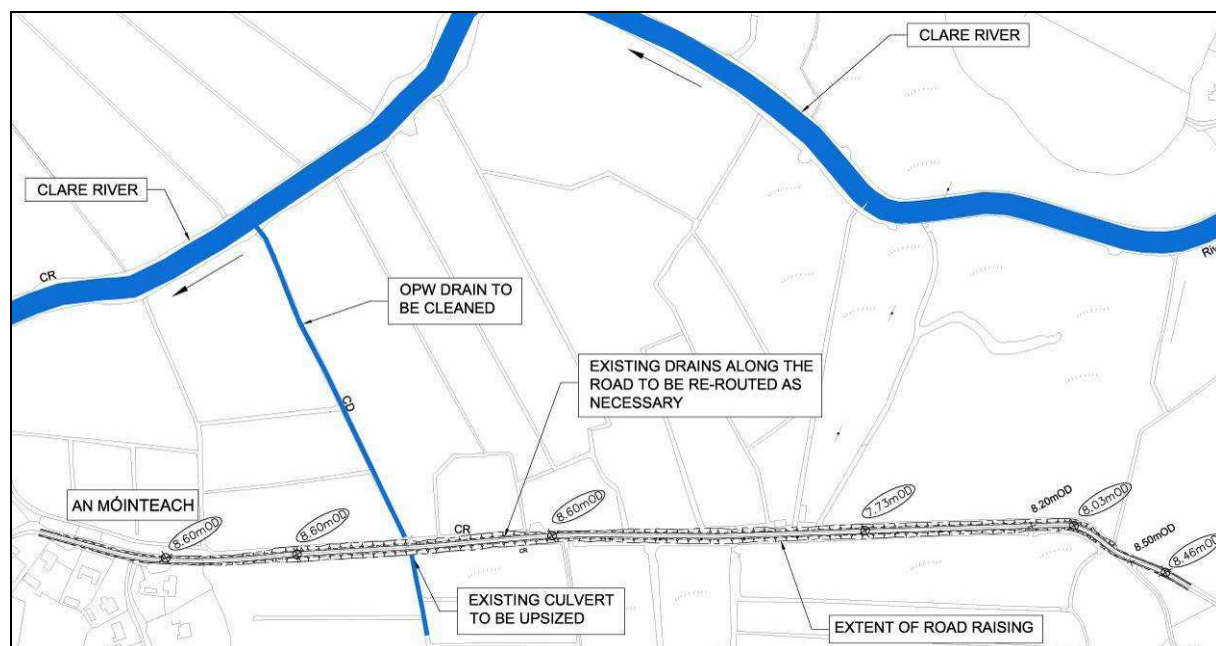
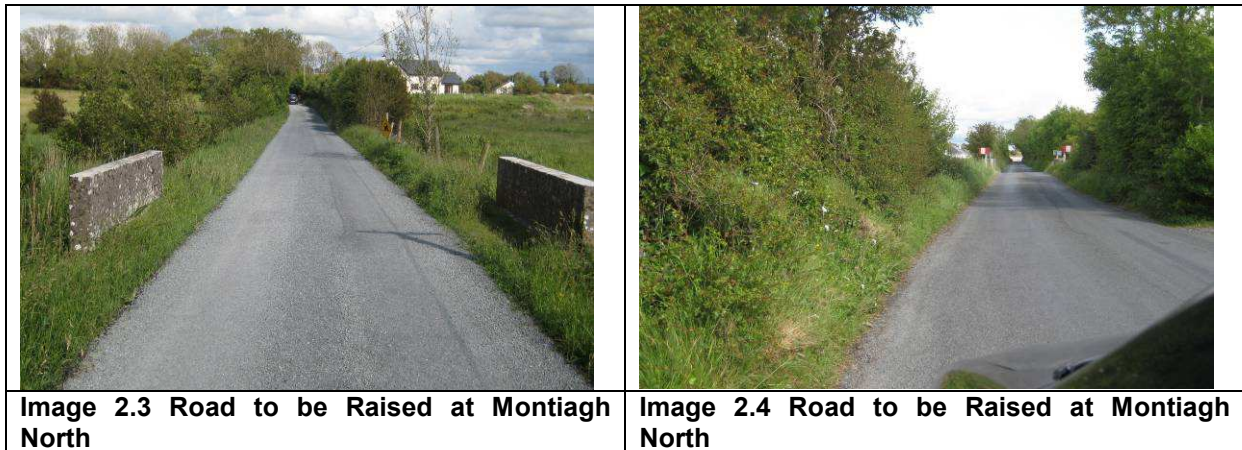


Figure 2.2 Extent of Works in Montiagh South

2.3.3 Area 3 – Montiagh North

The works proposed at Montiagh North include the raising of two separate sections of road. **Images 2.3** and **2.4** below show the proposed road sections to be raised.



2.3.3.1 Preferred Measures

The work will involve the following measures;

Measure 3a - Raise existing local road to a minimum level of 9.0m OD.

This will lead to the raising of approximately 430m of road by up to 1.23m in height to a minimum level of 9.0mOD.

It is proposed to use suitable material excavated from the channel widening works in the road raising. Raising of the existing road will mean that the road will be substantially higher than surrounding lands and the width of the road corridor will need to be widened to accommodate the raised road. Existing drains along the road will need to be re-routed or piped. Access to fields and driveways will need to be modified to tie into the new road levels. Crash barriers or railings will be required along sections of the road. It may also be necessary to install additional flood relief culverts under the road to prevent the raised road acting as an embankment and possibly worsening flooding effects elsewhere. The extent of the works is shown in **Figure 2.3** below.

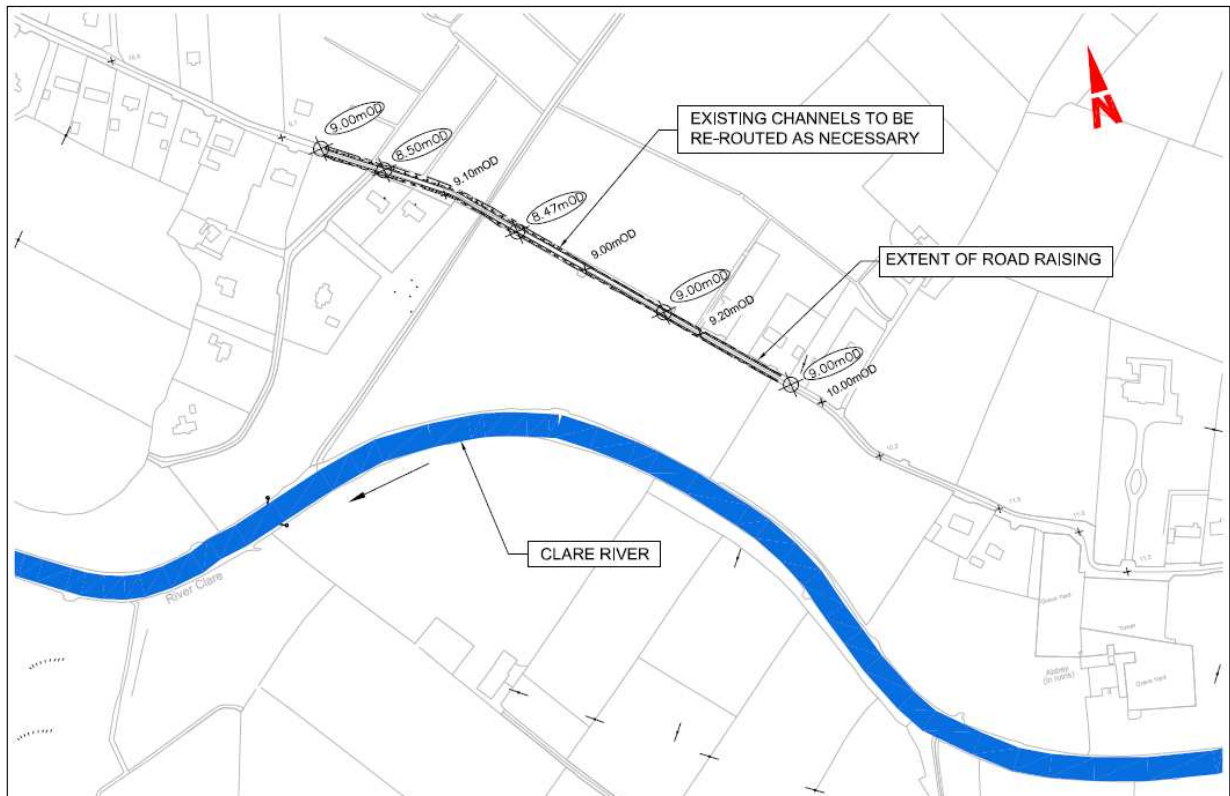


Figure 2.3 Extent of Works in Montiagh North-Measure 3a

Measure 3b - Raise existing local road to a minimum level of 9.0m OD.

This will lead to the raising of approximately 830m of road by up to 1.32m in height to a minimum level of 9.0mOD.

The extent of works required are shown in **Figure 2.4**.



Figure 2.4 Extent of Works in Montiagh North-Measure 3b

2.3.4 Area 4 – Claregalway Village

The measures proposed for Claregalway included an embankment at the Nine Arches Bridge (**Image 2.5**), the provision of a flood relief eye at Claregalway Bridge (**Image 2.6**), channel widening and deepening at the bridge, the infilling of the old river channel at this location, and addressing the gap in the pre-scheme flood defence wall of the private estate at An Mhainistir. The additional flood eye at Claregalway Bridge (Measure 4a) has been installed by OPW as advance works completed in June 2011.



Image 2.5 Nine Arches Bridge



Image 2.6 Flood eye at Claregalway Bridge installed as Advanced Works

2.3.4.1 Preferred Measures

The work will involve the following measures;

Measure 4b – Regrade Channel Upstream of, and Under Claregalway Bridge

The extent of regrading (river deepening) of the river bed is approximately 80m upstream of the existing weir located downstream of Claregalway Bridge, and will include the removal of the weir. The newly constructed flood eye will be used as a temporary diversion during the regrading. The river will be diverted through the flood eye for a period of up to approximately three weeks. The widened channel upstream and downstream of Claregalway Bridge will initially be excavated to a level of approximately 6.1m OD (minimum). A cofferdam will be installed to dewater this area. The cofferdam will be installed such as to dewater part of the southern section of the river (particularly downstream of the bridge) to allow regrading. The cofferdam will then be relocated to dewater the remaining section of the river with the flow to be diverted through the newly installed flood eye. The river will be deepened to a minimum level of 4.60m OD which will mean deepening of up to 1.2m approximately in some areas. The work will be performed during the summer months at periods of low flow. **Figure 2.5** and **Figure 2.6** show the proposed temporary works. The layouts shown are indicative and subject to site conditions.

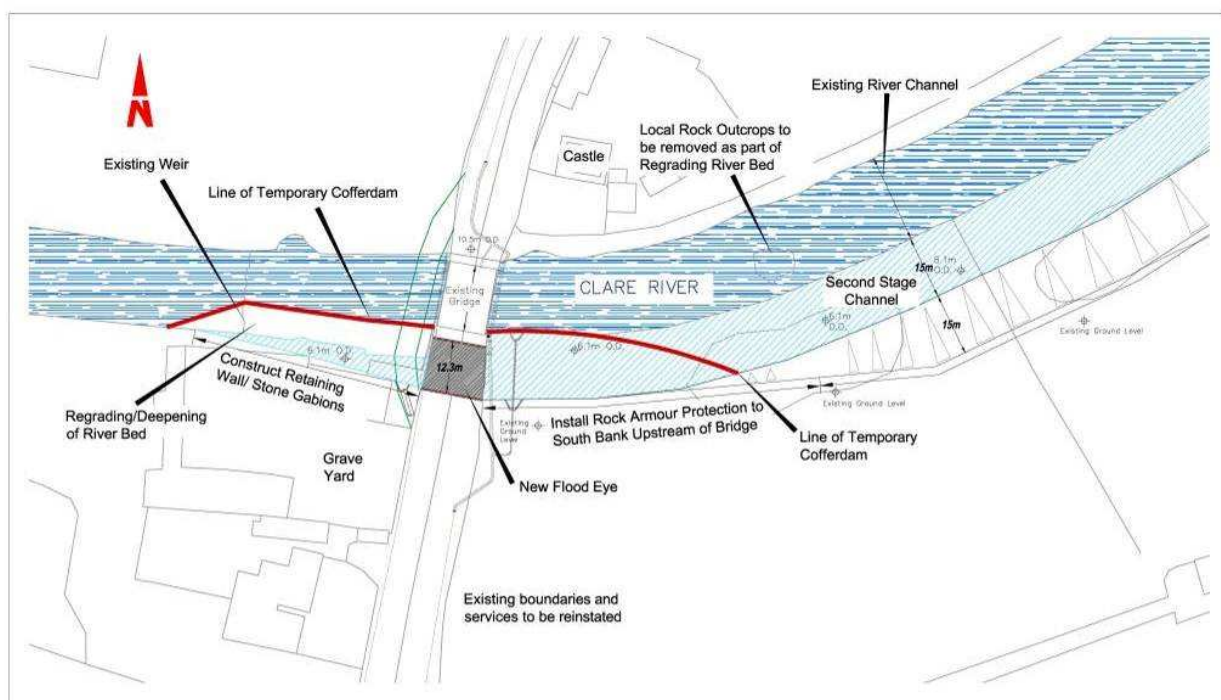


Figure 2.5 Temporary Works for River Deepening Works at Claregalway-Stage 1

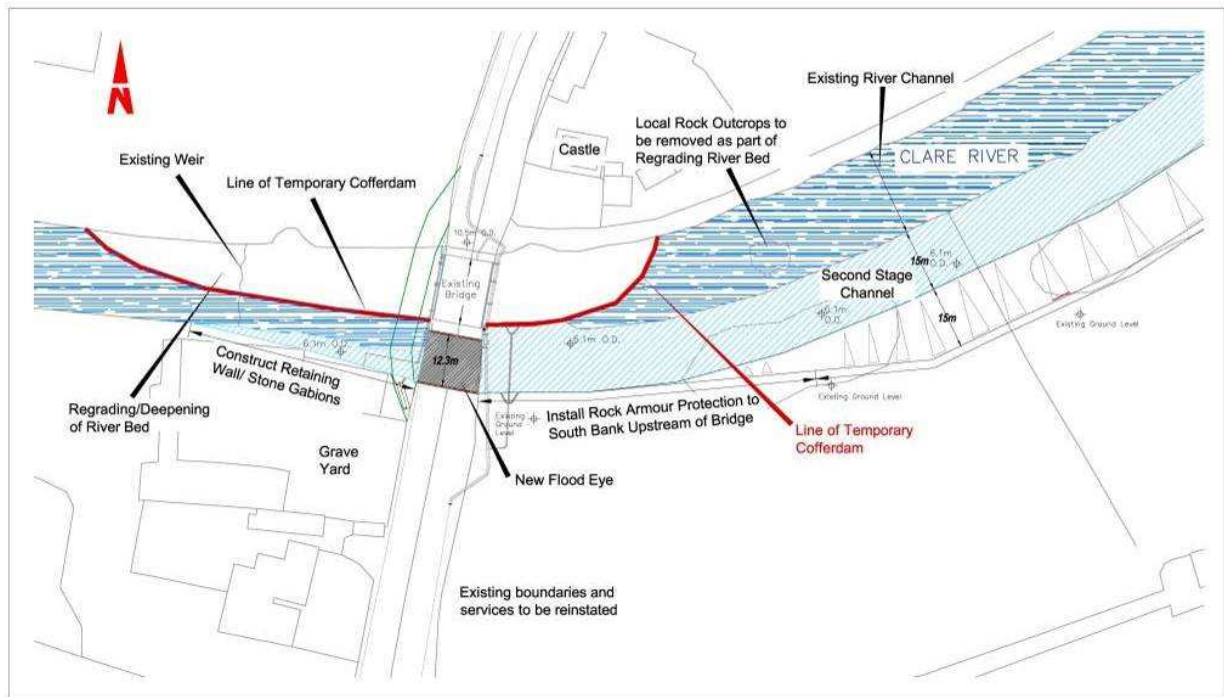


Figure 2.6 Temporary Works for River Deepening Works at Claregalway-Stage 2

Measure 4c – Fill gap in existing flood defence wall at An Mhainistir housing estate.

The retaining wall on the northern end of the An Mhainistir estate has a gap around the ESB substation (**Image 2.7**), which allows flood waters to enter the estate from the Clare River. The wall will be completed in this area to remove the breach. A pipe with a non-return valve will be installed to allow water to drain from the estate in the event of flooding from other sources (e.g. N17).



Image 2.7 Gap in the retaining wall behind the ESB substation at An Mhainistir housing estate

- **Measure 4d – Provide earthen embankment & infill old river channel in field behind old Nine Arches Bridge**

An embankment is to be installed along the eastern side of the existing Nine Arches Bridge to prevent the flow of flood water under the bridge. The embankment will be approximately 53m long, 4m wide and approximately 2.5m high. The embankment will be created using material excavated from the channel widening works. Additional material from the excavation will be placed within the old river channel to the rear of the Nine Arches Bridge to prevent overland flow at this location. **Figure 2.7** shows the extent of the embankment at the Nine Arches Bridge and the filling of the old Clare River channel.

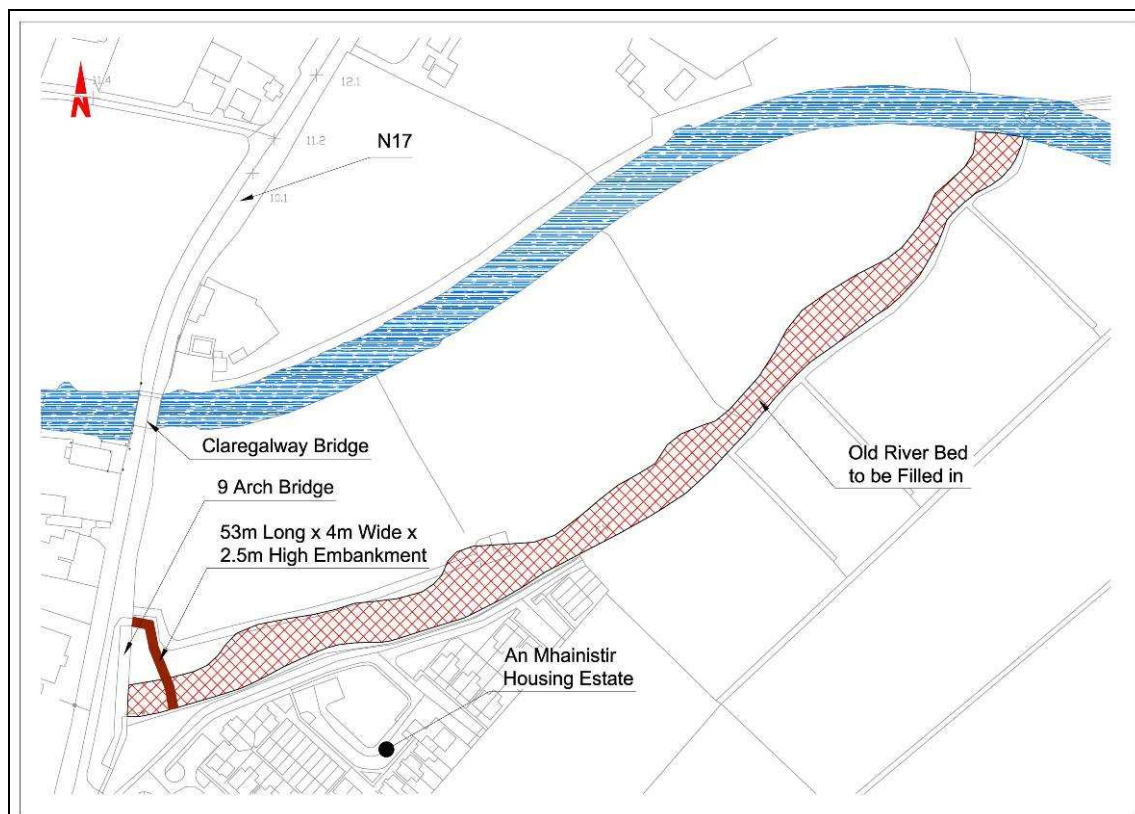


Figure 2.7 Embankment at Nine Arches Bridge and Infilling of Old Clare River Channel

2.3.5 Area 5 – Kiniska

2.3.5.1 Preferred Measures

The recommended measures outlined in the flood study were considered appropriate as follows;

Measure 5a – Increase culvert capacity in two places.

Two 900mm diameter culverts are to be replaced with culverts of approximately 1.5m diameter to alleviate restrictions in this tributary of the Clare River (OPW channel reference C3/5).

Measure 5b – Carry out general cleaning and channel maintenance.

It is necessary to clean OPW channel, reference C3/5, as part of the OPW's maintenance works to ensure its conveyance capacity is not restricted. Minor regrading works may be required in one area

immediately downstream of the bridge on the local road (LS 7133) to prevent erosion of the channel banks from reoccurring.

The locations of the proposed measures at Kiniska are shown in **Figure 2.8** below.

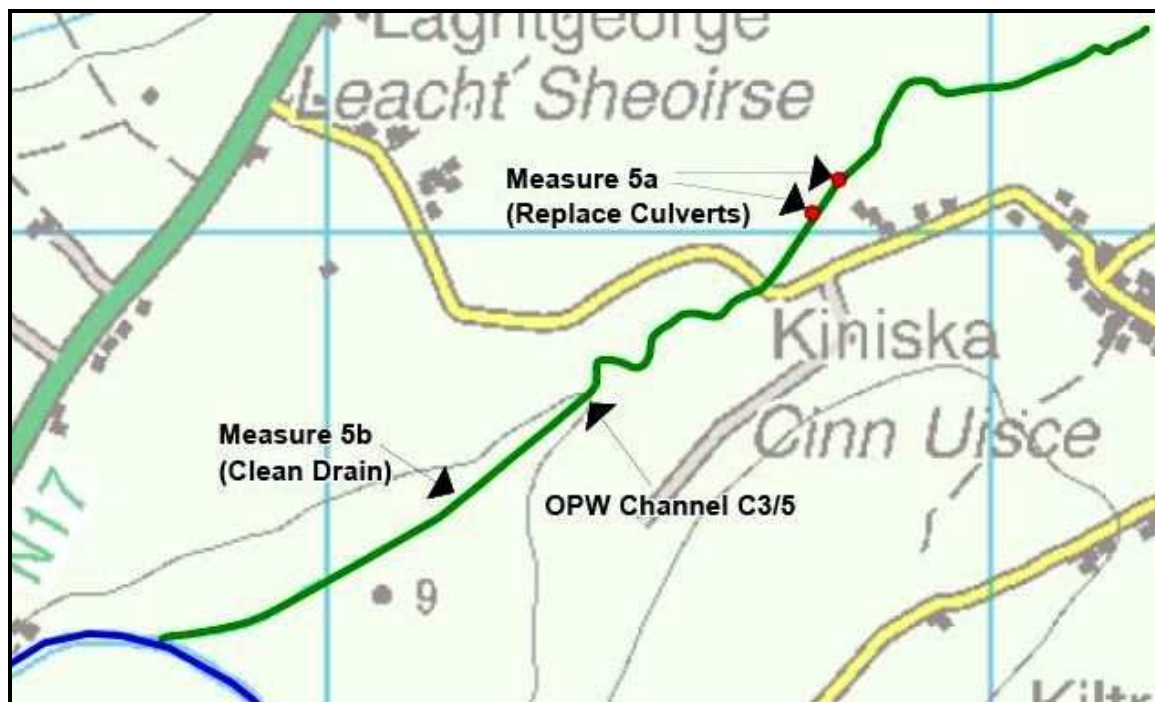


Figure 2.8 Proposed Works at Kiniska

2.3.6 Area 6 – Lakeview

The works proposed at Lakeview include the installation of a surface water drain from Claregalway Corporate Park through Cúirt na hAbhainn Estate to the Clare River to alleviate the worst effects of the flooding. The proposed surface water channel will reduce the water levels in the Lakeview Area to approximately 10.5mOD. The proposed route from the corporate park and through Cúirt na hAbhainn Estate is shown in **Images 2.8** and **2.9** below.



Image 2.8 Cúirt na hAbhainn Estate



Image 2.9 Claregalway Corporate Park

2.3.6.1 Preferred Measures

The work will involve the following measures;

Measure 6a – Provide surface water drain to river at Claregalway Bridge.

The proposed surface water outlet will consist of a combination of a surface water pipe and an open channel. The overall length of the surface water outlet will be approximately 1.65km. The pipeline will be a 1.5m diameter culvert with an equivalent open channel with a base width of approximately 1m. An appropriate safety fence will be required in areas where an open channel is used, set back an appropriate distance from the channel to facilitate drainage channel maintenance. **Figure 2.9** below shows the indicative location of the proposed measure at Lakeview. The location of this drain will be confirmed following detailed design and site investigation work.

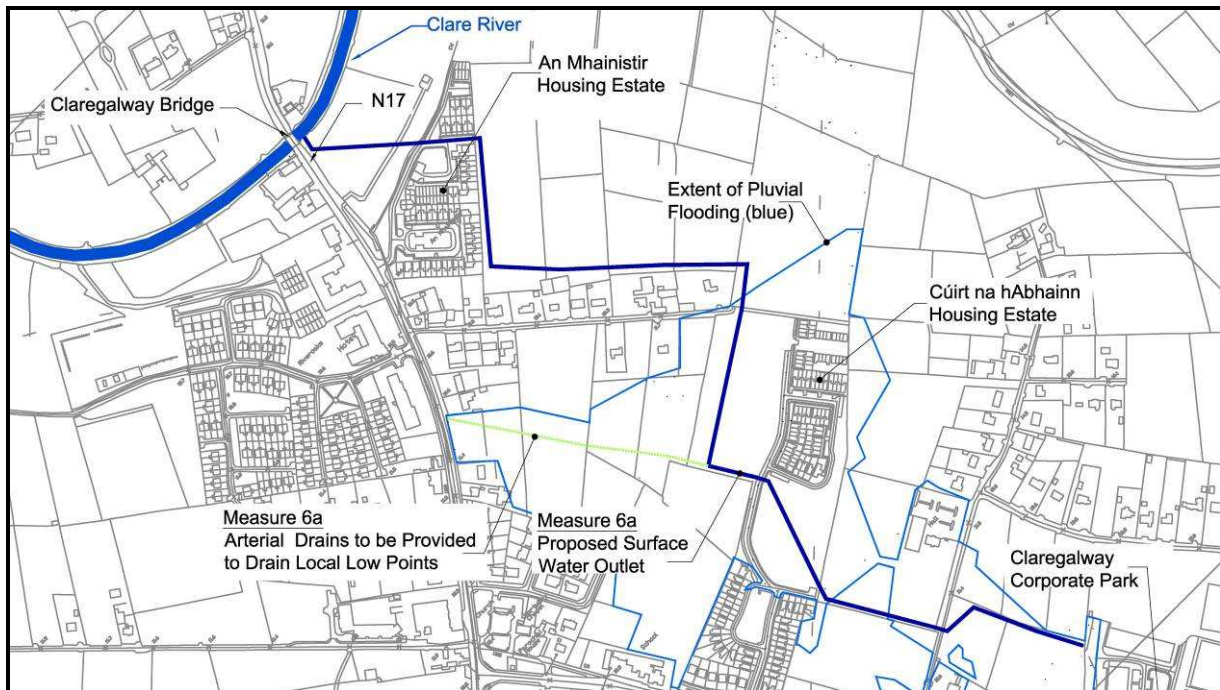


Figure 2.9 Proposed Surface Water Outlet from Lakeview

2.3.7 Area 7 – Gortatleva

No additional measures were proposed for this section of the Clare River.

2.3.8 Area 8 – Caherlea/Lisheenavalla

The works proposed in this area include the creation of a two-stage channel through channel widening from immediately downstream of Crusheeny Bridge to approximately 1.3km upstream of the bridge; construction of an embankment along the river from the Islandmore drain to a distance of approximately 750m upstream of the drain; cleaning of the Islandmore drain and future raising of road levels. The replacement of Crusheeny Bridge was completed in 2012. **Images 2.10** and **2.11** below show the old and new bridges at Crusheeny.



Image 2.10 Old Crusheen Bridge



Image 2.11 Replacement Bridge at Crusheen

2.3.8.1 Preferred Measures

The following measures were considered appropriate;

Measure 8a – Demolish existing bridge and replace it with a new bridge

The existing bridge at Crusheen has been demolished (September/October 2011) and the construction of the replacement bridge is now complete.

A three span structure with a central span of 20.0m with two end spans of 10.225m each and a cross sectional width of 9 metres was constructed to replace the old bridge. A cross-section of the bridge is provided in **Figure 2.10**.

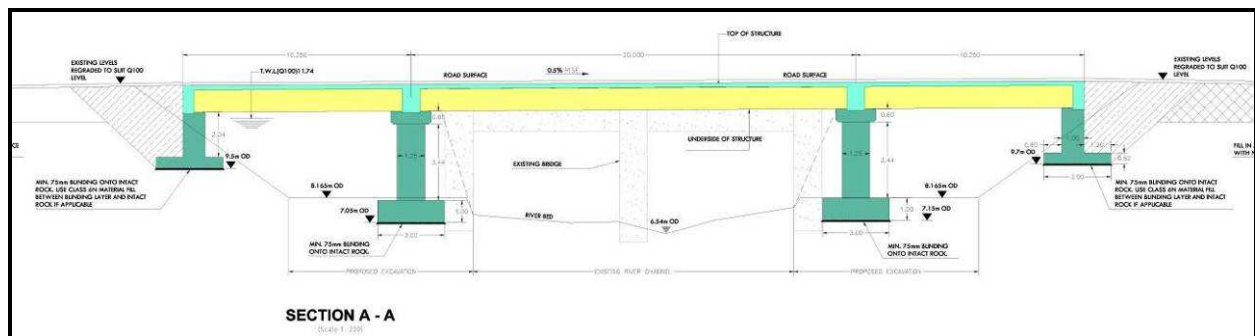


Figure 2.10 New Bridge at Crusheen

Details of the bridge cross-section are provided in **Table 2.3**.

Table 2.3 Crusheeny Bridge Cross-Section

Feature	Width (m)
Parapet beam	0.5
Raised verge / verge	1.0
Hardshoulder / Hard Strip	-
Carriageway	2.75
Central Reserve	-
Carriageway	2.75
Hardshoulder / Hard Strip	-
Raised verge / verge	1.5
Parapet beam	0.5
Total Width	9.0

Measure 8b – Widen the channel from 1.3km upstream of Crusheeny Bridge to immediately downstream of Crusheeny Bridge

The proposed works from downstream of Crusheeny Bridge to approximately 1.3km upstream of Crusheeny Bridge will consist of widening of approximately 1.3km of the Clare River to form a two-stage channel to increase its conveyance capacity during flood events. The excavation will generally consist of a 15m wide second stage channel excavated at a level generally a minimum of 0.8m above the existing river bed or the first stage channel. These two-stage channel works will be restricted to the months of May through September, unless otherwise agreed in advance with IFI and NPWS.

The two-stage channel works will result in a large amount of material being excavated. Approximately 88,634m³ of overburden and rock will be removed as part of the channel widening works. A further 33,80m³ is to be removed from the river bed at Claregalway Bridge as part of the channel deepening works. In addition 36,854m³ of existing spoil heaps on the bank of the river will also be removed as they are located within the footprint of the second stage channel. In total, this will result in 128,868m³ of material to be excavated. The excavation works will generally occur on the south bank of the river upstream of the Islandmore drain and on the north bank downstream of the Islandmore Drain. Excavation works on both sides of the river may be necessary in some areas.

Some of the material excavated as part of the two-stage channel works will be used to create the embankment on the south bank of the river. The remaining material may be added to existing spoil heaps by increasing the width of the spoil heaps but not the height. Alternatively the material will be spread adjacent to the river on the bank. However, removal off site may also be required at various locations, or reuse for other aspects of the scheme e.g. road raising measures, including Measures 2a, 3a, 3b and 8d, or for other projects e.g. construction of the proposed waste water treatment plant at Claregalway in the townland of Cahergowan/Summerfield.

The extent of the river widening works and cross sections of the channel widening are available in **Appendix C**.

Measure 8c - Cleaning and limited regrading of Islandmore Drain

Cleaning of the Islandmore drain along with minor regrading works along its entire length is also required to ensure that the drain's conveyance capacity is not restricted as a result of vegetation growth. This work will be accomplished in accordance with the OPW's EMPs and SOPs (OPW, April 2011).

Measure 8d – Raise the local road in Caherlea/Lisheenavalla (future measure)

The replacement of the bridge at Crusheeney along with the widening of the Clare River and cleaning of the Islandmore drain will have a significant effect on reducing the flood levels at Caherlea. For a flood event of the magnitude of November 2009 the maximum flood level will be approximately 11.89 mOD which is approximately the same level as the existing road and will thereby result in little or no flooding of the road and no flooding of houses in this area. Under design flood conditions, however, the road will flood to a level of approximately 280mm. Therefore it is proposed to raise the road at Caherlea/Lisheenavalla by an additional 500mm for a length of 500m as a future measure to cater for the design flood. The extent of the works required is shown on **Figure 2.11**.

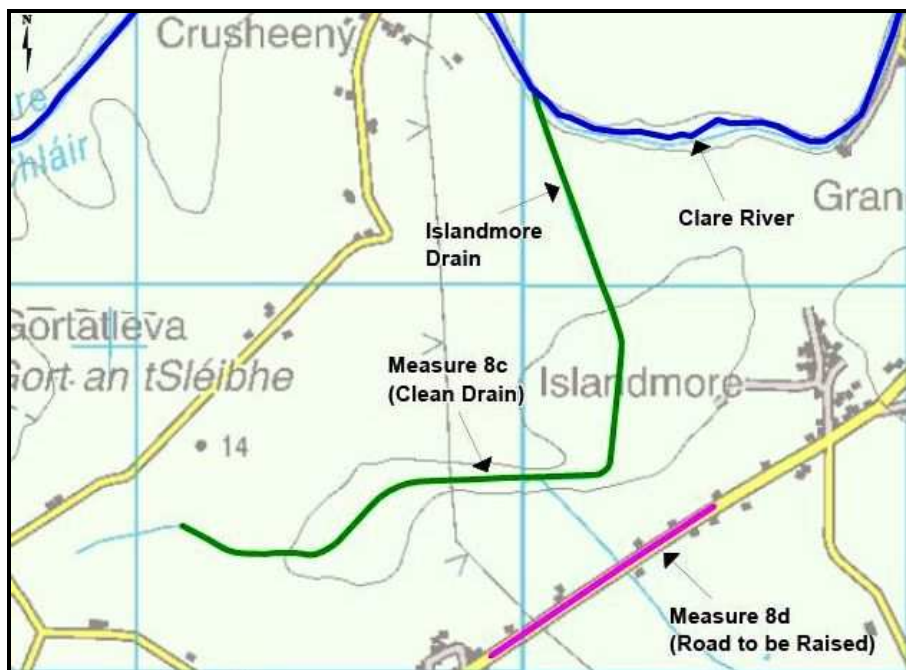


Figure 2.11 Islandmore Drain and Road to be raised at Caherlea

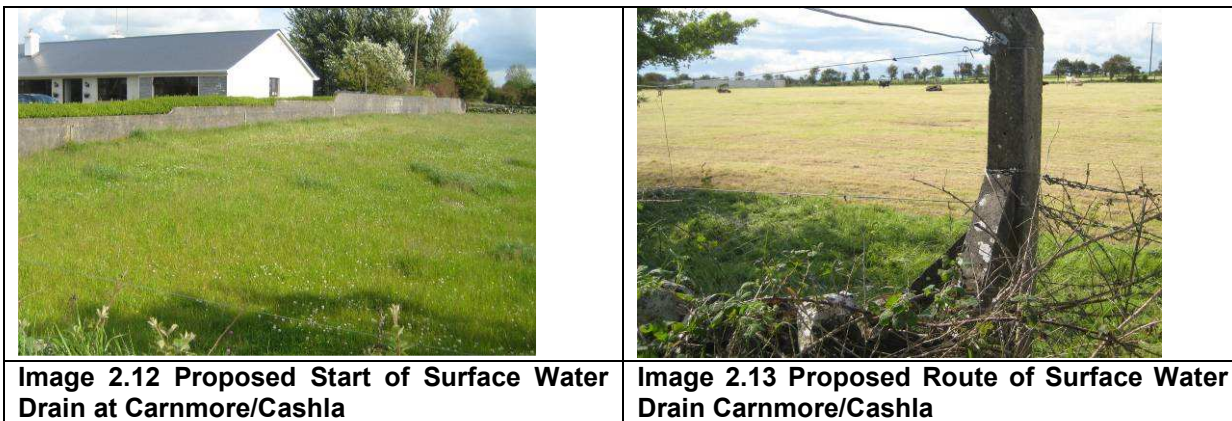
Measure 8e – Construction of an embankment along the southern bank of the Clare River from 1.3km upstream of Crusheeney Bridge to the Islandmore Drain and the installation of a non-return valve on the discharge from the Islandmore Drain

These works include the creation of an embankment on the south bank of the Clare River from a distance of approximately 750m upstream of the confluence of the Islandmore drain as far as the Islandmore drain itself. The embankment will prevent flood waters from the Clare River from flooding the Islandmore Drain catchment (Caherlea/Lisheenavalla area) during flood events. The embankment will generally be a minimum of 1-2m above the existing river bank. The maximum height of the embankments will not exceed the height of the existing spoil heaps in the immediate vicinity.

As part of this work, a non-return valve will be installed at the end of the Islandmore Drain to prevent backflow of flood waters from the Clare River to the Islandmore Drain. Non-return valves will also be required on 2-3 other small drains within the area scheduled for embankment (shown in **Appendix C**).

2.3.9 Carnmore/Cashla Area

The works proposed at Carnmore/Cashla include the installation of a surface water drain from Carnmore/Cashla to Kenny's Drain (extension of Islandmore Drain) to reduce the flood levels in this area. **Images 2.12** and **2.13** below show the beginning and part of the proposed route of the drain.



2.3.9.1 Preferred Measures

The recommended measures outlined in the flood study were considered appropriate as follows;

Provide surface water drain to river via Islandmore Drain.

The proposed surface water outlet will consist of a combination of a surface water pipe and an open channel. The overall length of the surface water outlet is approximately 1.925km. The pipeline will be a 1.05m diameter culvert with an equivalent open channel with a base width of approximately 1m. Appropriate safety fencing will be required in areas where an open channel is used, set back an appropriate distance from the channel to facilitate drainage channel maintenance. Additional arterial drains may be required to drain areas to the main surface water drain. The extent of the works required is shown on **Figure 2.12**.

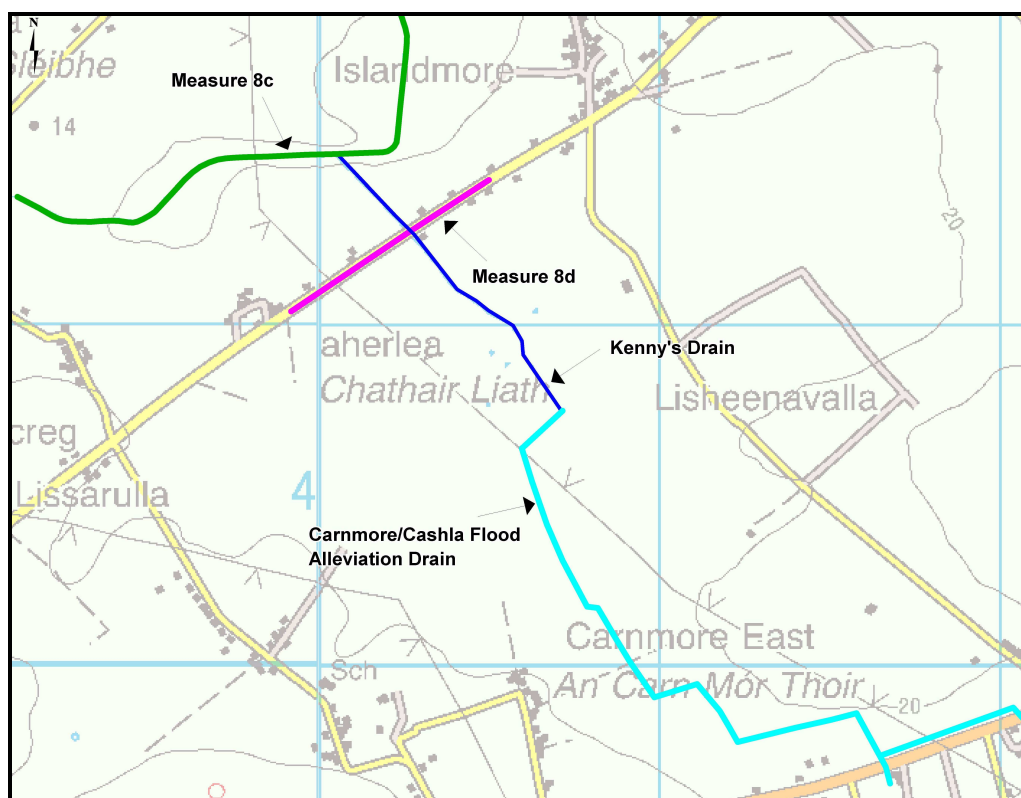


Figure 2.12 Proposed Flood Alleviation Drain from Carnmore/Cashla

2.3.10 Additional Measures - Arterial Drainage Maintenance Activities from Cregmore Bridge to Lough Corrib

The additional measures proposed consist of selective channel maintenance along the Clare River from Lough Corrib to Cregmore Bridge.

2.3.10.1 Preferred Measures

Arterial Drainage Maintenance activities are required to retain a scheme's design standards in terms of drainage and flood mitigation by maintaining the channel's designed capacity to convey water. In general, scheme channel maintenance activities are carried out by trained OPW drivers in accordance with the OPW's EMPs and SOPs. Maintenance is typically not required along the full length of channels with intermittent stretches skipped.

The section of the Clare River from Cregmore Bridge to Lough Corrib has not historically required ongoing maintenance but sections of the river upstream of Cregmore Bridge have undergone regular drainage maintenance activities. It is now proposed that the section of Clare River downstream of Cregmore Bridge will also undergo regular maintenance activities.

Proposed channel maintenance can be classified in accordance with the OPW's EMPs and SOPs under six headings:

- A – Silt and Vegetation Management;
- B – Aquatic Vegetation Cutting;
- C – Bank Protection;
- D – Bush Cutting / Branch Trimming;
- E – Tree Cutting, and
- F – Bridge/ Structure Repairs

An additional measure was identified by the OPW specific to this scheme as follows;

- G - Rock Removal from Bed

Category A. Silt and Vegetation Management

Silt and vegetation management are mostly undertaken using a hydraulic excavator, and in general, the material removed is small in volume and spread in a narrow band along the bank tops.

The removal of heavy instream silt and vegetation requires the use of a hydraulic excavator with a 1.5m wide (approx) bucket (capacity approx 500 litres). For standard excavators, works progress at a rate of 700m to 900m per week. In relation to long-reach excavators, works progress at a slower rate of between 200m and 350m per week. Rates may change due to channel width or ground conditions.

Silt and other alluvial substrates are often deposited on meanders and along the banks of rivers and streams forming berms. Where the capacity of a channel is affected by a berm, it is managed by topping it to form a two-stage channel.

Category B. Aquatic Vegetation Cutting

None proposed under this scheme.

Category C. Bank Protection

Restrictions in channels due to bank slippage or damage are generally regraded to their original profile. Channel breaches due to bank erosion are resolved by reprofiling the channel in-situ or by importing bank protection material such as rock armour or log poles. Bank protection works are generally required along discrete stretches of channels where erosion or instability is present due to the absence of vegetation cover.

Category D. Bush Cutting/Branch Trimming

Branches which hang into or just above the water during periods of low flow are generally targeted for removal as they serve to impede the passage of debris during periods of high flow or flood events. Such work are carried out manually or with a hydraulic shears fitted to an excavator. This gives greater flexibility in selective and clean removal of woody vegetation.

Category E. Tree Cutting

Tree cutting is required, where the capacity of the channel is reduced by trees growing in the channel, or where trees have fallen into the channel. In other cases, tree removal may be carried out in consultation with IFI where tunnelling is considered a problem. A selective approach to tree removal is devised to retain a dappling of shade along the channel length.

Category F. Bridge/ Structure Repairs

None proposed under this scheme.

Category G. Rock Removal from Bed

Localised rock removal will mean the removal of rock at the locations shown to design grade or as close to as possible. During scheme works often sections of rock were left for various logistical/cost reasons given the scale of the works. The rock referred to here will mean rock accessible from the bank with a twenty ton standard reach machine. If the rock is not sufficiently fissured and cracked (from blasting during scheme works) and will not "pull" with the bucket of the machine a rock breaker will be used to break up the material and then dig it out of the channel. OPW do not propose to track a machine in the channel to achieve this, further OPW only propose to remove rock that can be accessed from the bank and leave any remaining material that cannot be reached. Spoil will be stored on existing spoil heaps/used as fill locally (if requested by landowner)/ drawn away or buried. Most likely existing spoil heaps.

2.3.10.2 Schedule of Maintenance Works

The maintenance works proposed on the Clare River from the oufall to Lough Corrib to Clare Galway and from Claregalway to Cregmore Bridge, are outlined in **Table 2.4** below and shown in **Figures 2.13** and **2.14** below.

Table 2.4 Arterial Drainage Maintenance Activities from Cregmore Bridge to Lough Corrib

Point ID No.	Channel Maintenance Classification
--------------	------------------------------------

Point ID No.	Channel Maintenance Classification
Clare River from outfall into Lough Corrib to Claregalway	
Location A	Some deepening along Left Bank, Rock outcrop 250 linear m (A & G)
Location B	Typical weed growth (A)-Maintenance work along length of channel where necessary
Location C	Some deepening inside of bend left bank, solid bottom, 140 linear m (A & G)
Location D	Heavy tree growth on bank over water on bank edge – approx 450 linear m (D & E)
Clare River from Claregalway to Cregmore Bridge	
2	G very short length
3	E and G one rock
5	A Left Bank
6	A Left Bank
7	A, E, A and C
8	C, A, C
10	E all
11	E both banks
12	D all
13	Start of rock in bank D and E
14	end rock
15	E
16	D, E
17	A,C,D
19	A,D
20	No work
21	A
22	A
28	C
31	C
32	Oil tank, Remove
33	A,D
34	No work. E
35	E
36	E right bank
37	G,E
38	A,C
39	A
40	A
41	A
43	A
44	G,E
45	E + oil tank removal
46	Widening Left Bank
47	Widening Left Bank
48	C3/7 confluence. A, D + Widening. Sluice at outfall C3/7
49	Widening
50	Widening
51	D,A
52	A
53	No work
55	D
56	E

Point ID No.	Channel Maintenance Classification
57	No work
59	No work

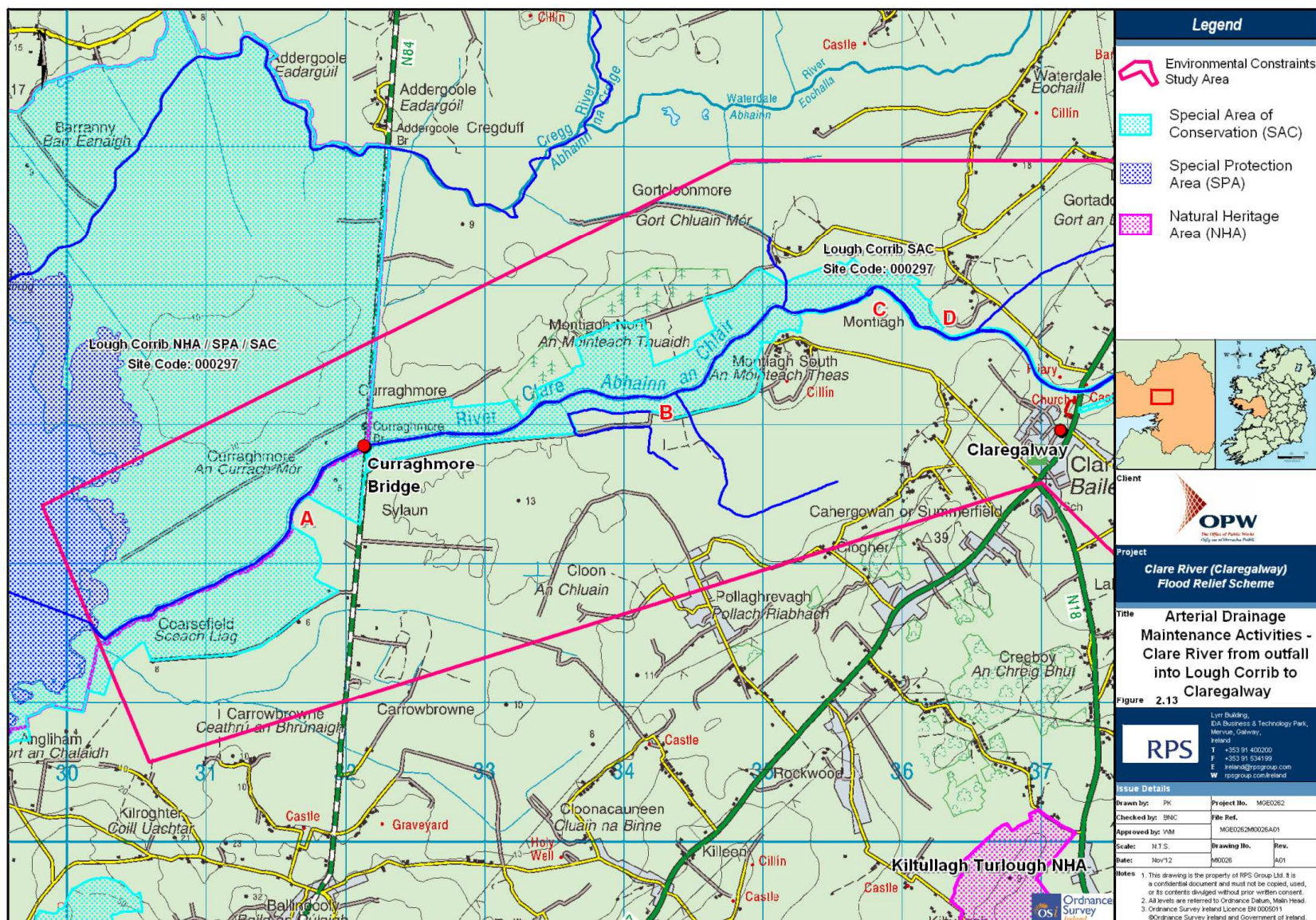


Figure 2.13 Proposed Maintenance Works on the Clare River from the Outfall to Lough Corrib to Claregalway

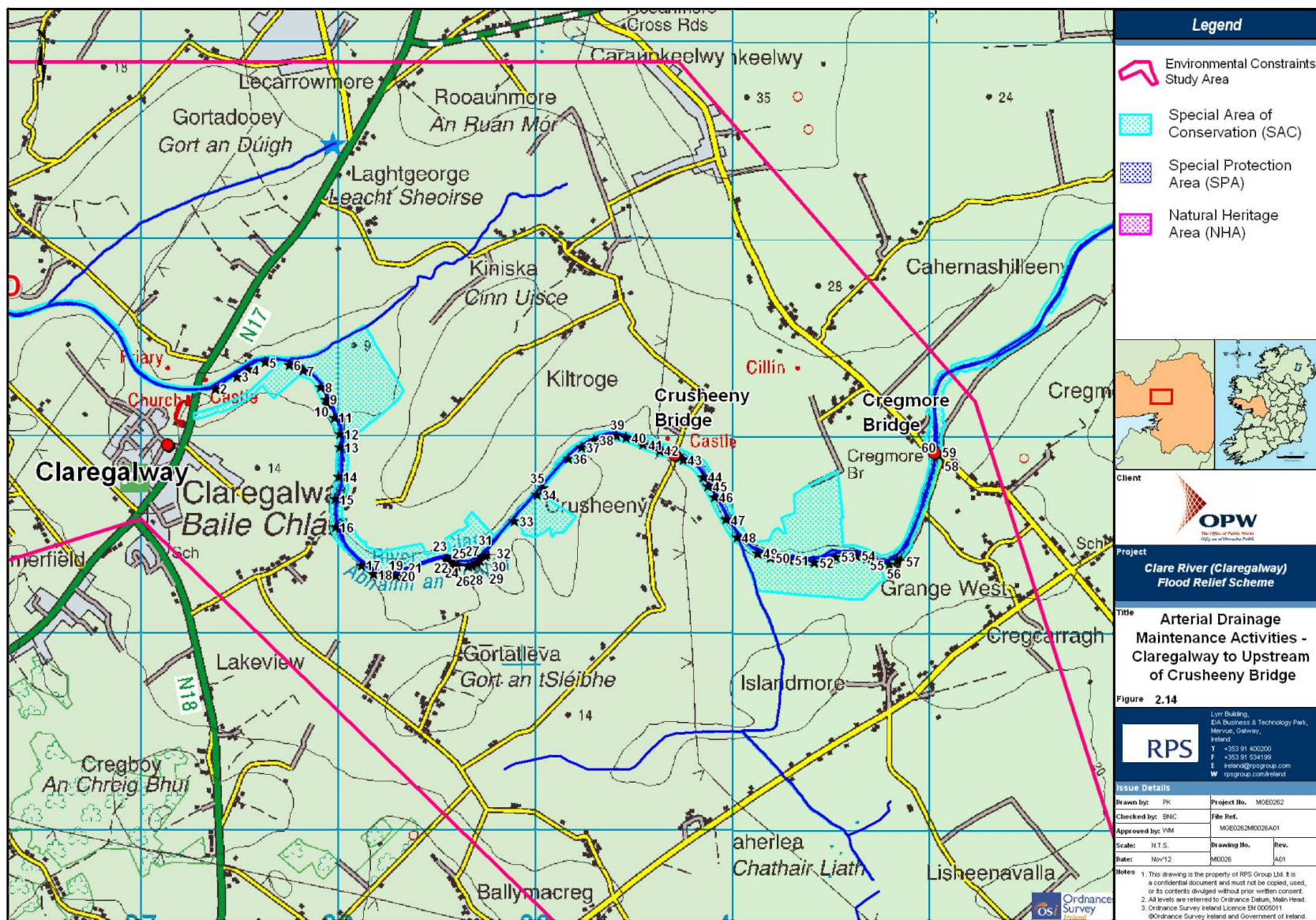


Figure 2.14 Proposed Maintenance Works on Clare River from Claregalway to Cregmore Bridge

2.3.10.3 Operation of the Proposed Flood Relief Scheme

The proposed flood relief scheme has been designed to cater for a 1 in 100 year flood event with a 20% increase in flows allowed for as a result of climate change.

Regular maintenance of the river channel and in particular the 2 stage channel will be required to ensure it retains its conveyance capacity. This will be performed as part of the OPW's regular maintenance activities using OPW EMPs and SOPs.

2.3.11 Programme and Phasing of the Works

Due to the extent of the flood relief scheme works required, this will necessitate the works being performed over a number of years. It is proposed that the excavated materials will be reused where suitable for the road raising and other activities associated with the wider scheme, and potentially also for the proposed site of the Claregalway waste water treatment plant at Cahergowan/Summerfield. This will necessitate these works being performed concurrently with the excavation works. It may be possible to programme other works such as the surface water channels during other periods of the year although these works cannot be completed until the associated downstream channel widening works on the Clare River are completed so as not to exacerbate downstream flooding. An outline programme is provided in **Figure 2.15**.

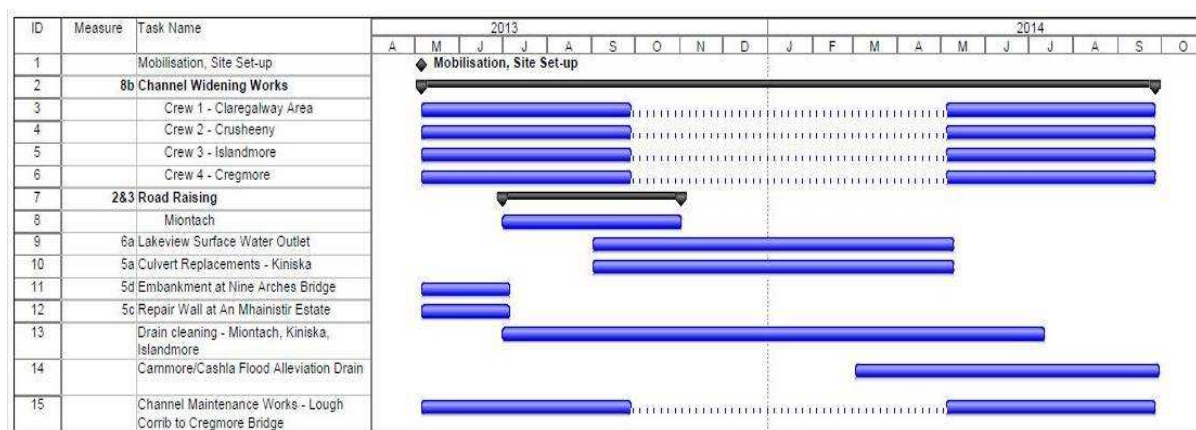


Figure 2.15 Outline Programme for Flood Relief Scheme Works

2.3.12 Excavations and Excavated Material

All river regrading and widening will be undertaken using tracked vehicles travelling along the temporary works area along the bank of the Clare River.

It is anticipated that approximately 88,634m³ of overburden and rock will be removed from the river bank and its surroundings as a result of channel widening. A small amount of deepening of the existing riverbed will occur in the vicinity of the Claregalway Bridge resulting in the removal of approximately 3,380m³ of material. A further 36,854m³ of existing spoil heaps will also be removed from the footprint of the new second stage channel resulting in a total excavation of approximately 128,868m³ of material as shown in **Table 2.5**.

It is envisaged that different techniques will be adopted with regard to the reuse or recovery of excavated material. However, the overall intention will be to reuse the excavated material for side slope protection, the creation of embankments and extended spoil heaps and/or the spreading of the material on the bank and adjacent lands where topsoil will be removed, excavated material will be spread and topsoil will be reinstated. These works will be undertaken with a view to minimising the transport of material off-site. Excavated materials will also be used (where suitable material is available) in the raising of the existing roads at Montiagh, and may also be used for site preparation in relation to the proposed Claregalway waste water treatment plant at Cahergowan/Summerfield.

A typical detail is shown in **Figure 2.16** of the landspreading of excavated material and of a proposed spoil heap in **Figure 2.17** and of the proposed embankment in **Figure 2.18**.

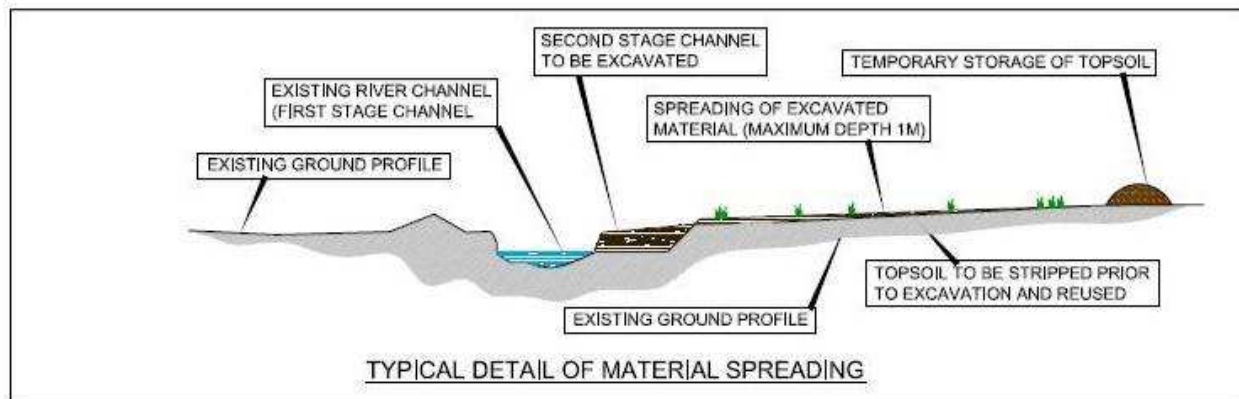


Figure 2.16 Typical Detail of Landspreading of Excavated Materials

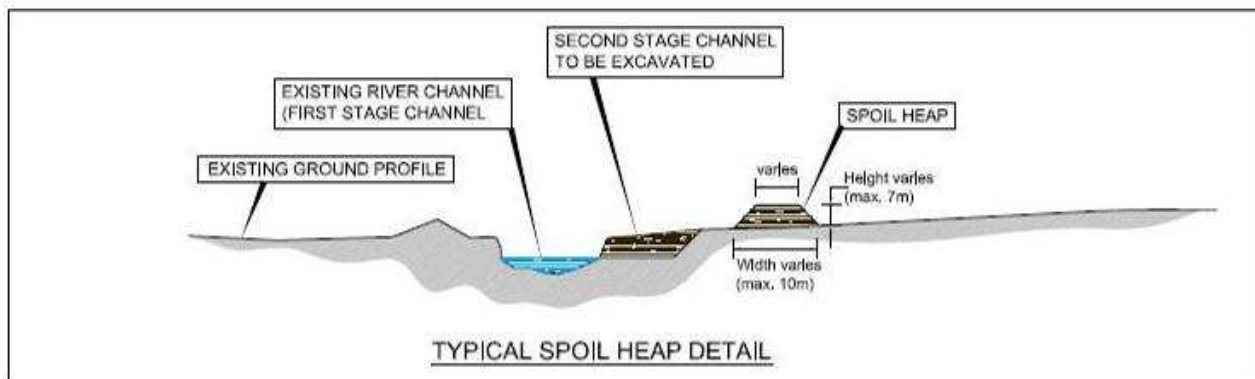


Figure 2.17 Typical Detail of Spoil Heap

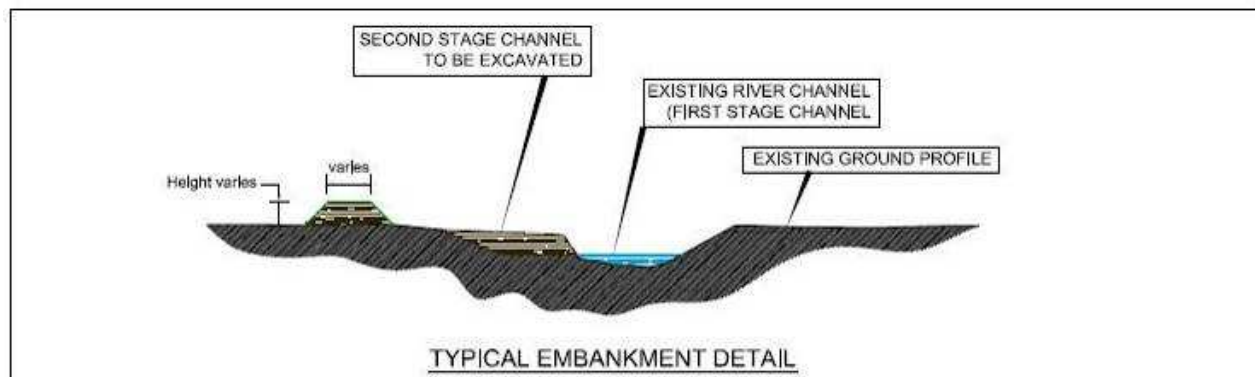


Figure 2.18 Typical Embankment Detail

Table 2.5 Summary of Approximate Volumes of Spoil to be Excavated

Section	Area (m ²)	Length (m)	Volume (m ³)
C71	94.184	19.000	1789.494
C72	128.839	19.000	2447.933
C73	145.109	68.000	9867.412
C89	-	-	4072.648
C90	-	-	7454.975
C91	83.622	237.000	19818.414
C92	6.440	224.000	1442.627
C93	72.926	251.000	18304.326
C94	62.573	229.000	14329.148
C95	43.356	288.000	12486.586
Subtotal	637.048	1,335.0	92013.563
Existing Spoil Heaps			36,854
TOTAL			128868

2.4 SITE ACCESS AND COMPOUNDS

It is anticipated that there will be up to four work crews in operation concurrently during the two stage channel and embankment works as well as performing other works. It is anticipated that one crew will operate out of a compound adjacent to Crusheeny Bridge and work upstream along the northern bank of the river. Two crews will operate out of compounds in the Islandmore Drain/Cregmore area carrying out the two stage channel and embankment works on the south bank of the river. A fourth crew will operate out of Claregalway, using the site compound area employed for the Claregalway Bridge works, performing the channel deepening and widening works at Claregalway Bridge. Additional access areas will be required as follows:

- i) Temporary access roads as necessary within the work zones to allow for movement of machinery;
- ii) The surface water channel and pipeline at An Mhainistir Housing estate will be constructed using the compound at Claregalway with additional access to the works as necessary from the Corporate Park Site, the Claregalway GAA pitch and the Cúirt na hAbhainn housing estate;
- iii) A site compound will be required in the vicinity of the works in Carnmore/Cashla on the Monivea Road to facilitate the construction of the surface water channel. It is proposed that this compound be located adjacent to Newell's roofing on the R339 (Monivea Road). This compound will also provide site access with additional access required from the Lisheenavalla road and from a farm road in Carnmore East;
- iv) The road raising works in Montiagh South and North as well as the culvert replacement and drain cleaning works in Kiniska will be undertaken using the site compound in Claregalway with local access to the site as required, and
- v) Site access will be required at Caherlea and Gortatleva to allow the cleaning of the Islandmore drain.

As noted above, it is envisaged that there will be five main site compounds which will include short term staff welfare facilities, and plant and materials storage for the proposed works. The locations of these compounds are illustrated in **Appendix C**.

2.4.1 Ground Investigations

2.4.1.1 Two Stage Channel Works

Preliminary Ground Investigation Works will take place along the extent of the Clare River where two stage channel works are to be undertaken to determine the actual site conditions along the route of the proposed works. The Ground Investigation works will be performed using an excavator to dig trial pits at distances of approximately 200m to 400m. Trial pits will generally be approximately 2m x 2m and will generally be excavated to rock or to a maximum depth of 4 metres. The trial pits will be used to determine subsurface conditions including; depth to rock, depth to groundwater and soil type. The trial pits will be backfilled and the area restored upon completion of the Ground Investigation Works. The proposed locations of the trial pits are shown in **Appendix C** above.

2.4.1.2 Other works

Preliminary Ground Investigation works will be required for other works to be completed under the Clare River Flood Relief Scheme including the proposed surface water outlet from the Claregalway Corporate Park to the Clare River and the proposed drainage of floodwater from the Carnmore/Cashla area via a new drainage pipeline/open drain to a local surface water stream at Islandmore. The Ground investigation works in these areas will include; slit trenches to locate existing services; trial pits to determine the type of subsoil and depth of water ingress and rotary cores to determine the depth and type of rock encountered if any.

The locations of proposed trial pit investigations along the Clare River are illustrated in **Appendix C**. It is proposed to undertake ground investigation works in late 2012 in order to determine ground conditions in advance of Scheme works beginning in 2013.

2.5 CLAREGALWAY FOOTBRIDGE

The proposed Claregalway footbridge will potentially be located on the western side of the Claregalway N17 road bridge. The footbridge will be craned into place; therefore no in-stream works will be required. Securing the bridge to the piers will be carried out in the dry on the northern and southern banks. An indicative location for the proposed footbridge is provided in **Figure 2.19**.

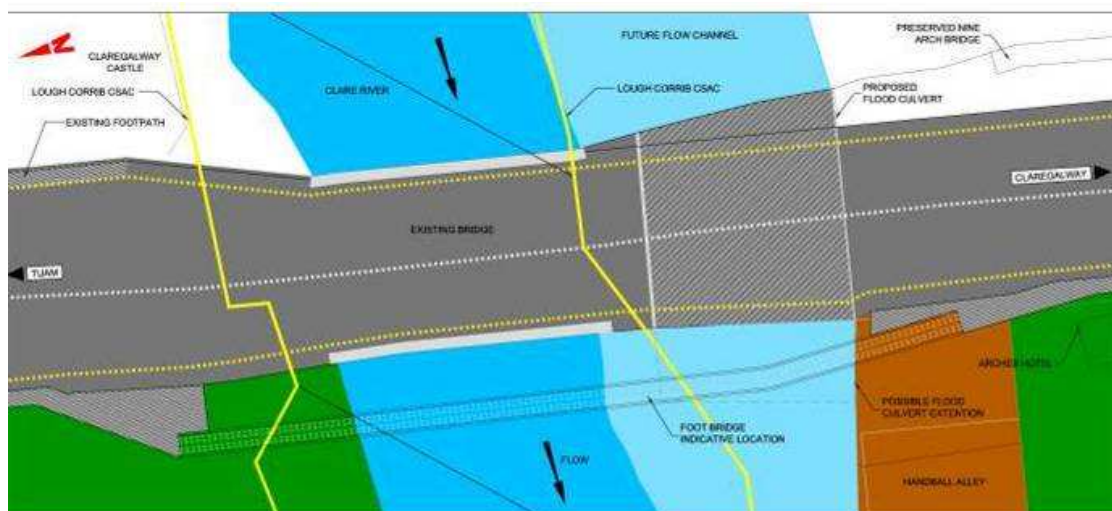


Figure 2.19 Indicative Location for Claregalway Footbridge

3 EXISTING ENVIRONMENT

3.1 CLARE RIVER WATER QUALITY

Two suitable sites were sampled by ASU for benthic macroinvertebrates on 12th July 2011. Site 1 was located at a shallower area of gravels in the mid-channel of the Clare River, approximately 650m downstream of Crusheen Bridge. Site 2 was located a distance of approximately 40m downstream of Claregalway Bridge in an area of shallower, turbulent flow over a mix of boulder/cobble/gravel and (to a lesser extent) bedrock substrates with a moderately high coverage of bryophytes, predominantly *Cinclidotus fontinaloides*.

The results were very similar at both locations. Both sites merited a Q4, or 'unpolluted' quality rating, with an EQR of 0.8 equating to potential 'Good' WFD status. Total BMWP scores were high (133/136) reflecting the fact that species diversity was quite high, with 22 scoring taxa recorded at each site. ASPT values of 6 and 6.2 for Sites 1 and 2, respectively, were indicative of 'good water quality'. These results concur with the most recent EPA monitoring data from this stretch of the Clare River as summarised in **Table 3.1**.

Table 3.1 Summary of EPA biological water quality monitoring on the Clare River at Cregmore Bridge (upstream) and Claregalway Bridge (downstream) (Source: EPA ENVision online map viewer)

EPA Station	1971	1977	1980	1985	1989	1993	1996	2000	2003	2006	2009
Cregmore Bridge 30C011100	-	-	4	4	4	3-4	3-4	3	4	4	4
Claregalway Bridge 30C011200	4	5		3-4	4	3	3	3-4	3-4	4	-
Curraghmore Bridge 30C011300			4	4	4	4	4	4	4	4-5	4-5

Table 3.2 shows EPA water chemistry quality monitoring at 3 locations on the Clare River, i.e., Cregmore Bridge (c. 1km upstream of proposed works), Claregalway Bridge and Curraghmore Bridge (near the confluence with L. Corrib). The data provides an overview of historical water quality trends. Data suggests a pattern of poorer water quality for a period of about 10 years on this part of the Clare River from 1993, with an improvement evident since 2006. Recent monitoring shows that most of the stretch is presently 'unpolluted', equating to 'Good' WFD status, with the most downstream site (Curraghmore Br.) presently rated as 'High' WFD Status.

Table 3.2 Summary of EPA water chemistry monitoring on the Clare River at Claregalway Bridge (Stn 1200) just downstream of the proposed works and at Curraghmore Bridge (Stn 1300) just upstream of Lough Corrib) (Source: EPA 2007-2009 sampling campaign)

	Number of samples	Min	Mean	Max	Stdev
Claregalway Bridge					
Alkalinity-total (mg/l CaCO ₃)	16	196.0	273.4	344.0	40.7
Conductivity @25°C (µS/cm)	16	407.0	597.2	681.0	73.5
pH	16	7.5	8.0	8.3	0.2
Temperature °C	16	3.5	10.8	17.0	4.1
True Colour (Hazen)	16	23	44	123	24
ortho-Phosphate (mg/l P)	16	0.006	0.028	0.048	0.015
Total Oxidised Nitrogen (mg/l N)	16	0.600	1.531	2.500	0.474

	Number of samples	Min	Mean	Max	Stdev
Ammonia-Total (mg/l N)	16	0.015	0.022	0.060	0.016
BOD - 5 days (Total) (mg/l O ₂)	16	0.5	0.6	2.0	0.4
Dissolved Oxygen (% Saturation)	16	89.0	100.4	129.0	10.2
Curraghmore Bridge					
Alkalinity-total (mg/l CaCO ₃)	43	75.0	259.8	340.0	48.7
Conductivity @25°C (µS/cm)	39	421.0	578.9	674.0	64.4
pH	45	7.3	7.8	8.3	0.3
Temperature °C	45	3.5	11.3	18.7	3.9
True Colour (Hazen)	45	19	58	154	32
ortho-Phosphate (mg/l P)	43	0.006	0.031	0.072	0.015
Total Oxidised Nitrogen (mg/l N)	45	0.900	1.474	2.720	0.451
Ammonia-Total (mg/l N)	45	0.003	0.022	0.090	0.018
BOD - 5 days (Total) (mg/l O ₂)	43	0.5	0.6	2.3	0.4
Dissolved Oxygen (% Saturation)	44	44.0	92.7	122.0	13.1

The data in **Table 3.2** confirms the alkaline, hard water nature of the Clare River in terms of its conservative chemistry as well as relatively its low pollution levels as revealed by the low mean BOD, total ammonia and total oxidized nitrogen concentrations. Mean ortho-phosphate concentration is also quite low and compatible with a Q-rating of Q4 at both stations (EPA, 2001). Note that more recent data for Curraghmore Bridge for 2011 has mean ortho-phosphate levels at 0.021 ml/l, P, for nine sample runs, i.e. compatible with a Q-rating of Q4-5 (EPA, 2001).

3.2 GEOLOGY, HYDROLOGY & HYDROGEOLOGY

The Geological Survey of Ireland (GSI) website was consulted for available geological/hydrogeological information.

3.2.1 Bedrock Geology

The Geological Survey of Ireland (GSI) website was consulted for available geological/hydrological information. The bedrock geology of the area is Visean Limestone (undifferentiated). Few faults are mapped in this area and very limited information exists in general (GSI, 2004).

3.2.2 Quaternary Geology

Quaternary geology is the study of geological deposits deposited or formed in the last 2 million years. It is primarily concerned with the study of soils and other materials overlying bedrock. In Ireland, quaternary deposits largely comprise soils deposited during and subsequent to the most recent ice ages.

Teagasc subsoils mapping shows the area is comprised predominantly of limestone till east of Claregalway and cutover peat to the west. Cutover peat is predominant along the banks of the Clare River from Montiagh townland downstream to Lough Corrib. Limestone till is predominant along the banks of the Clare River from Montiagh townland upstream to Crusheeney Bridge and Carnmore.

There is an area of made ground in the village of Claregalway and areas of alluvium can be found along the banks of the Clare River. Pockets of lake sediments can also be found in the study area. Outcrops of karst rock are scattered throughout the study area.

Soils in the area are mapped under the Teagasc FIPS classification system predominately as Basic Mineral Deep Well Drained Soil (BminDW), which is more commonly referred to as Grey Brown Podzolics. There are areas mapped as mineral alluvium (AlluvMIN) along the Clare River corridor.

3.2.3 River Catchment and Flood and Low-flow Hydrology

The regional hydrological environment within the study area is discussed below in the context of the hydrological attributes of flood and low-flow hydrology and drainage system.

The Clare River forms the part of the Corrib-Clare catchment and falls within National Hydrometric Area 9 (Corrib) and Western River Basin District.

The Clare River, with a reach of approximately 93km from its confluence with Lough Corrib Lower, rises approximately 8km above the town of Ballyhaunis, County Mayo. Its principal tributaries working in a southerly direction from its source in County Mayo are the Sinking River, the Nanny River, the Grange River and the Abbert River. For the greater part of its length the Clare River flows north south passing through Ballyhaunis, Milltown, the outskirts of Tuam, through the villages of Corofin and Claregalway to its confluence with Lough Corrib, approximately 8 km west of Claregalway. The confluence of the river with the lake is located at the Lough Corrib Lower which ultimately drains to the sea via the Corrib River channel to Galway City. The Clare River has an approximate catchment area of 1,100 km² upstream of its confluence with Lough Corrib.

The soil type within the Clare River catchment area vary between the UK Flood Studies Report (NERC, 1975) soil types 1 (50%) and 2 (50%), indicating low to very low runoff potential. The general soil description associated with soil type 1 is 'Well drained sandy, loamy or earthy peat soils' or 'Less permeable loamy solids over clayey soils on plateaux adjacent to very permeable soils in valley' while the general soil description associated with soil type 2 is 'Very permeable soils (e.g. gravel, sand) with shallow groundwater, Permeable soils over rocks, Moderately permeable soils some with slowly permeable subsoils'. Soil type 1 is defined as having very low runoff potential while soil type 2 has a low runoff potential. The river has a main channel slope of approximately 1 in 1000 (S1085). The observed long-term average annual rainfall at Galway (NUI, Galway) and Athenry are 1147 mm and 1164 mm respectively.

The geology of the Clare River catchment area is characterised by karst limestone bedrock from the Burren, Lucan and Tubber formation, and Visean limestone. The presence of turloughs, caves, enclosed depressions and springs throughout the study area provide the evidence of this karst geology. Such karstic geology lends itself to unpredictable hydrogeological and hydrological flow patterns encompassing a complex and dynamic relationship between rainfall, river flows and groundwater movement. However, the present day drainage network has been significantly influenced by arterial drainage schemes carried out since the early nineteenth century to reduce winter flooding.

Flooding has been a constant problem in the Clare River catchment, in particular, in the Claregalway area over the centuries, mainly because of the relatively flat and low-lying terrain and the heavy rainfalls associated with the west of Ireland. A number of noted high floods occurred in the Clare River catchment in 1990, 1995, 1999, 2005 and in the months of October and November in 2009. The November 2009 flood was the most severe of these floods in the Clare River catchment, particularly in the vicinity of Claregalway and in the Crusheeny/Caherlea areas. During this flood event extensive damage to properties in the surrounding areas occurred. The causes of flooding are believed to be the unprecedented intense and prolonged rainfall in the Clare River catchment, inadequate conveyance capacity of the river channel (for such an event) and the constrictions caused by a number of existing bridges/culverts and bed levels at various locations along its course.

Flow records for the Clare River at Ballygaddy, Corofin and Claregalway hydrometric stations were obtained from OPW and EPA. A summary of these flow records are provided in **Table 3.3**.

Table 3.3 Summary of flow records for the Clare River at Ballygaddy, Corofin and Claregalway hydrometric stations

Hydrometric station	Catchment area (km ²)	Mean annual flow (m ³ /s)	50%ile flow (m ³ /s)	95%ile flow (m ³ /s)	Annual maximum flow (m ³ /s)		
					Mean	Median	Highest
Ballygaddy (30007)	470	10.627	7.73	1.34	63.17 (0.134 m ³ /s/km ²)	63.00	108.90 (21/11/2009)
Corofin (30004)	695	15.185	10.71	1.74	98.51 (0.142 m ³ /s/km ²)	92.65	193.00 (21/11/2009)
Claregalway (30012)	1073	21.435	13.10	1.97	116.40 (0.108 m ³ /s/km ²)	-	165.30 (21/11/2009)

The observed mean annual and 95%ile flows for the Clare River at Claregalway are 21.435 m³/s and 1.97 m³/s respectively. The mean annual maximum flow (Q_{BAR}) at this location is 116.40 m³/s, in terms of specific flow; it is 0.108 m³/s/km². Because of the karstic type geology and presence of many lakes and turloughs, the Clare River can be characterised as a slow response catchments. However, in the event of prolonged intense rainfall, the underground storage capacity could be filled up and the flooding risk could be significant like the November 2009 flood event.

The west of Ireland experienced prolonged heavy rainfall in November 2009 along with many other parts in Ireland. This rainfall led to a situation where the soil was near saturation for much of the time, had no capacity to absorb rainfall and consequently resulted in flooding in many areas. The most extreme rainfall occurred over the period from 16th to 18th November, 2009. The highest daily total rainfalls of 47.10mm and 60.80 mm were recorded at Athenry and Galway City respectively on 17th November. A frequency analysis of the November 2009 rainfall records for a number of sliding durations ranging between 1 to 25 days was carried out for the Athenry and Galway City rain gauging stations. **Table 3.4** presents the observed maximum rainfalls for these sliding durations along with their associated return periods. The estimated return periods of the 2-day and 4-day maximum rainfall totals for Galway City are 100 and 200 years respectively. This suggests that the severity of the November 2009 flooding resulted from a prolonged rainfall event rather than from a high frequency intense rainfall event.

Table 3.4 Rainfall with estimated return periods during November 2009

Sliding duration (days)	Athenry	Estimated return period (Years)	NUI, Galway	Estimated return period (Years)	Date
	Maximum total rainfall (mm)		Maximum total rainfall (mm)		
1	47.10	8	60.80	23	17 Nov. 2009
2	84.40	75	89.50	100	17 to 18 Nov. 2009
4	120.90	232	126.70	200	15 to 18 Nov. 2009
8	178.20	>500	175.40	247	12 to 19 Nov. 2009
16	253.30	>500	255.00	200	9 to 24 Nov. 2009
25	310.20	>500	315.50	100	3 to 27 Nov. 2009

During the November 2009 flood event, the recorded flood flow for the Clare River at Corofin was 193m³/s. The estimated return for this flow is approximately 100 years.

3.2.4 Drainage

The geology of the Clare River catchment is characterised by karst limestone bedrock from the Burren, Lucan and Tubber formation, and Visean limestone. This karst geology is evident throughout

the study area as indicated by the presence of turloughs, caves, enclosed depressions and springs. Such karstic geology lends itself to unpredictable hydrogeological and hydrological flow patterns encompassing a complex and dynamic relationship between rainfall, river flows and groundwater movement. However, the present day drainage network has been significantly influenced by arterial drainage schemes carried out since the early nineteenth century to reduce winter flooding.

The lands along the study area between 1.3km upstream of Crusheeny Bridge to Lough Corrib drain as overland flows and also via a number of small drains and ditches/land drains to Clare River channel. The land elevations along this section of the river channel vary from 10 to 20 mOD and slope towards the river channel. The soil types within the main river catchment area vary between the UK Flood Studies Report (NERC, 1975) soil types 1 and 2, suggesting moderate to very high winter rain acceptance potential (i.e. low to very low runoff potential).

3.2.5 Hydrogeology

The bedrock underlying the study area is classified by the GSI as a Regionally Important Karst Aquifer with conduit karst flow system (**Rkc**). A segment of rock to the south east of the study area is classified as a 'Locally Important Aquifer – moderately productive only in local zones' (**LI**). The GSI has published in 2011 an updated vulnerability map for County Galway. The vulnerability across the study area ranges from Extreme to Low. In the eastern portion of the study area the vulnerability along the river corridor is predominantly high with areas of extreme vulnerability located around the periphery of the study area. There is a change in the vulnerability west of Claregalway where the vulnerability reduced to Moderate and Low.

There is one groundwater body in the study area known as the Clare-Corrib. This groundwater body has been classified as a drinking water protected area under the Western River Basin Management Plan (RBMP). There are no groundwater dependent terrestrial ecosystems (GWDTE) identified within this groundwater body. The Clare-Corrib groundwater body is classified as having *Poor status* due to contribution of surface groundwaters to surface water phosphorus levels. The objective set for this water body is to restore good status by 2021.

The GSI records show that there are a number of wells located in the area as shown in **Table 3.5** below. A number of these wells are used as sources for group water schemes. The Claregalway GWS is marked on the map at the source of the Laghtgeorge spring. This is however no longer used as an intake for the supply.

Table 3.5 GSI Well Data

GSI Name	Source Name	Type	Depth (m)	Source Use
1123SEW035	Claregalway GWS	Spring	-	Group Scheme
1421NWW050	Carnmore West GWS	Borehole	60.4	Group Scheme
1123SEW033	Cahernasheleehy - Kiltroge GWS	Borehole	23.8	Group Scheme
1123SEW029	Upper Lakeview GWS	Borehole	21.3	Group Scheme
1423SWW031	Cashla, Athenry GWS	Borehole	40.2	Group Scheme

3.2.5.1 Karst Features

The Clare-Corrib groundwater body is extensively karstified with over 219 documented karst features. The distribution and function of these karst features has been significantly influenced by arterial drainage schemes carried out since the early nineteenth century to reduce winter flooding. Prior to the construction of the existing arterial drainage schemes, many streams within the present Clare River catchments flowed underground or terminated in permanent or temporary lakes (turloughs) due to the

karst limestone geology of east County Galway. These surface waters discharged underground and emerged later from springs further down the catchment.

The GSI maintains a database of karst features in Ireland. The karst features located within the study area are listed in **Table 3.6** below. Additional karst features not documented in the GSI database, also shown in **Table 3.6**, were identified during the site walk-over.

Table 3.6 Karst features within study area

GSI Name	Type	Name	Townland
1123SEK014	Spring	N/A	Laghtgeorge
1123SEK007	Turlough	N/A	Gortatleva
1123SEK008	Spring	Polldonnell	Kiltroge
1421NWK009	Cave	N/a	Barrettspark
1421NWK010	Cave	N/A	Carnmore
*N/A	Turlough	Corporate Park	Lakeview
*N/A	Turlough	Cuirt na hAbhainn	Lakeview
*N/A	Spring	Buniska	Buniska
*N/A	Turlough	N/A	Barrettspark
*N/A	Spring Pool	N/A	Cregmore Br

*Identified during Site Assessment

The turlough feature at Gortatleva is no longer in existence. A deep drainage channel (OPW reference number C3/7) now runs through the centre of the catchment, which drains rising water from the area to the Clare River. There is a small area of wet grassland, which may be a remnant of the turlough (**Image 3.1**). There is no evidence that any seasonal flooding occurs in the area.



Image 3.1 Remnant Turlough, Wet Grassland at Gortatleva

- **Calcareous Spring**

This feature is identified as the Polldonnell Spring in **Table 3.6**. An estevelle was noted just downstream of Crusheeny Bridge in the towland of Kiltroge (see **Image 3.2** below). Estevelle is a geological term used to describe a karst feature which can act as a spring or swallow hole. This feature is best classified as a Calcareous Spring FP1 in accordance with Fossitt 2000. Calcareous springs with tufa formation are recognised as the Priority Annex I Habitat under the Habitats Directive, 'petrifying springs with tufa formation (Cratoneurion) (7220)'. No tufa formations were found at this location, however. The rocks at this point were covered in *Cinclidotus fontinaloides*, a species of moss which indicates seasonal inundation where it occurs. Very little other vegetation was noted at this location. None of the species characteristic of the Annex I habitat 'petrifying springs with tufa formation (Cratoneurion) (7220)' in Ireland was found at the estevelle, and it therefore does not correspond to

this Annex I habitat. This is an important feature however, as it is hydrogeologically linked to Lough Corrib cSAC and is therefore considered sensitive.



Image 3.2 Estevelle (spring) beside Crusheeny Bridge

3.2.6 Flooding

A search of the OPW National Flood Hazard Mapping website, www.floodmaps.ie, was performed to obtain information on flooding history in the vicinity of Clare River study area. This information may be useful in the appropriate assessment process given the high occurrence of water courses in the study area. Any potential for water pollution may be increased in the case of flood events.

There is a history of flooding in the Clare River catchment including the most notable flood events of recent times in November 2009, December 2006, January 2005, December 1999 and the winter of 1990. **Figure 3.1** shows the locations of the numerous flood events on the Clare River over the past number of years, while **Images 3.3 to 3.7** show flooding from recent years throughout the extent of the study area.

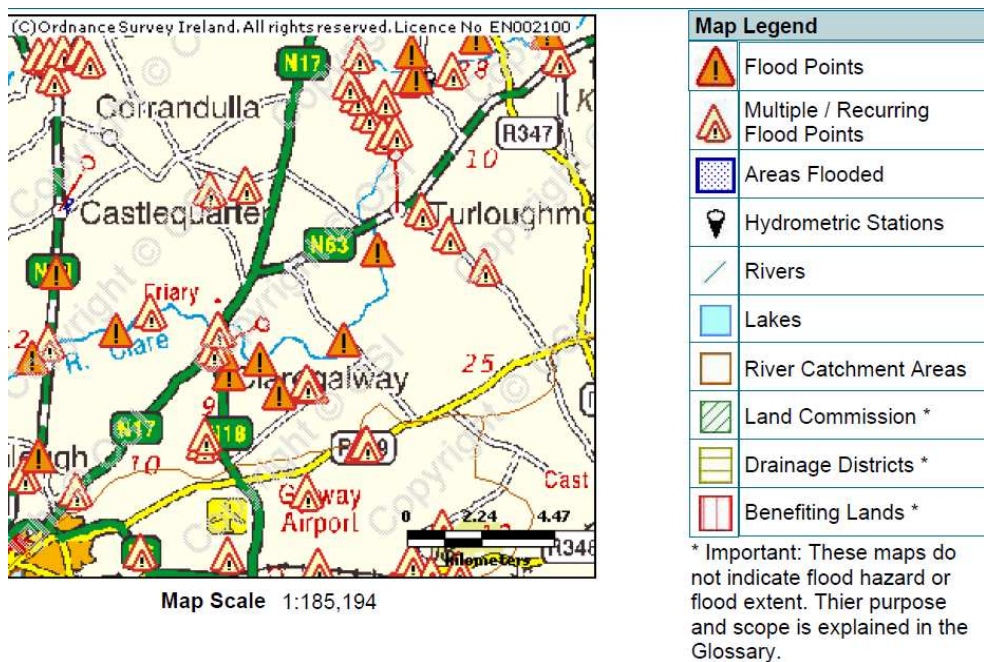


Figure 3.1 Extract from OPW Flood Hazard Map within the Clare River catchment (www.opw.ie; date 12th September 2012)



Image 3.3 Flooding at Claregalway in 2009 (Source: Dr. Martin O' Grady, IFI, & Irish Air Corps, November 2009)



Image 3.4 Flooding in the vicinity of Crusheen Bridge, Clare River, December 2006 (Source: Dr. Martin O' Grady, IFI, & Irish Air Corps, November 2009)



Image 3.5 Flooding in Caherlea/Lisheenavalla (Source: Dr. Martin O' Grady, IFI, & Irish Air Corps, November 2009)



Image 3.6 Flooding in Carnmore/Cashla (Source: Dr. Martin O' Grady, IFI, & Irish Air Corps, November 2009)



Image 3.7 Flooding at Claregalway Corporate Park (Source: Dr. Martin O' Grady, IFI, & Irish Air Corps, November 2009)

3.3 DESIGNATED SITES OF CONSERVATION IMPORTANCE

The Clare River is designated under Lough Corrib cSAC. Natura 2000 Sites (candidate Special Areas of Conservation (cSACs) and Special Protected Areas (SPAs)) which lie within a 15km radius of the proposed works are outlined in **Section 1.2** and **Figure 1.2**. These are Lough Corrib cSAC and Lough Corrib SPA.

Details for the Natura 2000 sites, including site characteristics, qualifying interests, potential pressures and threats and conservation objectives are set out in the following sections. This information is obtained from the site synopses and the Natura 2000 Standard Data Forms produced by the NPWS, which contain a description of the scientific interest and conservation importance of each designated site. The site synopses for the designated sites are provided in **Appendix D**.

A number of Natura 2000 sites have been excluded during Stage 1, Appropriate Assessment Screening as outlined in **Section 1.2**. Therefore, the scope of this Natura Impact Statement will be confined to the following two Natura 2000 sites:

- Lough Corrib cSAC, and
- Lough Corrib SPA.

3.3.1 Lough Corrib cSAC

Lough Corrib cSAC is of major conservation importance due to the presence of fourteen habitats listed on Annex I of the EU Habitats Directive, six of which are given priority status. The lake is host to internationally important populations of wildfowl listed on Annex I of the EU Birds Directive and is designated as an SPA under the same directive.

The qualifying habitats and species found within Lough Corrib cSAC are provided in **Table 3.7** and **Table 3.8** respectively.

Table 3.7 Lough Corrib cSAC Habitats

Habitat code	Habitat name (cSAC Qualifying Interest)	% Cover (approx.)	Representivity
3140	Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	85	A
3110	Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)	3	A
7110	Active raised bogs	1	B
91A0	Old sessile oak woods with Ilex and Blechnum in British Isles	1	A
6410	Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae)	1	B
7230	Alkaline fens	1	A
7210	Calcareous fens with Cladium mariscus and species of the Caricion davallianae	1	A
8240	Limestone pavements	1	A
6210	Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)(*important orchid sites)	1	B
91D0	Bog woodland	1	A
3260	Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation	1	C
7220	Petrifying springs with tufa formation (Cratoneurion)	1	C

Habitat code	Habitat name (cSAC Qualifying Interest)	% Cover (approx.)	Representativity
7120	Degraded raised bogs still capable of natural regeneration	1	B
7150	Depressions on peat substrates of the Rhynchosporion	1	A

- Habitats highlighted in **Bold** are Priority Habitats
- Representativity equates to the degree of representativity as a measure of 'how typical' a habitat type is (the representativity of the habitat type concerned on the site in question, either for a group of habitat types or for a particular combination of different habitat types). **A**: excellent representativity, **B**: good representativity **C**: significant representativity, and **D**: non-significant presence.

Table 3.8 Lough Corrib cSAC Species

Species code	Species name	Population significance
1095	Sea Lamprey (<i>Petromyzon marinus</i>)	C
1106	Atlantic Salmon (<i>Salmo salar</i>)	C
1096	Brook Lamprey (<i>Lampetra planeri</i>)	C
1303	Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>)	C
1355	Otter (<i>Lutra lutra</i>)	C
1092	Freshwater Crayfish (<i>Austropotamobius pallipes</i>)	C
1029	Freshwater Pearl Mussel (<i>Margaritifera margaritifera</i>)	C
1833	Slender Naiad (<i>Najas flexilis</i>)	B
1393	Green Feathermoss (<i>Drepanocladus vernicosus</i>)	C

- the population significance is based on the relative size or density of the population in the site with that of the national population. Population Significance (p) is ranked on a scale from A to D as follows; A - 100>=p>15%, B - 15>=p>2%, C - 2>=p>0% and D - Non-significant population.

3.3.2 Lough Corrib SPA

Lough Corrib is one of the most important ornithological sites in the country. The EU Birds Directive (2009/147/EC) requires designation of SPAs for:

- Annex I Listed rare and vulnerable species,
- Regularly occurring migratory species, such as ducks, geese and waders, and
- Wetlands, especially those of international importance, which attract large numbers of migratory birds each year (Internationally important means that 1% of the population of a species uses the site, or more than 20,000 birds regularly use the site).

Lough Corrib supports two wintering species having populations of international importance and a further sixteen species having populations of national importance.

The Annex I species which occur within Lough Corrib SPA are detailed in **Table 3.9** and the regularly occurring migratory birds (not listed in Annex I), are detailed in **Table 3.10**.

Table 3.9 Lough Corrib Annex I Bird Species

Species code	Species name	Population significance
A193	Common Tern (<i>Sterna hirundo</i>)	C
A194	Arctic Tern (<i>Sterna paradisaea</i>)	B
A395	Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>)	C
A140	Golden Plover (<i>Pluvialis apricaria</i>)	C
A038	Whooper Swan (<i>Cygnus cygnus</i>)	C

Table 3.10 Lough Corrib SPA Regularly Occurring Migratory Birds Not Listed on Annex I

Species code	Species name	Population significance
A065	Common Scoter (<i>Melanitta nigra</i>)	A
A179	Black-headed Gull (<i>Larus ridibundus</i>)	B
A182	Common Gull (<i>Larus canus</i>)	A
A183	Lesser Black-backed Gull (<i>Larus fuscus</i>)	C
A050	Widgeon (<i>Anas penelope</i>)	C
A051	Gadwall (<i>Anas strepera</i>)	B
A052	Teal (<i>Anas crecca</i>)	C
A053	Mallard (<i>Anas platyrhynchos</i>)	C
A056	Shoveler (<i>Anas clypeata</i>)	B
A059	Pochard (<i>Aythya ferina</i>)	A
A061	Tufted duck (<i>Aythya fuligula</i>)	B
A067	Goldeneye (<i>Bucephala clangula</i>)	C
A125	Coot (<i>Fulica atra</i>)	A
A142	Lapwing (<i>Vanellus vanellus</i>)	C
A160	Curlew (<i>Numenius arquata</i>)	C
A017	Cormorant (<i>Phalacrocorax carbo</i>)	C

3.3.3 Potential Pressures and Threats to Natura 2000 Sites

Tables 3.11 to 3.13 set out the main threats and impacts to the qualifying habitats and species of Lough Corrib cSAC and Lough Corrib SPA where the Clare River flood relief works are proposed.

Table 3.11 Potential Pressures and Threats on Annex I Habitats in Lough Corrib cSAC

Habitat Type (Annex I of the Habitats Directive)	Main Threats and Impacts
Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.	Fertilisation, grazing, forestry, leisure fishing, hunting, human induced hydraulic changes, eutrophication and invasive species.
Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)	Fertilisation, grazing, forestry, burning, leisure fishing, hunting, peat extraction, dispersed habitation, discharges, sport and leisure structures, pollution, drainage, erosion and invasive species.
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>)	Drainage and burning; afforestation; invasive species; grazing; dumping; fertilisation; restructuring agricultural land; communication routes; cultivation; mowing/cutting; modification of inland water structures; sand and gravel extraction.
Active raised bogs*	Peat cutting, grazing, burning.
Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in British Isles	Internal effects include inappropriate grazing levels and invasive species, whereas external threats include clearance for agriculture or felling for timber.
Alkaline fens	Fertilisation, grazing, forestry, burning, leisure fishing, hunting, peat extraction, dispersed habitation, discharges, sport and leisure structures, pollution, drainage, erosion, invasive species.
Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>	Overgrazing, restructuring agricultural land holding, peat extraction, mechanical removal of peat, water pollution, landfill, land reclamation and drying out in general. Infilling ditches, dykes, ponds, marshes and pits.

Habitat Type (Annex I of the Habitats Directive)	Main Threats and Impacts
Limestone pavements*	Removal of limestone pavement, removal of scrub, dispersed habitation, stock feeding, agricultural improvement, quarry, disposal inert material, electricity lines, infilling wetlands, routes, abandonment of grazing, agricultural structure, burning, discharges, disposal household waste, dumping dredgings, forestry, grazing, improved access, landfill, nautical sports, paths and restructuring agric land holding.
Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)(*important orchid sites)	Invasion by a species, undergrazing, fertilisation, agricultural improvement, abandonment of pastoral systems, sand & gravel extraction.
Bog woodland*	Burning, mechanical removal of peat, drainage.
Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation	Fertilisation, grazing, forestry, peat extraction, pollution, drainage, invasive species.
Petrifying springs with tufa formation (Cratoneurion)*	Peat cutting, arterial drainage, local drainage, water abstraction, agricultural reclamation.
Degraded raised bogs still capable of natural regeneration	Peat cutting, arterial drainage, local drainage, water abstraction, agricultural reclamation.
Depressions on peat substrates of the Rhynchosporion	Peat cutting; drainage and burning; afforestation; invasive species; grazing; dumping; fertilisation; restructuring agricultural land; communication routes; cultivation; mowing/cutting; modification of inland water structures; sand and gravel extraction.

*Priority Habitats

Source: Natura 2000 Standard Data Form for Lough Corrib cSAC

Table 3.12 Potential Pressures and Threats on Annex II Species in Lough Corrib cSAC

Species Type	Main Threats and Impacts
Otter (<i>Lutra lutra</i>)	Use of pesticides, fertilization, hunting, trapping, poisoning, water pollution, infilling of ditches, dykes, ponds, pools, marshes or pits, management of aquatic and bank vegetation for drainage purposes, removal of sediments, canalization of inland water course.
Slender Naiad (<i>Najas flexilis</i>)	Water pollution, water abstraction, invasive species, forestry and farming.
Atlantic Salmon (<i>Salmo salar</i>)	Water pollution, invasive species, forestry, farming and fishing.
Freshwater Pearl-mussel (<i>Margaritifera margaritifera</i>)	Water pollution, water abstraction, invasive species, forestry and farming.
Sea Lamprey (<i>Petromyzon marinus</i>)	Fish passages, water pollution (including discharges), commercial fishing, invasive species, forestry and farming.
Brook Lamprey (<i>Lampetra planeri</i>)	Fish passages, water pollution (including discharges), commercial fishing, invasive species, forestry and farming.
Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>)	Loss of suitable summer and winter roosting sites due to the demolition or renovation of derelict buildings for human occupation, loss of commuting routes linking roosts to foraging sites, and loss of suitable foraging sites are the major threats to this species. The use of insecticides, habitat destruction such as felling of trees and scrub clearance and deterioration of old buildings.
White-clawed Crayfish (<i>Austropotamobius pallipes</i>)	Water pollution, invasive species, forestry and farming.
Shining Sickle-moss (<i>Drepanocladus vernicosus</i>)	Fertilisation, abandonment of pastoral systems, undergrazing, forestry planting, water pollution, drainage.

Table 3.13 Potential Pressures and Threats on Annex I Species in Lough Corrib SPA

Species Type	Main Threats and Impacts
Common Tern (<i>Sterna hirundo</i>)	Leisure Fishing, Water Pollution, Hunting, Fertilisation, Grazing.
Arctic Tern (<i>Sterna paradisaea</i>)	
Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>)	
Golden Plover (<i>Pluvialis apricaria</i>)	
Whooper Swan (<i>Cygnus cygnus</i>)	

3.3.4 Conservation Objectives of the Natura 2000 Sites

European and national legislation places a collective obligation on Ireland and its citizens to maintain at favourable conservation status the habitats and species within areas designated as cSACs and SPAs. The Government and its agencies are responsible for the implementation and enforcement of regulations that will ensure the ecological integrity of these sites. According to the EU Habitats Directive, favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, is stable or increasing,
- the ecological factors that are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and
- the conservation status of its typical species is favourable as defined below.

The favourable conservation status of a species is achieved when:

- population data on the species concerned indicate that it is maintaining itself, and the natural range of the species is neither being reduced or likely to be reduced for the foreseeable future, and there is, and will probably continue to be, a sufficiently large habitat to maintain its populations on a long-term basis.

3.3.4.1 Designated Sites Conservation Objectives

A Conservation Management Plan has not been prepared for the Lough Corrib cSAC. The following conservation objectives have been provided by the NPWS for Lough Corrib cSAC:

Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the cSAC has been selected (see **Table 3.7** and **Table 3.8**).

A Conservation Management Plan has not yet been prepared for the Lough Corrib SPA. The following conservation objectives have been provided by the NPWS for Lough Corrib SPA:

Objective: To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (see **Table 3.9** and **Table 3.10**).

3.3.5 NPWS Rare and Protected Species Data

The NPWS Rare and Protected Species database was consulted for records on species in the area which are qualifying interests of Lough Corrib cSAC or Lough Corrib SPA. The location for the proposed development lies within the 10km Grid squares (hectads) M33, M43 and M44. According to this database, there are records for twenty-eight rare and protected species within the three grid squares. However, the NPWS dataset is known to be incomplete, particularly for fish, bats and birds,

and so the absence of records for a species does not necessarily mean that the species does not occur in the area.

The relevant hectads are shown in **Figure 3.2**. Rare and protected species recorded within these squares which are qualifying interests of either Lough Corrib cSAC or Lough Corrib SPA are detailed in **Table 3.14**.

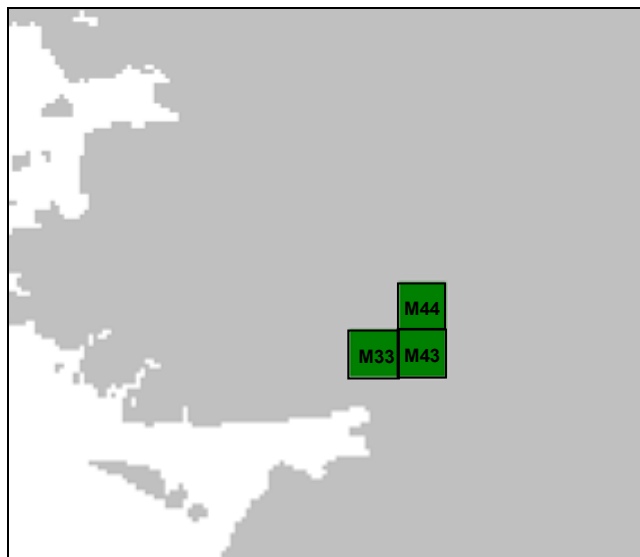


Figure 3.2 10km Square M33, M43, M44

Table 3.14 NPWS Rare and Protected Species Records

Common Name	Scientific Name	Grid Square(s)	Sample Locations
White-clawed Crayfish	<i>Austropotamobius pallipes</i>	M43, M44	Abbert / Bridge at Bullaun, Abbert / Pallas Bridge
Otter	<i>Lutra lutra</i>	M33, M43, M44	Numerous records including several on the Clare River (Corbally Bridge, Curraghmore Bridge, Claregalway, Grange, north of Cahernahoon)
Curlew	<i>Numenius arquata</i>	M43, M44	N/A
Cormorant	<i>Phalacrocorax carbo</i>	M33, M43, M44	N/A
Golden Plover	<i>Pluvialis apricaria</i>	M43, M44	N/A
Atlantic Salmon	<i>Salmo salar</i>	M43	River Clare near Grange

3.3.6 Bird Atlas Data

The New Atlas of Breeding Birds in Britain and Ireland: 1988-1991 (Gibbons *et. al.*, 1993) was consulted for information on breeding birds recorded within 10km grid squares M33, M43, and M44 within which the study area is located. **Table 3.15** presents details of bird species of high conservation concern which are also qualifying interests of Lough Corrib SPA and are recorded as breeding within 10km Grid Squares M33, M43, and M44 and during the 1988-1991 survey.

The following sources of information were consulted in order to determine the conservation status of bird species:

- Annex I of the EU 'Birds Directive' 2009/147/EC,

- The 'Red List' of Birds of Conservation Concern in Ireland (BoCCI) (Lynas *et. al.* 2007), and,
- The Irish Red Data Book (RDB) (Whilde 1993).

Table 3.15 Bird Species of High Conservation Concern Recorded by Gibbons *et. al.* (1993) from 10km National Grid Squares M33, M43, and M44.

Species	Qualification for 'High Conservation Concern' status	Breeding status in OS 10km square M33	Breeding status in OS 10km square M43	Breeding status in OS 10km square M44
Shovler (<i>Anas clypeata</i>)	Red Data Book 'Endangered'	Confirmed	Not recorded	Not recorded
Lapwing (<i>Vanellus vanellus</i>)	Red Data Book 'Vulnerable'	Confirmed	Not recorded	Not recorded
Curlew (<i>Numenius arquata</i>)	BoCCI, Red List	Confirmed	Not recorded	Not recorded
Black headed Gull (<i>Larus ridibundus</i>)	BoCCI, Amber List	Confirmed	Not recorded	Not recorded

Three bird species are recorded as breeding within Grid Squares M33, M43, and M44 during the 1988-1991 survey are protected under Annex I of the EU Birds Directive; Hen Harrier, Merlin, and Kingfisher, however none of these species are listed as qualifying interests of Lough Corrib SPA.

The species listed on the BoCCI Red and Amber List, Shovler and Blackheaded Gull are associated with the lake habitats and islands of Lough Corrib.

'The Atlas of Wintering Birds in Britain and Ireland' (Lack, 1986) was consulted for information on wintering birds recorded within 10km grid squares M33, M43, and M44 within which the study area is located. **Table 3.16** presents details of bird species of high conservation concern recorded as wintering within 10km Grid Squares M33, M43, and M44 and which are also listed among the qualifying interests for the conservation objectives of Lough Corrib SPA.

Table 3.16 Wintering Birds by Lack (1986) from 10km National Grid Squares M33, M43, and M44

Species	Qualification for 'High Conservation Concern' status	Wintering status in OS 10km square M33	Wintering status in OS 10km square M43	Wintering status in OS 10km square M44
Whopper Swan (<i>Cygnus cygnus</i>)	EU Bird's Directive Annex I	Confirmed	Not recorded	Not recorded
Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>)	EU Bird's Directive Annex I	Confirmed	Not recorded	Not recorded
Shoveler (<i>Anas clypeata</i>)	Red Data Book 'Endangered'	Confirmed	Not recorded	Not recorded
Golden Plover (<i>Pluvialis apricaria</i>)	EU Bird's Directive Annex I	Confirmed	Not recorded	Not recorded
Lapwing (<i>Vanellus vanellus</i>)	Red Data Book 'Vulnerable'	Confirmed	Not recorded	Not recorded
Curlew (<i>Numenius arquata</i>)	BoCCI, Red List	Confirmed	Not recorded	Not recorded
Black headed Gull (<i>Larus ridibundus</i>)	BoCCI, Amber List	Confirmed	Not recorded	Not recorded

Three bird species listed as qualifying interests of Lough Corrib SPA and recorded as wintering within Grid Squares M33, M43, and M44 are protected under Annex I of the EU Birds Directive; Whopper Swan, Greenland White-fronted Goose, and Golden Plover. The wintering habitat preferences of these species are discussed below.

Whopper Swan winter on bays, lakes, estuaries and adjacent fields.

Greenland White-Fronted Goose winter on wet grassland, salt marshes, peat bogs and fields.

Golden Plover winter on arable pastures.

The species listed on the BoCCI Red List, **Shovler, Lapwing, Curlew, and Blackheaded Gull** are associated with the lake habitats and islands of Lough Corrib.

3.3.7 Flora Atlas Data

The principal source of information regarding the distribution of flora in Ireland is the New Atlas of the British and Irish Flora (Preston *et al.*, 2002). The data included in this atlas is from the 1987-1999 atlas survey. This atlas shows data for vascular plants in individual hectads (10 km by 10 km squares). The proposed Flood Relief Scheme falls within hectads M33, M43 and M44 (**Figure 3.2**). The records for these hectads were consulted and a search was carried out to investigate if any rare or protected plant species had been recorded in the squares, during the 1987-1999 atlas survey (and previous surveys) carried out by the Botanical Society of the British Isles (BSBI). The search included the vascular plants that are listed in Annex II of the EU Habitats Directive, Flora Protection Order (FPO) of 1999, the Wildlife Act 1976, the Irish Red Data Book (IRDB) and the NPWS site synopsis. None of the plant species identified during this investigation are qualifying interests of Lough Corrib cSAC.

4 ASSESSMENT OF HABITATS AND SPECIES OF CONSERVATION INTEREST WITHIN STUDY AREA

4.1 ANNEX I HABITATS

A total of fourteen Annex I Habitats and nine Annex II species have been selected as the qualifying interests for Lough Corrib cSAC and five Annex I bird species of the E.U. Birds Directive are the qualifying interests of Lough Corrib SPA. The distribution of these habitats and species within the Natura 2000 sites are detailed in **Tables 3.7 - 3.10**.

The Annex I habitats which correspond to the qualifying habitats of Lough Corrib cSAC found in the vicinity of the proposed flood relief works include Annex I habitat *Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. (3140)*, *Water courses of plain to montane levels with the Ranunculus fluitantis and Callitriche-Batrachion vegetation (3260)*, *Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinia caerulea) (6410)* the Priority Annex I habitat *Active Raised Bogs (7110)*.

The proposed flood relief and ongoing maintenance works between Lough Corrib and Cregmore Bridge (approximately 14km) will be undertaken on the banks of the Clare River and largely within the boundary of Lough Corrib cSAC. In addition the other measures, which are proposed outside the boundaries, may impact on drainage channels and minor streams which feed into the Clare River.

Article 10 of the Habitats Directive refers to features of the landscape, outside designated sites which are of major importance for wild flora and fauna, as the follows:

'Member States shall endeavour, where they consider it necessary, in their land-use planning and development policies and, in particular, with a view to improving the ecological coherence of the Natura 2000 network, to encourage the management of features of the landscape which are of major importance for wild fauna and flora.

Such features are those which, by virtue of their linear and continuous structure (such as rivers with their banks or the traditional systems for marking field boundaries) or their function as stepping stones (such as ponds or small woods), are essential for the migration, dispersal and genetic exchange of wild species.'

The habitats found within the study area are shown in **Figure 4.1**. The habitats are classified in accordance with the guidelines set out in *'A Guide to Habitats in Ireland'* (Fossitt, 2000), which classifies habitats based on the vegetation present and management history. The classification is a standard scheme for identifying, describing and classifying wildlife habitats in Ireland. The classification is hierarchical and operates at three levels, outlining the correlation between its habitat categories and the phytosociological units (plant communities) of botanical classifications.

Habitats are also described in terms of their correspondence to Annex I habitats as per the Interpretation Manual of European Union Habitats - EUR27, see below. The *Status of EU Protected Habitats and Species in Ireland* (NPWS 2008) was also consulted which provides details on the status of listed habitats and species and also provides lists of typical species for these habitats in Irish context.

4.1.1 The Interpretation Manual of European Union Habitats - EUR27

Habitats are described in terms of their correspondence to Annex I habitats Based on the Interpretation Manual of European Union Habitats - EUR27. This is a scientific reference document published by the European Commission for the interpretation of Priority and Non-Priority Annex I habitat types of the

Council Directive 92/43/EEC. This manual incorporates descriptive sheets for Priority and Non-Priority Habitats, which establishes clear, operational scientific definitions of habitats, using pragmatic descriptive elements (e.g. characteristic plants) and taking into consideration regional variations.

The habitats found within the zone of influence of the project and their corresponding 'Fossitt' codes and possible links to Annex I habitats, are listed in **Table 4.1**. Those with links to Annex I Habitats or which support Annex II species are highlighted in bold. The area of each habitat impacted, i.e. either removed through river widening or infilled through land spreading, both outside and within the cSAC is listed in **Table 4.1**.

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Figure 4.1 Habitat Mapping for the Study Area

Table 4.1 Habitats found in the Study Area of the Proposed Flood Relief Works, with ‘Fossitt’ reference codes, with total area or length within the floodplain, within the cSAC, within land impacted by Measure 8b and land impacted by Measure 8b within the cSAC.

Habitat Type (Townland Locations)	Reference Code	Possible Links to Annex I Habitat	Area (ha) within Floodplain	Area (ha) within cSAC	Area (ha) Impacted	Area (ha) Impacted within cSAC
Mesotrophic Lake (Lower Lough Corrib)	FL4	3140*	0	16996	0	0
Eutrophic Lake	FL5	N/A	0.06	0	0	0
Turloughs	FL6	3180	12.76	0	0	0
Depositing Lowland River	FW2	3260*	1.318	1.038	0	0
Drainage Ditches (in km)	FW4	N/A	120.732	94.079	0.306	0.001
Calcareous Springs	FP1	7220*	0.016	0.008	0	0
Reed and Large Sedge Swamps	FS1	N/A	0.74	0	0	0
Improved Agricultural Grassland	GA1	N/A	568.10	114.49	7.6	2.56
Dry Calcareous & Neutral Grassland	GS1	6210*	20.79	11.23	5.3	0.87
Dry Meadows & Grassy Verges	GS2	6510	0.01	0	0	0
Wet Grassland	GS4	N/A	361.94	216.23	8.51	8.4
Wet Grassland (Grange West, Kiniska)	6410	6410*	18.81	9.33	0	0
Marsh	GM1	6430	21.41	15.64	0.9	0.9
Raised Bog	PB1	7110*	20.55	0	0	0
Cutover Bog	PB4	7150*	157.71	7.70	0	0
Bog Woodland	WN7	91D0*	0	0	0	0
Mixed Broadleaved Woodland	WD1	N/A	2.05	1.91	0	0
Conifer Plantation	WD4	N/A	43.94	0.22	0	0
Scrub	WS1	5130	22.55	11.09	0.36	0.36
Exposed Calcareous Rock	ER2	8210, 8240*	0.35	0	0	0
Exposed Sand, Gravel or Till	ED1	N/A	0.84	0.03	0	0
Spoil and Bare Ground	ED2	N/A	0.7	0.7	0.7	0.7
Recolonising Bare Ground	ED3	N/A	0.31	0.31	0	0
Earth Banks	BL2	N/A	12.98	11.02	0	0
Buildings and Artificial Surfaces	BL3	N/A	16.71	2.29	0	0
Hedgerows (in km)	WL1	N/A	3.120	1.756	0	0
Treelines (in km)	WL2	N/A	4.866	3.436	0	0
Stone Walls and Other Stone Work (in km)	BL1	N/A	1.059	0.404	0	0

*Only the habitats listed which correspond to the qualifying interest of Lough Corrib cSAC are discussed in this NIS

4.2 CONSERVATION STATUS OF HABITATS FOUND WITHIN THE STUDY AREA

This section addresses the habitats and species which are qualifying interests of Lough Corrib cSAC or Lough Corrib SPA which may be affected by the proposed works. The conservation status of habitats found within the study area with links to the qualifying habitats of Lough Corrib cSAC are discussed individually in the following sections. General descriptions, typical plant species and examples of corresponding habitat classifications throughout as detailed in the *Interpretation Manual of European Union Habitats* (EUR 27) are given in the tables in Appendix F. Typical species of each Annex I habitat in an Irish context, as outlined in The Status of EU Protected Habitats and Species in Ireland (NPWS, 2008), are detailed below the habitat description, in order to provide a comparison with any species list provided and to ascertain whether the habitat present within the study might correspond to that Annex I habitat.

4.2.1 Annex I Aquatic Habitats

Appendix E contains the report on aquatic ecology surveys undertaken by the Aquatic Services Unit, Environmental Research Institute, University College Cork.

- **Mesotrophic Lakes FL4 - Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. (3140)**

Lough Corrib, at around 170km², is Ireland's second largest lake after Lough Neagh in Northern Ireland. It is of high conservation value and forms the bulk of two Natura 2000 sites: Lough Corrib cSAC and SPA. The lake can be divided into two parts, a relatively shallow basin underlain by Carboniferous limestone in the south, and a larger, deeper basin to the north underlain by a combination of Carboniferous limestone in the south and east and by more acidic granite, schists, shales and sandstones, to the north and west. The maximum depth in the upper lake is 44-46m, with very extensive shallow embayments, while the entire lower lake rarely exceeds 3m depth. The Clare River occupies one third of the entire Lough Corrib catchment and is the main tributary of L. Corrib, flowing into the eastern shore of the lower lake just 3km from its outlet to Galway Bay.

The lake is a very important site for wintering waterfowl including: Common Tern (*Sterna hirundo*), Arctic Tern (*Sterna paradisaea*), Greenland White-fronted Goose (*Anser albifrons flavirostris*) Golden Plover (*Pluvialis apricaria*) and Whooper Swan (*Cygnus cygnus*). The lake is very popular with anglers for its brown trout and salmon fishing. One of the most significant features of the site are the submerged beds of aquatic macrophytes, which cover extensive areas of the shallow littoral of the lake, these include several *Chara* species, *Potamogeton* and other aquatics. These latter habitats are very seriously threatened by the recent arrival of a non-native macrophyte (*Lagarosiphon major*), which has rapidly spread within the lake.

The Lower Lake of Lough Corrib is currently classified as Mesotrophic based on average maximum chlorophyll *a* concentrations of 8 mg/l, during the 2007-2009 sampling period whilst Lough Corrib (Upper and Lower) is currently classified under the Water Framework Directive as being of *Moderate* Ecological Status because the fish population in the lake has been classified as Moderate (CFB, 2009). Other biological and chemical indicators are either high or good, although low confidence is associated with the chlorophyll status recorded due to the presence of zebra mussels in the lake. Since 2006 the lowest EPA monitoring station on the Clare River (Curraghmore Bridge) has been rated at *High* ecological status with a Q-value of Q4-5. Prior to that, at least as far back as 1980, the same site had *Good* Ecological Status (Q4), suggesting that its impact on the lake is not especially adverse, which appears to be borne out by the mesotrophic or oligotrophic status of the lake over 3 decades. In a 1986 plant survey of the lake (Krause and King, 1994), the lower lake held very low densities of the more sensitive *Chara* species, whereas *Potamogeton pectinatus*, a species very tolerant of enrichment, and several filamentous algal species totally dominated the central and eastern

part of the lower lake, and was locally very abundant. The authors attributed this to inputs from the Clare River. It is, however, possible that more recent improvements in water quality on the Clare River may have facilitated re-establishment of more sensitive *Chara* spp., an Annex I qualifying habitat for the Lough Corrib site, for which there are specific conservation objectives.

The EPA monitors macrophytes along many transects throughout the upper and lower lake as part of WFD Lake monitoring programme (*pers. comm.*, Ms. Caroline Plant, EPA). The two transects closest to the confluence of the Clare with the lower lake (Transect 16 just to the north and Transect 17 to the south) were surveyed in 2007 and 2010 and on both occasions returned abundances of filamentous algae generally higher than the majority of other transects within the lower lake, especially transects farther north or on the western side. Transect 16 and 17 also had somewhat lower representation of *Chara* species. These data partially support the findings of (Krause and King, 1994) for the eastern side of the lower lake. However, the EPA transects in general show that Lower Lough Corrib has a very strong representation of *Chara* species, which contributes to its good macrophyte status, concurring with its overall Good water chemistry status. Furthermore, *Potamogeton pectinatus* a species tolerant of higher nutrients and turbidity levels than *Chara* was only rarely or occasionally recorded in the 2010 EPA survey of Lower Lough Corrib compared to the earlier findings of Krause and King (1994), when it was abundant. *Chara* is believed to out-compete *Potamogeton pectinatus* in lakes where the transparency is high (van den Berg *et al.*, 1999).

One of the qualifying Annex I habitats for Lough Corrib is No. 3140 *Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.* As outlined above this habitat has a good representation throughout the Lower Lake of Lough Corrib although EPA transects in close proximity to the confluence of the Clare River with the Lower Lake have shown a low representation of *Chara* species. **Table 4.2** below details the characteristics of this Annex I habitat.

Although there has been a low representation of this Annex I habitat recorded close to the confluence of the Clare River with the Lower Lake of Lough Corrib it is possible that it exists at this location. Therefore potential impacts to this Annex I habitat should be considered.

Table 4.2 Comparison of Mesotrophic Lake (FL4) with Annex I Habitat

Typical species found in 'Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.(3140)' The Status of EU Protected Habitats and Species in Ireland (NPWS 2008) -
Typical Species : <i>Chara</i> spp. and <i>Nitella</i> spp

- **Depositing Lowland Rivers FW2 - Water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation (3260)**

The Clare River, designated under Lough Corrib cSAC, has been designated for a number of aquatic interests. The proposed works have the potential to directly affect the Clare River within the study area, and to indirectly affect other water-dependent habitats adjacent to, and downstream of, this watercourse. The Clare River can be characterised as a wide (averaging approximately 12m), lowland meandering channel that has undergone extensive hydromorphological change as a result of past drainage, see **Image 4.1**.

One of the qualifying Annex I habitats for the site is No. 3260: *Water courses of plain to montane levels with the Ranunculon fluitantis and Callitricho-Batrachion vegetation*. A very poor example of this habitat type may be present at Crusheeney Bridge (elevated water flows during the field survey made a detailed assessment difficult). However, heavy drainage, which has effectively canalised the stretch, has clearly prevented a more representative example of the habitat from developing. It appeared that the community was a somewhat poor example of the habitat type, given that the main characteristic species were uncommon along much of the stretch. Characteristic species of 3206 recorded along the stretch included: *Ranunculus* spp., *Oenanthe fluviatilis*, *Potamogeton* spp. and *Callitriche* spp.

Table 4.3 below details the characteristic species of this Annex I habitat. Although this Annex I habitat may be located within the Clare River, this is considered a poor example with some representation of the typical species as outlined above.

Although that the main characteristic species of this Annex I habitat were uncommon it is considered that as poor example of this habitat may exist and as this habitat is a qualifying interest of Lough Corrib cSAC potential impacts should be assessed.

Table 4.3 Comparison of Lowland River (FW2) with Annex I Habitat

Typical species found in 'Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (3260)' as outlined in The Status of EU Protected Habitats and Species in Ireland (NPWS 2008)

Typical Species : *R. trichophyllus*, *R. peltatus*, *R. penicillatus*, *R. aquatilis*, *Myriophyllum spp.*, *Callitriche spp.*, *Sium erectum*, *Zannichellia palustris*, *Potamogeton spp.*, *Fontinalis antipyretica*.



Image 4.1 The Clare River at Crusheeney Bridge – classified as a Depositing Lowland River FW2

4.2.2 Terrestrial Habitats

- **GS4 Wet Grassland - *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caerulea*) (6410)**

Wet grassland habitat is quite common within the study area, occurring regularly along the banks of the Clare River, and on lower slopes where drainage is impeded. This habitat is characterised by rushes (*Juncus articulatus/acutiflorus*), sedges (*Carex spp*), Purple Moor-grass (*Molinia caerulea*), Tormential (*Potentilla erecta*), Devil's-bit Scabious (*Succisa pratensis*), and Cuckooflower (*Cardamine pratensis*). This habitat often forms mosaics with marsh and improved grasslands. Most of the wet grassland communities found within the study area are relatively species-poor and do not correspond to any EU Annex I habitats. However, the EU Annex I habitat *Molinia* Meadows 6410 was found at two

locations within the Study Area, within the townland of Kiniska just northeast of Claregalway and within Lough Corrib cSAC, and in the townland of Grange West.

The area of wet grassland habitat in Kiniska is dominated by *Molinia caerulea* with abundant *Filipendula ulmaria*, *Potentilla anserina* and *Festuca rubra*. *Anthoxanthum odoratum* and a *Dactylorhiza* sp. were frequent while *Carex nigra* was occasional. Other species noted within the area included *Holcus lanatus*, *Juncus conglomeratus*, *Carex disticha*, *Potentilla erecta*, *Cardamine pratensis*, *Ranunculus acris*, *Angelica sylvestris*, *Plantago lanceolata* and *Lotus corniculatus*.

The area of wet grassland habitat in Grange West is also dominated by *Molinia caerulea*. Other species present in this area include *Filipendula ulmaria*, *Potentilla anserina*, *Anthoxanthum odoratum*, *Dactylorhiza* sp., *Holcus lanatus*, *Juncus conglomeratus*, *Potentilla erecta*, *Briza media*, *Ranunculus flammula*, *Hyoscyamus tetrapetalus*, *Carex viridula* subsp. *oedocarpa*, *Equisetum* spp., *Cirsium palustre*, *Eriophorum angustifolium*, *Carex panacea*, *Pedicularis* sp. and *Iris pseudacorus*. Table 4.4 below details the characteristic species of this Annex I habitat.

These two areas of wet grassland in the study area correspond with the Annex I Habitat, *Molinia meadows on calcareous, peaty or clayey-siltladen soils (Molinion caeruleae) (6410)* (see Table 4.6 below). However, only the area of habitat within the townland of Kiniska is within Lough Corrib cSAC and so impacts on this area are assessed in this report. Impacts to Annex I habitats outside the European sites are assessed in full in the EIS for this project.

Table 4.4 Comparison of Wet Grassland with Annex I Habitat

Typical species found in ‘*Molinia meadows on calcareous, peaty or clayey-siltladen soils (Molinion caeruleae) (6410)*’ as outlined in The Status of EU Protected Habitats and Species in Ireland (NPWS 2008)

Typical species : *Agrostis* spp., *Carex echinata*, *Carex nigra*, *Carex hostiana*, *Carex panicea*, *Carex pulicaris*, *Holcus lanatus*, *Angelica sylvestris*, *Caltha palustris*, *Cardamine pratensis*, *Cirsium dissectum*, *Cirsium palustre*, *Filipendula ulmaria*, *Juncus acutiflorus*, *Juncus articulatus*, *Juncus conglomeratus*, *Juncus effusus*, *Lotus pedunculatus*, *Lychnis flos-cuculi*, *Lythrum salicaria*, *Molinia caerulea*, *Myosotis laxa*, *Orchidaceae* spp., *Potentilla anglica*, *Potentilla erecta*, *Ranunculus repens*, *Ranunculus flammula*, *Senecio aquaticus*, *Succisa pratensis*, *Pseudoscleropodium purum*, *Thuidium tamariscinum*, *Hylocomium splendens*, *Carex pallescens*, *Carum verticillatum*, *Sisyrinchium bermudiana*, *Wahlenbergia hederacea*.



Image 4.2 Wet Grassland in Kiniska, classified as Annex I habitat, *Molinia* Meadow

• **PB1 Raised Bog - Priority Annex I Habitat *Active Raised Bogs (7110)*, Annex I Habitat *Degraded Raised Bogs (7120)***

Intact areas of Raised Bog can be found in the townlands of Montiagh North immediately east of the N84 and 570m north of the Clare River. This Raised Bog is not designated under Lough Corrib cSAC. However, the raised bog to the west of the N84, 500m north of the Clare River comprises a large area of western raised bog in the townlands of Curraghmore and Addergoole, on the eastern shores of Lough Corrib which is designated under Lough Corrib cSAC and SPA. This area of Raised Bog has been extensively cut around its margins. However, the bog is largely intact and towards the centre of the peat mass, there is a well developed pool system. The active parts of these bogs mostly correspond to the wettest areas, where there are well developed surface features with hummocks, lawns and pools. It is in such areas that Rhynchosporion vegetation is best represented. Wet areas and pools are characterised by Common Cottongrass (*Eriophorum angustifolium*), White Beak-sedge (*Rhynchospora alba*), Bog Asphodel (*Narthecium ossifragum*), sundews (*Drosera* spp.), Bogbean (*Menyanthes trifoliata*), bladderworts (*Utricularia* spp.) and *Sphagnum* spp.

The largest part of the uncut high bog comprises degraded raised bog. Degraded bog is dominated by a raised bog flora which tends to be rather species-poor because of disturbance and/or drying-out. Dry areas and hummocks usually support Ling heather (*Calluna vulgaris*), Hare's-tail Cottongrass (*Eriophorum vaginatum*), Deergrass (*Trichophorum cespitosum*), Cross-leaved Heath (*Erica tetralix*), Lichens (*Cladonia* spp.) and low *Sphagnum* cover.

Two areas of the Raised Bog which correspond to the Priority Annex I Habitat *Active Raised Bogs (7110)* and Non-Priority Annex I Habitat *Degraded Raised Bogs (7120)* are found within the study area, however, only the habitat within the townland of Curraghmore/Addergoole is within Lough Corrib cSAC and so impacts on this area are assessed in this report. Impacts to Annex I habitats outside the European sites are assessed in full in the EIS for this project.

Table 4.5 Annex I Habitats *Active Raised Bogs (7110)* and *Degraded Raised Bogs (7120)*

Typical species found in '*Active Raised Bogs (7110)* and *Degraded Raised Bogs (7120)*' as outlined in The Status of EU Protected Habitats and Species in Ireland (NPWS 2008)

Typical species (7110): *Erico-Sphagnetalia magellanici*- *Andromeda polifolia*, *Carex pauciflora*, *Cladonia* spp., *Drosera rotundifolia*, *Eriophorum vaginatum*, *Odontoschisma sphagni*, *Sphagnum magellanicum*, *S. imbricatum*, *S. fuscum*, *Vaccinium oxycoccos*.

A summary of the Annex I habitats which are qualifying interests of Lough Corrib cSAC and which may occur and be impacted by the proposed flood relief scheme are presented in **Table 4.6** below.

Table 4.6 Summary of Annex I Habitats which are qualifying Habitats of Lough Corrib cSAC and their Locations within the Study Area

Qualifying Annex I Habitat of Lough Corrib cSAC	Location(s) within cSAC
3140 Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara</i> spp.	Lough Corrib
3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation	Poor example within Clare River at Crusheen
6410 <i>Molinia</i> meadows on calcareous, peaty or clayey-siltladen soils (<i>Molinion caeruleae</i>)	Kiniska
7110 <i>Active Raised Bog</i> , 7120 <i>Degraded Raised Bogs</i>	Curraghmore/Addergoole

4.3 CONSERVATION STATUS OF PROTECTED OR VULNERABLE SPECIES WITHIN STUDY AREA

The Status of EU Protected Habitats and Species in Ireland is a report which was prepared by the NPWS in 2008 to establish the conservation status of protected habitats and species. Excerpts from this report are provided for each of the Annex II species mentioned in the site synopses for the Natura 2000 sites in the study area.

The conservation status of a protected species may be taken as favourable when:

- Through monitoring, the population has been shown to be self-maintaining in the long term within its natural habitat,
- The natural range and habitat of the species is currently favourable, i.e. not in decline or in threat of decline, and
- Favourable habitat for the species is assessed as being available in terms of area, over the long-term.

4.3.1 Freshwater Pearl Mussel (*Margaritifera margaritifera*)

The Freshwater Pearl-mussel (*Margaritifera margaritifera*) is listed as a qualifying feature of the Lough Corrib cSAC. The EU Habitats Directive lists *M. margaritifera* under Annex II (species whose conservation requires the designation of special conservation areas) and Annex V (species whose taking in the wild and exploitation may be subject to management measures). Under Irish law, the Wildlife Act (1976), the Wildlife (Amendment) Act (2000) it is illegal to interfere with *M. margaritifera* or its habitat (Statutory Instrument No. 112, 1990).

Freshwater pearl mussels live in nutrient-poor, acid to neutral waters of rivers flowing over granite or sandstone rock (rivers with soft waters and low levels of calcium). There are no known records of freshwater pearl mussel from the Clare River (Dr. Evelyn Moorkens, *pers. comm.*) and this is expected given the bedrock geology of the river (karst) and the water hardness of the river (>200 mg/l CaCO₃).

The conservation status of *Margaritifera margaritifera* in Ireland is provided in *The Status of EU Protected Habitats and Species in Ireland* (NPWS 2008), a summary is provided in **Table 4.7**.

Table 4.7 Conservation Status of Freshwater Pearl Mussel (from the Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Good
Population	Bad
Habitat for the species	Bad
Future prospects	Bad
Overall assessment of CS	Bad

4.3.2 Atlantic Salmon (*Salmo salar*)

The Atlantic salmon is listed under Annexes II and V of the EU Habitats Directive and Appendix III of the Bern Convention. Atlantic Salmon is listed as a qualifying interest for Lough Corrib cSAC. The salmon population in Ireland has declined by 75% in recent decades, with salmon now occurring in 148 rivers but only 43 of these rivers have healthy populations.

The Clare River is an important brown trout fishery although salmon are also taken on rod and line. The main spawning areas within the catchment are those of the Abbert and Grange Rivers. The most

recent published data within the study area is from survey work undertaken in 2010 by IFI as part of the WFD fisheries surveys and is summarised in **Table 4.8**.

Table 4.8 Fish species and numbers caught on the Clare River near Crusheen Bridge (IFI, 2010)

Species	Salmon	Brown Trout	Eel	Perch	Pike	Stickleback	Lamprey	Roach
No.	104	24	1	42	2	25	1	44
Density (nos./m ²)	0.03044	0.00702	0.00029	0.01229	0.00059	0.00732	0.00029	0.01288

The survey was undertaken at Kiltroge (Crusheen Bridge) on 24th August, 2010 by 2 boat-based electrofishing units. The total area fished was 3416m² (234m of channel, average width 14.6m, average depth 0.53m). The overall salmon density was the 2nd highest of the seven river sites in the Western Basin District Region fished using boat based units during 2010 in which salmon were recorded. Of the 104 salmon recorded at Crusheen (Kiltroge) 39% were 0+ (i.e. young-of-the-year), while 61% were 1+ salmon (fish in their 2nd year). The assemblage at the site was quite diverse, which probably reflects the size of the channel and the diversity of its microhabitats for fish as well as the connection to the greater Corrib catchment. The highest fish densities were of salmon (104 fish). Of note regarding salmon recorded as part of the study is that the proportion of 0+ fish is the same as in the much shallower (12cm) tributary, the Abbert River, which also had 39% 0+ fish. According to Dr. Martin O'Grady, Inland Fisheries Ireland, the 1+ salmon parr are likely to be moving down from the main spawning tributaries (Abbert and Grange River) in their second year of growth. However, the relatively high proportion of 0+ fish may indicate that there is some spawning in the main channel of the Clare. In general, the main channel of the Clare is not currently utilised by salmon for spawning although it is recognised that some pockets of spawning may occur (M. O'Grady, IFI, *pers comm.*). Salmon redds have, in fact, been noted on occasion within the study area both in the Crusheen Bridge vicinity and about 1km downstream of Claregalway Bridge where beds of suitable spawning gravels exist (Sean Francis, IFI Galway, *pers comm.*). Generally, however, water depth at the site precludes a systematic annual redd count like that which takes place elsewhere in the system. **Table 4.9** presents the summarised salmon redd count data for the 5 spawning seasons 2006/2007 to 2010/2011, which clearly shows the importance of the system for spawning salmon, especially the main channel upstream of Milltown (Dalgan River) and the Abbert and Grange tributaries.

Table 4.9 Summarised salmon redd count data for the spawning seasons 2006/7 to 2010/11 (data courtesy Mr Sean Francis, IFI Galway)

River Name	Mean (Std Dev)	Max-Min
Abbert	486 (126)	(620-372)
Grange	331 (105)	(442-234)
Sinking	171 (94)	(276-71)
Dalgan	301 (169)	(479-119)
Tonemoyle	35 (8)	(45-27)
Knocknagur	33 (7)	(44-27)
Dawros	39 (15)	(57-24)
Nanny	18 (23)	(59-5)
Bluepig	25 (19)	(45-5)
Illaun	10 (5)	(15-5)
Total Count	1441 (489)	(1814-906)

Deeper, slow flowing stretches and pooling areas on river bends would be more likely to hold older salmonids i.e. mainly 2+ or older trout as well as pike and coarse species such as roach and perch. Shallower, more turbulent areas would be expected to hold 1+ trout and perhaps 0+ (young-of-the-year) salmon as well, if spawned locally. Several 0+ salmonids were observed during the current survey over shallow gravel beds below the bend at Point 49 (please refer to Photo 14 in **Appendix E Aquatic Ecology and Fisheries Ecological Impact Assessment**), lending further support to the possibility that salmon may have spawned locally in the 2010/2011 season. Salmon and trout spawning occurs in the main, further upstream, primarily in the Abbert and Grange tributaries and on the main channel upstream of Milltown where the Clare main channel divides into the Dalgan and Sinking Rivers.

The stretch of the Clare River downstream of Cregmore Bridge to about halfway to Crusheen Bridge, would also seem to be an ideal area for 0+ and 1+ salmon given its higher flow velocities and generally coarse substrate dominated by riffle/run and run/glide type habitats. Costello's Pool, also in this stretch, is a noted angling spot, which probably acts as a holding area for older fish.

The Clare River has not been designated under S.I. No. 293/1988: European Communities (Quality of Salmonid Waters) Regulations, 1988.

The conservation status of *Salmo salar* in Ireland is provided in *The Status of EU Protected Habitats and Species in Ireland* (NPWS 2008), a summary is provided in **Table 4.10**.

Table 4.10 Conservation Status of Atlantic Salmon (from The Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Favourable
Population	Bad
Habitat for the species	Inadequate
Future prospects	Inadequate
Overall assessment of CS	Bad

4.3.3 Otter (*Lutra lutra*)

Otter are listed on Annex II and Annex IV of the EU Habitats Directive and also on the Wildlife Act (1976, amendment 2000). Annex II species require the designation of protected areas by Member States (Special Areas of Conservation) as set out in Articles 3, 4 and 6 of the Directive. Annex IV species require strict protection measures by Member States in accordance with Article 12 of the Directive, the Eurasian Otter is also listed on Appendix 1 of CITES and Appendix II of the Bern Convention. The Irish population is also listed in the *'Irish Red Data Book 2: Vertebrates'* (Whilde, 1993) as being of international importance.

Otters are largely solitary, territorial and nocturnal animals and in many areas their distribution is scarce. They are rarely found far from water and tend to occupy linear home ranges along watercourses and coasts. They require suitable bankside vegetation as cover for their burrows or rest sites which are termed 'holts'. Otters mark their home ranges by depositing their droppings termed 'spraints', at distinct landmarks such as grassy mounds, large rocks or ledges under bridges. These favoured sites are known as seats and are usually found at important locations i.e. access points to the water, good fishing grounds etc.

This species is listed as a qualifying interest of Lough Corrib cSAC and the NPWS online database contains several records for otters within the 10km grid squares M33, M43 and M44.

Although there are no seasonal requirements for otter surveying, dense vegetation in areas along the riverbanks may reduce success in the identification of otter holts and couches. However, due care was taken to thoroughly investigate all areas to ensure that this seasonal constraint did not impact on the completeness of the findings of the surveys.

Otter surveys were conducted in June 2011, November 2011 and March 2012. Surveys for otter holts and signs in the winter months when vegetation has died back ensure that this seasonal constraint did not impact on the completeness of the findings of the surveys. During the multidisciplinary surveys during the spring/summer months all signs of otter were recorded. Signs were recorded on the banks of rivers and streams during terrestrial habitat surveys. Holts and signs were searched for in the banks of the rivers and islands within the watercourses during aquatic surveys. Two otter holts were found during site surveys. These were both located on the southern bank of the Clare River approximately 1km and 1.5km upstream of Claregalway Bridge. A number of otter signs, in the form of otter spraints on rocks in the river channel, and along the banks of the Clare River were found during site surveys. Observations of otter activity including holts/couches, spraints, and footprints are provided in **Table 4.11**.

Table 4.11 Observations of Otter Activity within Study Area

Ref. on Drawings	Type of Sign	Location and Activity
OS1	Spraint	220m upstream of Crusheeny Bridge on south bank.
OS2	Spraint	180m downstream of Crusheeny Bridge on the south bank.
OS3	Spraint	240m downstream of Crusheeny Bridge on the south bank.
OS4	Spraint	270m downstream of Crusheeny Bridge on the south bank.
OS5	Spraint	320m downstream of Crusheeny Bridge on the south bank.
OS6	Spraint	370m downstream of Crusheeny Bridge on the south bank.
OS7	Tracks	800m downstream of Crusheeny Bridge on the south bank
OH1	Holt	1.43km upstream of Claregalway Bridge on the south bank. Co-ordinates: X:137,984, Y:232,574
B1*	Burrow	970m upstream of Claregalway Bridge on the south bank.
OH2	Holt	905m upstream of Claregalway Bridge on the south bank. Co-ordinates: X:137,990, Y:233,080
OS8	Tracks	480m upstream of Claregalway Bridge on the south bank.

*This burrow has an exit hole directly onto improved grassland approximately 2-3m from the river bank. Otter and Badger tracks were abundant in the area and a well defined mammal trail runs on the field side of the fenceline. The burrow is very exposed so is very unlikely to be used as a holt or sett.

The conservation status of *Lutra lutra* in Ireland is provided in **Table 4.12**.

Table 4.12 Conservation Status of *Lutra lutra* (from The Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Favourable
Population	Inadequate
Habitat for the species	Favourable
Future prospects	Favourable
Overall assessment of CS	Inadequate

4.3.4 Slender Naiad (*Najas flexilis*)

Slender Naiad is included on Annex II of the EU Habitats Directive, and is listed as a qualifying interest for Lough Corrib cSAC and it is known to occur within Lough Corrib itself. This species is a submerged aquatic herb which occurs in lakes of acid to slightly base-rich water.

The conservation status of *Najas flexilis* in Ireland is provided in **Table 4.13**.

Table 4.13 Conservation Status of *Najas flexilis* (from The Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Good
Population	Poor
Habitat for the species	Poor
Future prospects	Good
Overall assessment of CS	Poor

4.3.5 Sea Lamprey (*Petromyzon marinus*) – Lough Corrib cSAC

Sea lamprey is listed as one of the qualifying interests of Lough Corrib cSAC. They live as external parasites on other fish species. There is, currently, no firm evidence that Sea Lamprey, *Petromyzon marinus*, is present in Lough Corrib and its tributaries, including the Clare River. Sea lampreys seem to be confined to below the Galway Regulating Weir and whilst there are historical records of sea lampreys in some of the tributaries of Lough Corrib, these pre-date the construction of the existing weir (O'Connor, 2007). The conservation status of *Petromyzon marinus* in Ireland is provided in **Table 4.14**.

Table 4.14 Conservation Status of *Petromyzon marinus* (from The Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Poor
Population	Poor
Habitat for the species	Poor
Future prospects	Poor
Overall assessment of CS	Poor

4.3.6 Brook Lamprey (*Lampetra planeri*) – Lough Corrib cSAC

Brook lamprey is listed as one of the qualifying interests of Lough Corrib cSAC. It is listed on Annex II of the EU Habitats Directive. The brook lamprey is the smallest of the three lampreys native to Ireland, at 15 to 20cm, and it is the only one of the three which is non-parasitic and spends all its life in freshwater.

Brook lamprey (*Lampetra planeri*) has been previously recorded in the Clare River (O'Connor, 2007) and were recorded at only a few sites on the lower channel of the Clare River in the vicinity of Claregalway. There are records of lamprey (records of undifferentiated river/brook lamprey (*Lampetra* spp.) on the Clare just downstream of Claregalway Bridge in an area that was used for cattle watering (O'Connor 2007) and the IFI found one lamprey (not identified) in their 2010 survey at Crusheeney Bridge. Lamprey habitat is generally considered sub-optimal within the Corrib system (O'Connor, 2007).

Brook lamprey were not recorded during the aquatic ecology survey carried out by ASU (**Appendix E**), however the Gortadooey tributary, Gortcloonmore tributary, Kiniska tributary and Islandmore /Caherlea arterial drainage network may provide suitable habitat.

The conservation status of *Lampetra planeri* in Ireland is provided in **Table 4.15**.

Table 4.15 Conservation Status of *Lampetra planeri* (from The Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Good
Population	Good
Habitat for the species	Good
Future prospects	Good
Overall assessment of CS	Good

4.3.7 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) – Lough Corrib cSAC

The Lesser Horseshoe Bat is listed as a qualifying interest of Lough Corrib cSAC. This species is confined to the western counties of Ireland. The Irish population of this species is estimated at 9,500 individuals and is considered of International Importance, as its numbers have declined dramatically and the species has become extinct in many other parts of Europe. The Lesser Horseshoe Bat usually forages in woodland and scrub. It roosts mainly in roofs of old houses or in stables, outhouses, or old cottages. In winter this species hibernates in places that maintain a constant low temperature throughout the winter, such as caves, mines, disused cellars and souterrains. The Gatehouse and Ice House in Ross Demesne, located 12km northwest of the proposed development on the other side of Lough Corrib, supports an internationally important breeding colony of Lesser Horseshoe Bats. The bats forage predominantly in deciduous woodland and riparian vegetation within c. 3km of the maternity roost (Bontadina et al. 2002, and Biggane, 2003). They rely on linear landscape features such as treelines, stone walls and hedgerows to navigate and commute from roosts to feeding sites as unlike other bat species they do not fly out in the open. This roost will not be impacted by the proposed works.

No signs of this species were noted in the study area, and there are no suitable roosting/hibernation sites in the vicinity of the proposed works.

The conservation status of *Rhinolophus hipposideros* in Ireland is provided in **Table 4.16**.

Table 4.16 Conservation Status of *Rhinolophus hipposideros* (from The Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Good
Population	Good
Habitat for the species	Good
Future prospects	Good
Overall assessment of CS	Good

4.3.8 White-clawed Crayfish (*Austropotamobius pallipes*) – Lough Corrib cSAC

White-clawed Crayfish is listed as a qualifying interest of Lough Corrib cSAC. In Ireland, this species most commonly occurs in small and medium-sized lakes, large rivers, streams and sometimes in drains. The species prefers relatively cool temperatures and adequate dissolved oxygen and lime, although it is capable of tolerating significant fluctuations in these parameters. Juveniles live among gravel, submerged tree-roots or aquatic plants, while larger crayfish must have stones to hide under, or earthen banks in which to burrow. Females carrying eggs require undisturbed shelter over a prolonged winter-spring period.

The National Biodiversity Data Centre (NBDC) holds the Irish National Crayfish Database which consists of IFI, EPA and Reynolds datasets for White-clawed Crayfish. NBDC online maps² show there are no reported records found for crayfish within or in close downstream proximity to the study area on the Clare River. Previous records (ranging between 1971 and 2009) are confined to areas well upstream on the Abbert, Grange and Sinking Rivers. Reynolds (2006) has reported crayfish at the mouth of the Clare River, but the year of the record is currently unknown. Reynolds (2007) also noted declines in crayfish populations of drained rivers such as the Clare River in recent years, despite indications that water quality has improved. NBDC White-clawed Crayfish records for Lough Corrib are at locations c.9km north of the Clare River confluence with the lake. O'Connor *et al.* (2009), in a survey of Irish lakes, found no crayfish at two sites on lower Lough Corrib (one on the eastern and one on the western shore), but reported 2004 anecdotal records from Kilbeg and Knockferry piers, c.10km northwest of the Clare River mouth.

No crayfish were captured during surveys, carried out by ASU (**Appendix E**), conducted in July, 2011 on the Clare River within the study area. Further surveys were carried out in August 2012 on the reach upstream of the Islandmore confluence. These involved timed manual searches and baited traps deployed overnight. Survey methods were adapted to be appropriate to habitats encountered, based on Peay (2003) and Reynolds *et al.* (2010). Although water levels were high at the time of surveying it was clear that crayfish habitat in the lower Clare was classified as 'sub-optimal' in the main, however, crayfish can often be found in habitat that is not considered to be ideal for the species (King *et al.*, 2008).

More recent historical data suggests that populations in the lower Clare River may have declined, however, given that water quality is suitable and there are some habitat opportunities, their presence can not be entirely ruled out. If present, population densities within the study area and on the lower Clare River in general, appear likely to be low.

The conservation status of *Austropotamobius pallipes* in Ireland is provided in **Table 4.17**.

Table 4.17 Conservation Status of *Austropotamobius pallipes* (from The Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Poor
Population	Poor
Habitat for the species	Poor
Future prospects	Poor
Overall assessment of CS	Poor

² <http://maps.biodiversityireland.ie/#/SpeciesGroup/44/Species/17487?FullDictionary=false&UseCommonNames=false>

4.3.9 Shining Sickle Moss (*Drepanocladus vernicosus*) – Lough Corrib cSAC

Shining Sickle Moss (*Drepanocladus vernicosus*), an Annex II species and one of the qualifying species of the Lough Corrib cSAC, is also protected under the Flora Protection Order (1999). The Lough Corrib cSAC complex contains only one known location for this species, confined to small flushes within areas of lowland blanket bog, habitat which is not located within the study area. Therefore, this species will not be impacted by the proposed works. The conservation status of *Drepanocladus vernicosus* in Ireland is provided in **Table 4.18**.

Table 4.18 Conservation Status of *Drepanocladus vernicosus* (from The Status of EU Protected Habitats and Species in Ireland (NPWS 2008))

Parameter	Findings
Range	Favourable (FV)
Population	Favourable (FV)
Habitat for the species	Favourable (FV)
Future prospects	Favourable (FV)
Overall assessment of CS	Favourable (FV)

5 IN-COMBINATION EFFECTS

5.1 POTENTIAL IN-COMBINATION EFFECTS

As part of the Natura Impact Statement, other relevant projects and plans in the region must also be considered at this stage, together with the proposed flood relief works. This step aims to identify any possible significant in-combination or cumulative effects/impacts of the proposed development with other such plans and projects on Lough Corrib cSAC. Plans and Projects specific to Lough Corrib cSAC are discussed. The potential 'In-Combination Effects' of other plans and projects are described in **Table 5.1**.

Table 5.1 Potential In-Combination Effects of Other Plans and Projects

Plans And Projects	Key Policies/Plans/Projects Directly Related To The Study Area	Potential For Cumulative Effects
	LAND USE AND SPATIAL PLANS	
Galway County Development Plan 2009-2015	<p>Policy HL31: It is the policy of the Council to implement Article 6(3) of the EU Habitats Directive, and to subject any plan (including County Development Plan, Local Area Plans) or project likely to impact Natura 2000 or European Sites (cSACs, SPAs), whether directly (in situ), indirectly (ex-situ) or in combination with other plans or projects, to an Appropriate Assessment in order to inform decision making. A plan or project may only be authorised after the competent authority has made certain, based on scientific knowledge, that it will not adversely affect the integrity of the site; in the case of derogations, authorisation must be pursued under Article 6(4).</p> <p>Policy HL32: It shall be the policy of Galway County Council to ensure that development in Galway and the provision of services take into account the relevant Management Plans (if any) for cSACs and SPAs in the county.</p> <p>Policy HL33: Have regard to any impacts developments may have on or near existing and proposed, Natural Heritage Areas, Special Protection Areas and Special Areas of Conservation, Nature Reserves, Ramsar Sites, Wildfowl Sanctuaries, Connemara National Park and any other designated sites including any future designations.</p> <p>Policy HL34: Consult the Department of the Environment, Heritage and Local Government in relation to proposed developments adjoining designated conservation sites.</p> <p>Policy HL35: Protect and conserve habitats and species designated under the Habitats Directive, Birds Directive, Wildlife Act, Flora Protection Order, National Nature Reserves, Connemara National Park, Ramsar Sites and any other Directives, Acts or Policies which may be issued during the lifetime of this Plan.</p> <p>Designated Sites, Habitats and Species Objectives</p> <p>Objective HL22: Promote the conservation of biodiversity outside of designated areas, while allowing for appropriate development, access and recreational activity.</p> <p>Objective HL23: It is an objective of the Council to conduct a study to see if any areas would be suitable for designation as Local Nature Reserves.</p> <p>Objective HL24: It is an objective to provide protection to all natural heritage sites designated or proposed for designation in accordance with National and European legislation. This includes Special Areas of Conservation, Special Protection Areas, Natural Heritage Areas, Statutory Nature Reserves and Ramsar sites.</p>	<p>Positive Impact</p> <p>Positive Impact</p>

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	are to be lost as a result of implementation of the County Development Plan without appropriate and reasonable remediation and/or compensatory measures. Objective HL27: The Council will avail of opportunities that may arise to create or promote new features of biodiversity in the context of new developments.	
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Plans And Projects	Key Policies/Plans/Projects Directly Related To The Study Area	Potential For Cumulative Effects
	Land Use And Spatial Plans	
	<p>Coastal Zone and Inland Waterways Policies</p> <p>Policy HL54: Seek to have protected rivers, streams and other watercourses and, wherever possible, maintain them in an open state capable of providing suitable habitat for fauna and flora.</p> <p>Policy HL55: Seek to have protected and to enhance the natural heritage and landscape character of river and stream corridors (together with immediate floodplains and valleys of streams and smaller rivers) to maintain them free from inappropriate development, and to provide for public access where feasible and appropriate.</p> <p>Policy HL56: Seek to have protected and conserve their quality character and features by controlling developments close to navigable and non-navigable waterways.</p> <p>Policy HL57: Seek to have protected and seek to provide access to inland waterways.</p> <p>Policy HL64: Support the implementation of appropriate measures to manage surface water drainage and prevent/minimise flooding impacts on natural systems, human settlements and infrastructural elements.</p> <p>Designated Sites, Habitats and Species Policies</p> <p>Natural Water Systems Policies</p> <p>Policy HL71: Implement water protection measures to prevent any deterioration of “good status” waters, and to restore substandard waters to “good status”.</p> <p>Policy HL72: Adopt and implement the provisions of the Western River Basin Management Plan and Shannon International River Basin Management Plan. Have regard to recommendations that may result from the applicable River Basin Management Plan.</p> <p>Policy HL73: Introduce a comprehensive and integrated approach to the management of our natural water resources.</p> <p>Policy HL74: Intensify public awareness of water quality issues and the measures required to protect natural water bodies.</p> <p>Policy HL75: Ensure that substandard public wastewater treatment plans are upgraded. In the interim prevent an increase in the nutrient load discharged from these plants and the urgent provision of modern sewerage treatment systems in those towns and villages that have insufficient capacity to meet current demands, do not meet modern standards or currently represent a pollution risk to local water courses.</p> <p>Policy HL76: Ensure that industrial facilities and commercial premises discharging wastewater are operating within the parameters of an IPPC licence or a wastewater discharge licence.</p> <p>Policy HL77: Ensure that all dwellings outside town sewerage systems have an appropriate wastewater treatment system, correctly installed and maintained.</p> <p>Policy HL78: Ensure that agricultural waste is returned to the land in accordance with the provisions of scientifically prepared nutrient management plans.</p> <p>Policy HL79: Ensure that all new treatment systems, including single house systems, comply with the relevant EPA wastewater manuals.</p> <p>Policy HL80: Protect and maintain the quality of bathing waters and bring back to good status any substandard bathing waters.</p> <p>Policy HL81: The Local Authority will investigate other “quality mark” schemes for beaches and work to achieve such awards</p>	<p>Positive Impact</p> <p>Positive Impact</p>

Plans And Projects	Key Policies/Plans/Projects Directly Related To The Study Area	Potential For Cumulative Effects
	<p>such as the Green Coast award which will increase the number of recognised beaches with a high standard of environmental quality and tourism potential.</p> <p>Policy HL82: Support the relevant agencies and statutory bodies in the control and elimination of invasive species in water bodies.</p> <p>Policy HL83: Ensure that all new development which is reliant on private waste water treatment and disposal systems is assessed with regard to the impact on ground waters, having regard to the relevant EPA wastewater treatment manuals.</p> <p>Policy HL84: Adopt the Galway Groundwater Protection Scheme and have regard to the need to protect water sources through the identification of source protection zones in the scheme.</p> <p>Policy HL85: Have regard to the programme of measures set out in the Western River Basin Management Plan and Shannon International River Basin Management Plan to bring water up to a good standard, as defined in the EU Water Framework Directive, by 2015.</p> <p>Policy HL86: Ensure that the ongoing development of Towns and their Environs are undertaken in such a way so as not to compromise the quality of surface water (and associated habitats and species) and groundwater within the zone of influence of the Development Plan or Local Area Plan area.</p> <p>Policy HL87: The Planning Authority shall consider the use of temporary proprietary effluent treatment units to service new developments as an interim measure until such time as the planned infrastructural investment as set out in the Water Services Investment programme is delivered and commissioned.</p> <p>Policy HL88: Galway County Council shall address the significant water management issues identified in the Water Matters Consultation publications for the relevant RBDs.</p> <p>Policy HL89: When published, the relevant policies and objectives of the Western and Shannon River Basin Management Plans and associated Programmes of Measures shall be integrated into the Plan through amendment or otherwise.</p> <p>Policy HL90: Galway County Council shall ensure that the ongoing development of Towns and their Environs are undertaken in such a way so as not to compromise the quality of surface water (and associated habitats and species) and groundwater within the zone of influence of the Development Plan area.</p> <p>Policy HL91: Land uses shall not give rise to the pollution of ground or surface waters during the construction or operation of developments. This shall be achieved through the adherence to best practice in the design, installation and management of systems for the interception, collection and appropriate disposal or treatment of all surface waters and effluents.</p> <p>Invasive Species Policies</p> <p>Policy HL92: The local authority will have regard to best practice with respect to minimising the spread of invasive species in the carrying out of its own development in the county and shall encourage private developers to have regard to same.</p> <p>Policy HL93: It is a policy of the Council to support measures for the prevention and eradication of invasive species. This will include the dissemination of information to raise public awareness, consultation with relevant stakeholders, the promotion of the use of native species in amenity planting and landscaping and the recording of invasive/native species as the need arises and resources permit.</p> <p>Invasive Species Objectives</p> <p>Objective HL43: Support initiatives that reduce the risks of invasions, by non-native species, help control and manage new and established invasive species, monitor impacts, raise public awareness, improve legislations and address international obligations.</p>	Positive Impact

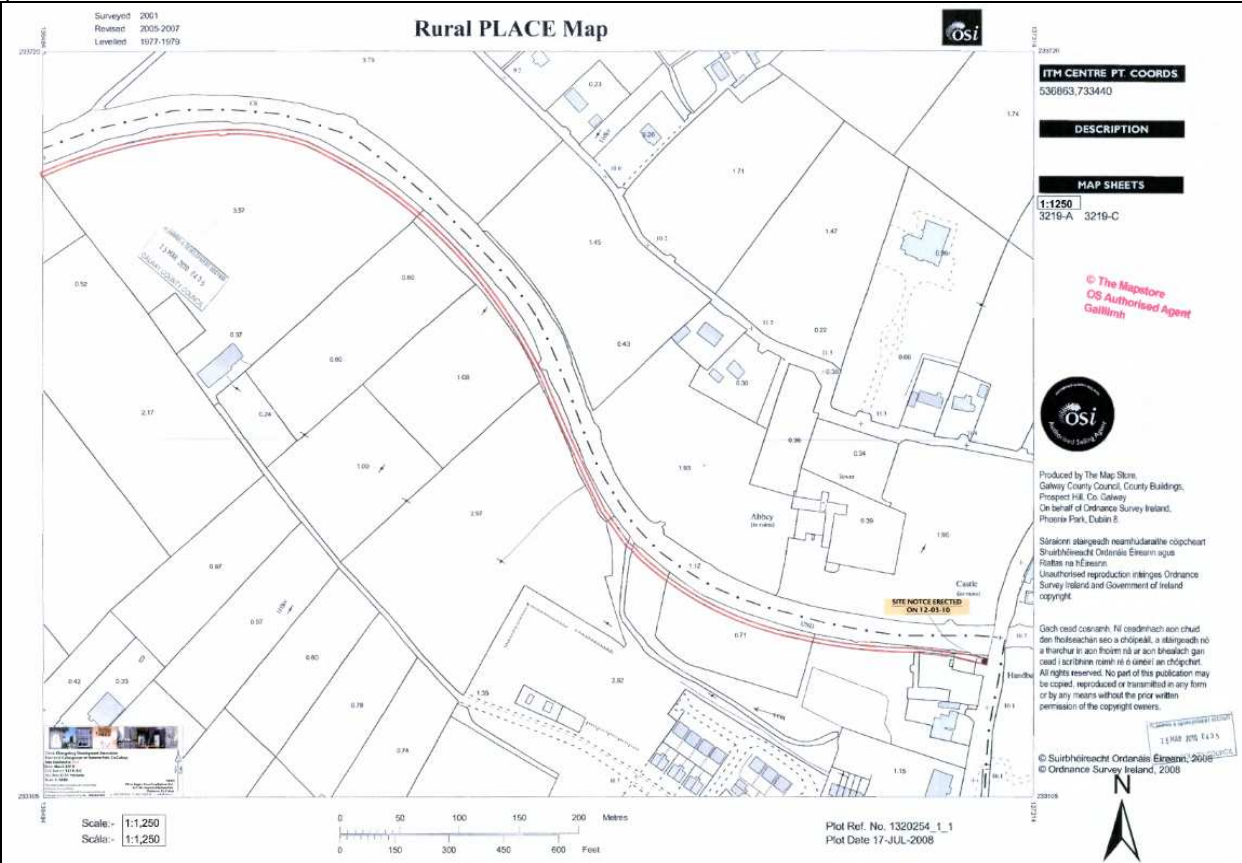
Conservation And Management Plans		
NPWS Conservation Management Plans	A Conservation Management Plan for Lough Corrib cSAC or SPA has not been prepared as of yet by the NPWS.	No Impact
Western River Basin Management Plan 2009-2015	<p>The Western River Basin Management Plan, issued in July 2010, sets out a number of objectives and measures for all water bodies in the Western River Basin.</p> <p>Objectives: Ensure that the status of waters supporting protected areas is protected and (where necessary) improved by 2015.</p> <p>Measures: Implement 11 EU Directives.</p> <p>The Clare River Water Management Unit (WMU) Action Plan, which was prepared as part of the Western River Basin District Management Plan, contains information on water body status, objectives and measures for the WMU.</p> <p>The Corrib Water Management Unit (WMU) Action Plan, which was prepared as part of the Western River Basin District Management Plan, contains information on water body status, objectives and measures for the WMU.</p>	Positive Impact
Pollution Reduction Plans		
- IPPC Programme	There is one IPPC Licence holder discharging to the Clare Water Management Unit, Dawn Country Meats trading as Western Proteins, in Ballyhaunis, Co. Mayo.	No Impact
- Other Point Sources	<p>Tuam WWTP currently discharges directly in to the Clare River. In response to the increasing population grown in north county Galway, it is proposed now to construct two new wastewater treatment facilities, one in Milltown village and one in Claregalway village, with discharges of treated effluent to the Clare River. An Appropriate Assessment Screening Report was prepared for Tuam WWTP discharge licence application. This document included an assessment of the cumulative impacts of Tuam WWTP discharge with the potential future discharges from the proposed Claregalway and Milltown Village WWTPs. This assessment concluded that the Tuam WWTP discharge will not have a significant negative impact on Lough Corrib cSAC, either alone or in combination with the estimated future discharges from the proposed WWTPs at Claregalway and Milltown Village.</p> <p>A Ground Water Protection Plan for the County in conjunction with the Geological Survey of Ireland has not yet been prepared.</p>	Positive Impact
- Local Authority Discharge	There are 20 Section 4 licenced facilities within the Clare Water Management Unit – all within the County Galway portion of the WMU.	No Impact
- Shellfish Pollution Reduction Programmes	N/A	Potentially Negative Impact
		No Impact

Forest Management Plans		
Indicative Forestry Statement	Department of Agriculture, Fisheries and Food, Dec 2008 - Sets out Environmental Protection and Consultation Process when Proposing Afforestation Schemes.	Positive Impact
Coillte Draft Strategic Plan 2011-2015 East Galway/Roscommon (W2)	<p>The long-term vision for the District is of forestry management at an intensity that is appropriate to the environmental sensitivity and productivity of its land resource. By adopting policies that ensure our efforts are concentrated on timber production in some areas and on habitat restoration in other areas we will maximise the benefits to the environment, local communities and the timber processing industry. This vision includes:</p> <ol style="list-style-type: none"> 1. Forestry will be a vibrant industry in the area, integrated into the local economy, providing employment opportunities in the forest, the timber industry and in many down stream activities 2. Broadleaves will account for 25% of the gross area of the District 3. Natural and semi-natural habitats are protected and enhanced through appropriate management; 4. There is continuity of forest habitat for rare and threatened species; 5. Forest recreational sites will be a part of the tourism infrastructure and will be an important contributor to the tourism economy; 6. There will be a shared vision between the District and local communities on expectations from the forests and how they are managed. 	Positive Impact
FISHERIES PLANS		
The Western Regional Fisheries Board- Strategic Plan 2007-2011	Water Quality Strategies <ul style="list-style-type: none"> - Work with all relevant agencies and interest groups to identify sources of nutrients impacting on the main lakes, - Use the catchment management process to maximum effect to redress eutrophication and other water quality problems, - Disseminate information to the public in regard to impacts on water quality, - Seek to influence public opinion on the issue of water quality, - Monitor all proposals for development which may impinge on water quality, - Use the powers that are available to the Board to prosecute offenders where necessary, - Endeavour to influence Government and EU policies in regard to protection of water quality and activities which impact on it, and - Monitor water quality trends on an on-going basis on selected rivers and streams. 	Positive Impact
FUTURE ROAD SCHEMES		
M17/N18 Gort to Tuam road (permitted)	The commencement of works on this project has been delayed. However a route has been chosen which crosses the Abbert River, a tributary of the Clare River.	Potentially Negative Impact in the absence of mitigation
Claregalway Bypass (proposed)	Plans are currently underway to construct a new bypass at Claregalway. Four possible routes for the new road are being considered, all of which would cross the Clare River.	Potentially Negative Impact in the absence of mitigation
Galway City Outer Bypass (GCOB)	The GCOB crosses the Lough Corrib cSAC further downstream. This project is currently awaiting a preliminary court ruling by the Court of Justice of the European Union.	Potentially Negative Impact in the absence of mitigation
N59 Moycullen Bypass	The N59 Moycullen Bypass Project is awaiting a decision from An Bord Pleanála. The road cross-section for the proposed N59 Moycullen Bypass is Type 1 Single Carriageway. The total length of the N59 Mainline is 4.3km comprising 3.8km off-line and 0.5 km on-line tie-in to the existing N59. The proposed road crosses the Lough Kip River and runs adjacent to Ballyquirke Lough, both of which are designated under Lough Corrib cSAC. The conclusion of the Natura Impact Statement for this project is that it is	Potentially Negative Impact in the absence of mitigation

	anticipated that the proposed development will not have a significant effect either individually or in combination with other plans or projects on the conservation objectives of the European Site	
N59 Maam Cross to Oughterard Proposed Road Project	Provision of an approx. 15km upgrade of the existing N59 between Maam Cross and Oughterard. An application for consent has been submitted to An Bord Pleanála. The application included an Environmental Impact Statement, Natura Impact Statement and Compulsory Purchase Order documentation.	Potentially Negative Impact in the absence of mitigation
LOCAL DEVELOPMENT		
Advance works at Claregalway N17 Bridge	Clare River Flood Relief Scheme advance works were undertaken at Claregalway Bridge in order to improve flood conveyance at this point. An additional flood eye at Claregalway Bridge has been constructed by the OPW as advance works completed in June 2011. An NIS was prepared for this project. If best environmental practice was employed during the proposed flood relief works, it is expected that these works will not result in any in combination impacts with the advance works at Claregalway Bridge.	Potentially Negative Impact in the absence of mitigation
Advanced works at Crusheeny Bridge - Clare River Flood Relief Scheme (OPW)	<p>Crusheeny Bridge replacement works were completed in March 2012 and were carried out as advance works. The location of the works is illustrated in the Figure below. These works include three main measures: 1) Demolition of the Existing Crusheeny Bridge, 2) River Bank Widening and 3) Construction of a Replacement Bridge. An NIS was prepared for this project.</p>  <p>Location of the Advanced Works at Crusheeny Bridge - Clare River Flood Relief Scheme (OPW)</p> <p>Environmental practice and specific mitigation measures were employed during the bridge works, and the works did not result in any impacts and there for will pose no in combination impacts with the proposed flood relief scheme.</p>	No negative effects

A pedestrian riverside walkway is proposed along the Clare River at Claregalway. This pedestrian walkway, measuring 1,025m linear distance will be located along the south bank of the Clare River. The walkway will commence at the site of the old Hand Ball Alley on the N17 and terminates as a cul-de-sac. The development will consist of the provision of a graded footway c.2.0m wide with concrete post and wire fencing c.1.3 m high on one side only. Permission was also sought for all other ancillary works necessary in the provision of the footway and seating area and disabled fishing platform associated with same. The location of this walkway is shown in the image below. As works will be undertaken along the banks of the Clare River, there is potential for impacts to the Clare River and its downstream environment in the absence of mitigation measures. However, if best environmental practice is employed during the walkway works, it is expected that these works will not result in any in combination impacts with the proposed flood relief scheme.

Riverside Walk,
Claregalway



Location of Claregalway Walkway Project. (Source www.galwaycoco.ie)

Potentially Negative
Impact in the absence
of mitigation

6 IMPACT ASSESSMENT

6.1 IMPACT ASSESSMENT CRITERIA

6.1.1 Characterising Impacts

The methodology for the assessment of impacts is derived from the Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites (EC, 2002). When describing changes/activities and impacts on ecosystem structure and function, the types of impacts that are commonly presented include:

- direct and indirect effects,
- short- and long-term effects,
- construction, operational and decommissioning effects, and
- isolated, interactive and cumulative effects.

6.1.1.1 Assessment of Significance of Adverse Effect on European Sites

A likely change in conservation status should be used as a measure to determine whether an impact on a habitat or species is likely to be significant. As a guide, any element of a plan or project that has the potential to affect the conservation objectives of a Natura 2000 site, including its structure and function, should be considered significant (EC, 2006). Examples of significance indicators from Commission guidance (EC, 2002) are listed in **Figure 6.1**.

Impact type	Significance indicator
Loss of habitat area	Percentage of loss
Fragmentation	Duration or permanence, level in relation to original extent
Disturbance	Duration or permanence, distance from site
Species population density	Timescale for replacement
Water resource	Relative change
Water quality	Relative change in key indicative chemicals and other elements

Figure 6.1 Example of Significance Indicators (from EC (2002), Box 4)

For those species or habitats for which conservation objectives or targets have been set, then any impact which would inhibit the achievement of those targets would also be considered significant, at the geographic scale at which the target has been set. Some examples of effects that are likely to be significant are:

- Any impact on an Annex I habitat,
- Causing reduction in the area of the habitat or Natura 2000 site,
- Causing direct or indirect damage to the physical quality of the environment (e.g. water quality and supply, soil compaction) in the Natura 2000 site,
- Causing serious or ongoing disturbance to species or habitats for which the Natura 2000 site is selected (e.g. increased noise, illumination and human activity),

- Causing direct or indirect damage to the size, characteristics or reproductive ability of populations on the Natura 2000 site, and
- Interfering with mitigation measures put in place for other plans or projects.

6.1.1.2 Meaning of ‘Adversely affect the integrity of the site’

The concept of the ‘integrity of the site’ is explained in the EU publication Managing Natura 2000 sites: The provisions of Article 6 of the ‘Habitats’ Directive 92/43/EEC, as follows:

‘It is clear from the context and from the purpose of the directive that the ‘integrity of the site’ relates to the site’s conservation objectives. For example, it is possible that a plan or project will adversely affect the integrity of a site only in a visual sense or only habitat types or species other than those listed in Annex I or Annex II. In such cases, the effects do not amount to an adverse effect for purposes of Article 6(3), provided that the coherence of the network is not affected. On the other hand, the expression ‘integrity of the site’ shows that focus is here on the specific site. Thus, it is not allowed to destroy a site or part of it on the basis that the conservation status of the habitat types and species it hosts will anyway remain favourable within the European territory of the Member State.

As regards the connotation or meaning of ‘integrity’, this can be considered as a quality or condition of being whole or complete. In a dynamic ecological context, it can also be considered as having the sense of resilience and ability to evolve in ways that are favourable to conservation. The ‘integrity of the site’ has been usefully defined as ‘the coherence of the site’s ecological structure and function, across its whole area, or the habitats, complex of habitats and/or populations of species for which the site is or will be classified’³

A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realised, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required. When looking at the ‘integrity of the site’, it is therefore important to take into account a range of factors, including the possibility of effects manifesting themselves in the short, medium and long-term.’

The integrity of the site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site’s conservation objectives.

6.1.2 Precautionary Principle

The precautionary principle is a principle of EU Environmental Policy and is mentioned now in Article 193 (2) of the Treaty on the functioning of the European Union⁴ and has been interpreted by the European Court of Justice in the Waddenzee Judgement (Case C- 127/02) where there was scientific uncertainty about the effect on bird feeding and resting sites of a consent to mechanical cockle fishing in a Dutch SPA. The ECJ stated⁵:

‘It is therefore apparent that the plan or project in question may be granted authorisation only on the condition that the competent national authorities are convinced that it will not adversely affect the integrity of the site concerned [...] So, where a doubt remains as to the absence of adverse effects on the integrity of the site linked to the plan or project being considered, the competent authority will have to refuse authorisation.’

³ PPG 9, UK Department of the Environment, October 1994.

⁴ OJ C 83/132, 30.3.2010.

⁵ C-127/02, [2004] ECR I-7405.

6.2 IMPACTS TO THE QUALIFYING INTERESTS OF NATURA 2000 SITES

The qualifying interests of Lough Corrib cSAC/SPA are the habitats and species for which the sites have been designated (as described in **Section 3**). When determining the impacts on the qualifying interests of the cSAC and the SPA, the main threats and pressures on these habitats and species as detailed in **Section 3**, **Table 3.11**, **Table 3.12** and **Table 3.13**, are taken into account.

6.2.1 Hydrology and Drainage Potential Impacts

The potential impacts of the proposed flood relief works on the existing hydrological environment have been examined / assessed in accordance with the “*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Scheme*” (NRA, 2007). The assessments were carried out for both the construction and operational phases of the scheme.

All relevant authorities including the OPW, the Environmental Protection Agency (EPA), Inland Fisheries Ireland (IFI) and the Western River Basin District (WRBD) Office were contacted in order to obtain feedback on any likely adverse impacts that the proposed works might have on the existing hydrological and drainage environment.

The proposed flood alleviation measures have been designed by developing a HEC-RAS hydraulic model for the Clare River channel. Any effects of the proposed development on the upstream and downstream flooding risk have also been examined through this modelling approach. The proposed alleviation measures have been modelled for the design flood flow of a 100 year return period together with a future climate change allowance of 20%. The details of this modelling approach and results are given in the Flood Study report and also in the RPS Stage 1 Report prepared for the scheme (RPS, 2011a). **Table 6.1** presents the simulated flood levels at a number of points for both the do-nothing and proposed conditions under the design 100 year flood scenario. The results suggest that the proposed flood alleviation works will reduce the flood levels in the river within the study area. The results also show that the proposed flood relief scheme will not pose any flooding risk to the areas upstream and downstream of the study area.

Table 6.1 Computed Flood Levels at a Number of Points for the Do-Nothing and Proposed Scenarios

Locations	Cross Section reference	Change (m)	Computed 100 year flood levels (mOD) [inclusive of 20% climate change allowance]	
			Do-nothing scenario	Proposed scenario
Curraghmore Bridge	C23	2628	8.30	8.30
Montiagh South	C52	6276	8.61	8.61
Montiagh North	C63	7628	8.98	8.98
Claregalway Gauge (d/s bridge)	C72	8506	9.82	9.84
u/s Claregalway Bridge	C73	8557	10.62	10.14
Kiniska	C75	8936	10.77	10.34
Lakeview, Cuirt na hAbhain	C79	9565	11.15	11.01
Gortatleva	C83	10785	11.75	11.70
d/s face Crusheen Br.	C89	12153	12.03	11.90
u/s face Crusheen Br.	C90	12163	12.61	11.92
Caherlea / Lisheenavalla	C91	12387	12.89	12.09
Caherlea / Lisheenavalla	C92	12615	13.01	12.27
Caherlea / Lisheenavalla (at the confluence of Islandmore drain)	C92.6	12775.67	13.02	12.35
Caherlea / Lisheenavalla	C93	12856	13.02	12.39
Caherlea / Lisheenavalla	C94	13068	13.03	12.52
Caherlea / Lisheenavalla	C95	13088	13.04	12.71

Locations	Cross Section reference	Change (m)	Computed 100 year flood levels (mOD) [inclusive of 20% climate change allowance]	
			Do-nothing scenario	Proposed scenario
Grange West	C96	13486	13.11	12.90
Grange West	C97	13677	13.41	13.41
Cregmore	C98	13914	13.95	13.65

An examination of the impacts of the proposed flood relief scheme on the low-flow regime of the river showed minimal impact.

A summary of the likely impacts of the proposed developed on each of the hydrological attributes are presented below for both the construction and operational phases of the proposed works.

6.2.2 Flooding

During Construction:

During the construction phase of the works, the potential causes of flooding could include:

- Flooding of adjacent lands and properties caused by any reduction of channel conveyancing capacity during the implementation of channel widening works, and
- Blockage to the river flows due to collapsing of unstable river banks or temporary or permanent stockpiles during construction.

During Operation:

The proposed flood relief scheme will reduce flooding risk significantly in the Claregalway, Crusheeny, Caherlea/Lisheenavalla and Carnmore/Cashla areas and will not pose any flooding risk in the upstream and downstream vicinity.

6.2.3 Low-flow

During Construction:

- Any blockage to normal flow rate in the river during the implementation of channel widening works and river crossing works could reduce the downstream flow rate which could have an impact on the aquatic ecology, and
- Any obstruction to lateral overland flow (surface runoff) paths towards the river channel from the temporary storage of excavation materials along the river bank could reduce the flow rate in the river.

During Operation:

During the operational phase of the works no changes in the existing low-flow patterns are anticipated. The results of the simulated flood levels at a number of key flood defence points for both the do-nothing and proposed conditions under the design flood suggest that the proposed flood alleviation works will reduce the flood levels in the study area reach of the river. The results of the simulation also show that the proposed development will not pose any flooding risk in the upstream and downstream vicinity of the alleviation works. An examination of the impact of the flood alleviation measures on the low-flow regime of the river flow showed minimal impact.

6.2.4 Drainage:

During Construction:

The existing land drainage system in the study area will likely be affected during the construction period of the works. Potential impacts on the existing drainage systems could include:

- The pattern of runoff could change with some existing drains and ditches receiving significantly more or less flow than they receive currently,
- Rainfall on elevated areas could wash peat and silt into the surrounding watercourses. Localised erosion and scouring could occur while reduced flow may result in stagnation in some drains and ditches, and
- Obstruction of upland flow paths could cause localised water logging in the upstream vicinity of the temporary storage of excavation material along the river bank.

During Operation:

The proposed infilling of excavation material in the floodplain will change the slope of the existing lands in some areas which consequently may have an impact on the existing surface water drainage pattern. For example, the existing permeability of the soil could be reduced and the time of concentration to surface water flow could increase if the existing slope reduces. The completed scheme will however result in changed velocities along the river stretch during all flow conditions. The potential impacts of these changed velocities are discussed in detail in **Appendix E Aquatic Ecology and Fisheries Assessment**.

6.2.5 Overview of Potential Changes to Hydraulic Environment of the Clare River

6.2.5.1 Hydraulic modelling and comparison of pre- and post- works conditions

As an aid to assessing the potential impacts of the proposed measures on the hydraulic (flow) environment of the river, and by extension certain aspects of its ecological impact, the pre- and post-works values for three hydraulic parameters were measured by modelling of low (85%ile & 95%ile), intermediate (50%ile and 65%ile) and high (Q-Bar) flow conditions. The measured parameters included channel velocity (m/s), stream power (watts / m²) and Froude number. The latter is a dimensionless descriptor of the flow environment of a river combining both depth and velocity. It has been used here as it is also used as a parameter to assess the suitability of river stretches for salmon spawning. The data are presented graphically in Figures 1 to 15 *Aquatic Ecology and Fisheries Ecological Impact Assessment Appendix E*, each figure with two graphs (a) and (b), as follows:

- (a) covering the entire study reach from upstream of Cregmore Bridge to downstream of Claregalway Bridge, and,
- (b) looking in detail at the stretch between Cregmore Bridge and just downstream of Crusheen Bridge.

Note that points on the 'b' graphs are broadly proportional to the distance between stations, whereas in the 'a' graphs points are spaced equidistant.

6.2.5.2 Summary of Hydraulic Changes

The greatest hydraulic changes are evident at the higher flows, mainly at 50%ile and QBar, particularly the latter. These changes tend to be concentrated in four main areas, namely upstream and downstream of the three bridges (Cregmore, Crusheeney and Claregalway) and between Cregmore Bridge and Crusheeney Bridge. In most cases there is reduced velocity; stream power and Froude number at Crusheeney and Claregalway Bridge stretches and between Cregmore Bridge and Crusheeney Bridge, whereas around Cregmore Bridge, velocities are generally predicted to rise under higher flow scenarios. A localised rise in velocity will also be noticeable, at high flows only (QBar), in the lower part of the Crusheeney to Claregalway reach (section 76.6-75), possibly due to rock removal downstream of this area. At lower flows (85%ile and 95%ile) the changes in all of the parameters are marginal in most cases, because there is minimal interference with the low-flow channel.

Reductions in each of the parameters (velocity, stream power and Froude No.) are owing to the bridge works at Crusheeney and Claregalway, whereas increases in these parameters around Cregmore Bridge and reductions (primarily) from section 92 to 96 are owing to the construction of the 2-stage channel along this stretch. These changes will be referred to in more detail in the following sections in relation to potential impacts of specific measures, i.e., 4a, 4b, 8a and 8b.

6.2.6 Impacts during the Construction Phase

6.2.6.1 Annex I Habitats

The proposed works will take place largely within and adjacent to the Clare River which is designated under Lough Corrib cSAC, there are potential directly impact the aquatic habitats of this Natura 2000 site, due to increased sedimentation and run-off of pollutants and potential direct and indirect impacts to terrestrial habitats. The current threats to the water-dependent habitats within the Natura 2000 sites (as outlined in **Table 3.8**) include discharges, water pollution, reclamation of land, dredging, dumping of dredged material, invasion of species, roadway, motorways, drainage and other human induced changes in hydraulic conditions.

Potential impacts to the Annex I Priority and Non Priority habitats for which Lough Corrib cSAC have been designated are discussed **Table 6.2** below.

Table 6.2 Potential Impacts to Annex I Habitats during the Flood Relief Works

Annex I Habitats	Measures Likely to Cause Impacts	Construction Impacts
3140 Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara spp.</i>	Measure 4b Measure 4d Measure 6 Measure 8b Measure 10	All of the watercourses within the study area are hydrologically linked to Lough Corrib, part of which corresponds to the EU Annex I habitat 3140 Hard oligo-mesotrophic waters with benthic vegetation of <i>Chara spp.</i> Potential run-off of pollutants to these waterbodies during the construction phase of the proposed Flood Relief Scheme and hydraulic changes may impact the water quality of the lake and may subsequently have a negative effect on the lakes and their associated aquatic species, if pollution control measures are not implemented.
3110 Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)	N/A	Not found within zone of influence of proposed works, no impact

Annex I Habitats	Measures Likely to Cause Impacts	Construction Impacts
3260 Water courses of plain to montane levels with the <i>Ranunculus fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation	Measure 4b Measure 4d Measure 6 Measure 8b Measure 10	<p>A poor example of this habitat types is found near Crusheeny Bridge. However it may also be found along other stretches of the River.</p> <p>Under measure 4b, the in-channel works will remove plant cover by the bridge, which cause local damage to what is considered to be a poor example of Annex I habitat No. 3206: <i>Watercourses of plain to montane levels with the Ranunculus fluitantis and Callitriche-Batrachion</i> vegetation. This impact will be slight, with vegetation expected to re-colonise rapidly, albeit with a different distribution which will be dependent on residual flow types created by EREP measures. Over the relatively short affected stretch, all other removed plant species will be rapidly replaced by re-growth, and invertebrates will recolonise primarily through downstream drift from the undisturbed upstream areas.</p> <p>All other works carried out within and in the immediate vicinity of the Clare River, may have the potential to act as a conduit for pollutants, and thus to affect the aquatic habitats in the immediate vicinity of the works and downstream of the works, if pollution control measures are not implemented.</p>
7110 Active raised bogs 7120 Degraded raised bogs still capable of natural regeneration	Measure 10	Raised bog both active and degraded can be found in the townlands of Curraghmore and Addergoole. This habitat is located 560m from the Clare River and will not be impacted by the flood alleviation measures. Under Measure 10 selective channel maintenance is required on the Clare River including some deepening along Left Bank, and removal of rock outcrop for a distance of 250m (See Section A Figure 2.13). It is unlikely that these works will impact raised bog habitat in the wider area
91A0 Old sessile oak woods with Ilex and Blechnum in British Isles	N/A	Not found within zone of influence of proposed works, no impact
6410 <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinia caerulea</i>)	Measure 10	It is proposed to remove bankside habitat as part of Measure 8b immediately downstream to 1.3km upstream of Crusheeny Bridge. The <i>Molinia</i> Meadow in Kiniska will not be affected by the proposed works as it is located 2.6km downstream. Under Measure 10 selective channel maintenance is required on the Clare River at Points 8-13 in the vicinity of the <i>Molinia</i> Meadow in Kinska. The works comprise of silt and vegetation management, tree removal, rock removal and bank stabilisation. This habitat may be impacted during these works.
7230 Alkaline fens	N/A	Not found within zone of influence of proposed works, no impact
7210 Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i>	N/A	Not found within zone of influence of proposed works, no impact
8240 Limestone	N/A	Not found within zone of influence of proposed works,

Annex I Habitats	Measures Likely to Cause Impacts	Construction Impacts
pavements		no impact
6210 Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites)	N/A	Not found within zone of influence of proposed works, no impact
91D0 Bog woodland	N/A	Not found within zone of influence of proposed works, no impact
3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation	Measure 8b and 10	This habitat is found in the vicinity of Crusheeny Bridge. Measure 8a is completed and did not result in a negative impact on this habitat. Measures 8b and the selective channel maintenance Measure 10 (Point 42 and 43) will involve silt and vegetation management. Impacts to this habitat may arise through direct removal of the vegetation and siltation.
7220 Petrifying springs with tufa formation (Cratoneurion)	N/A	Not found within zone of influence of proposed works, no impact
7150 Depressions on peat substrates of the Rhynchosporion	N/A	Not found within zone of influence of proposed works, no impact

6.2.6.2 Annex II Species

Potential impacts from suspended sediment due to runoff of soil from construction areas can have severe negative impacts on invertebrate and plant life and on all life stages of fish. The common impacts on watercourses as a result of the construction activities include:

- Suspended sediment can settle on spawning areas, infill the intragravel voids and smother the eggs and alevins (newly hatched fish) in the gravel,
- Bed Load (coarse material transported along the bottom of the stream) and settled sediments can infill pools and riffles, reducing the availability and quality of rearing habitat for fish,
- Suspended sediment can reduce water clarity and visibility in the stream, impairing the ability of fish to find food items,
- Settled sediments can smother and displace aquatic organisms such as macroinvertebrates, reducing the amount of food items available to fish, and
- Increased levels of sediment can displace fish out of prime habitat into less suitable areas (Chilibeck *et al.* 1992). Suspended solids can abrade or clog the gills of salmonid fish. It takes a high concentration of solid wastes to clog a fish gill and cause asphyxiation, but only a little to cause abrasions and thus permit the possibility of infections (Solbe 1988).

The potential exists for a range of serious pollutants to enter watercourses during the construction phase, if appropriate pollution control measures are not implemented. For example any of the following will have deleterious effects on fish, plants and invertebrates if allowed to enter watercourses, as follows:

- Raw or uncured concrete and grouts,

- Wash down water from exposed aggregate surfaces, cast-in-place concrete and from concrete trucks,
- Fuels, lubricants and hydraulic fluids for equipment used on the development site,
- Bitumen and silanes used for waterproofing concrete surfaces, and
- Wastewater from on site toilet and wash facilities.

A number of migratory fish associated with the cSAC are sensitive to indirect effects such as turbidity, noise and vibration, habitat exclusion and changes in hydrodynamics in areas that they are required to pass from or to the sites with which they are associated. Barrier effects may also prevent them from reaching the rivers where they breed.

Increased runoff from the excavated site has the potential to change the water quality and trophic status of a waterbody.

The proposed Flood Relief Scheme is located within Lough Corrib cSAC. Potential impacts to these Annex II species within the Natura 2000 site are discussed in **Table 6.3** below.

Table 6.3 Potential Impacts to Annex II Species during the Flood Relief Works

Annex II Species	Measures Likely to Cause Impacts	Construction Impacts
Freshwater Pearl Mussel <i>(Margaritifera margaritifera)</i>		The Freshwater Pearl-mussel (<i>Margaritifera margaritifera</i>) is one of the key species for which Lough Corrib cSAC has been designated. There are no known records of freshwater pearl mussel from the Clare River (Evelyn Moorkens, <i>pers. comm.</i>). This would be expected given the bedrock geology of the river (karst) and the water hardness of the river (>200 mg/l CaCO ₃). Freshwater Pearl Mussel is not known to occur within Lough Corrib itself. The main population for which the site has been designated occurs in the Owenriff River, a tributary of Lough Corrib, which flows in to the western side of the lake. Therefore there will be no impacts on Freshwater Pearl Mussel as a result of the proposed works.
Atlantic Salmon <i>(Salmo salar)</i>	Measure 4b Measure 8b	<p>The Atlantic salmon is listed as a qualifying interest of Lough Corrib cSAC. The Clare River is an important brown trout fishery, but salmon are also taken on rod and line. Potential run-off of pollutants to these waterbodies during the construction phase of the proposed Flood Relief Scheme may impact the water quality of the Clare river and will have a negative effect on the conservation status of Atlantic Salmon, if pollution control measures are not implemented.</p> <p>Release of sediment during these works can damage the gills of salmon. Salmon are likely to occur throughout the Clare and therefore any release of sediment would be likely to result in an impact. The main spawning grounds for the Clare are in upstream tributaries such as the Abbert and the Grange, nevertheless, minor adverse impacts to juvenile fish owing to sediment escape cannot be ruled out. Such an impact, in the context of the cSAC as a whole would be considered short-term, significant negative impacts.</p>

Annex II Species	Measures Likely to Cause Impacts	Construction Impacts												
	Measure 10	<p>There would be no significant effects on fisheries by limited, select large boulder removal and the overall impact would be imperceptible. Removal of bedrock outcrops usually involves rock breaking during low flow removal of loose material. Cyprinid fish are more susceptible to noise disturbance associated with rock breaking, and salmonids less so (Amoser <i>et al.</i>, 2004). Fish would therefore be likely to avoid the area for a short time while rock breaking occurs. These effects can be described as temporary and imperceptible.</p> <p>Although there is a low likelihood of hydrocarbon spills as a result of the project any spill could give rise to tainting of fish or fish kills which would be a moderate, short-term, negative impact.</p>												
Otter (<i>Lutra lutra</i>)	<p>Measure 8b</p> <p>Measure 10</p>	<p>Otter is listed as a qualifying interest of Lough Corrib cSAC. Otters are known to use the Clare River, potential otter holts, slides and spraints were noted in the Study Area during site surveys.</p> <p>Impacts to otters include destruction of holts or couches, disturbance, and physical obstructions in watercourses. Indirect impacts affecting otter may potentially arise as a result of reduced food supply i.e. where impacts affecting water quality may result in reduced macroinvertebrate and fisheries production. The otter is dependent on fish stocks, which are ultimately dependent on water quality.</p> <p>Under Measure 10, Points, 11, 12, 13 and 15 are located in proximity to active otter holts. The works proposed at these locations include D – Bush Cutting / Branch Trimming and E – Tree Cutting. The otter holts are found amongst the roots of trees in the left bank.</p> <p>Potential impacts to Otter Holts</p> <table border="1"> <thead> <tr> <th>Ref. on Drawings</th><th>Type of Sign</th><th>Location and Activity</th></tr> </thead> <tbody> <tr> <td>OH1</td><td>Holt</td><td>1.43km upstream of Claregalway Bridge on the south bank Co-ordinates: X:137,984, Y:232,574</td></tr> <tr> <td>B1*</td><td>Burrow</td><td>970m upstream of Claregalway Bridge on the south bank.</td></tr> <tr> <td>OH2</td><td>Holt</td><td>905m upstream of Claregalway Bridge on the south bank. Co-ordinates: X:137,990, Y:233,080</td></tr> </tbody> </table>	Ref. on Drawings	Type of Sign	Location and Activity	OH1	Holt	1.43km upstream of Claregalway Bridge on the south bank Co-ordinates: X:137,984, Y:232,574	B1*	Burrow	970m upstream of Claregalway Bridge on the south bank.	OH2	Holt	905m upstream of Claregalway Bridge on the south bank. Co-ordinates: X:137,990, Y:233,080
Ref. on Drawings	Type of Sign	Location and Activity												
OH1	Holt	1.43km upstream of Claregalway Bridge on the south bank Co-ordinates: X:137,984, Y:232,574												
B1*	Burrow	970m upstream of Claregalway Bridge on the south bank.												
OH2	Holt	905m upstream of Claregalway Bridge on the south bank. Co-ordinates: X:137,990, Y:233,080												
Slender Naiad (<i>Najas flexilis</i>)	N/A	Slender Naiad is also listed as a qualifying interest of Lough Corrib cSAC. This species is a submerged aquatic herb which occurs in lakes of acid to slightly base-rich water, and it is known to occur within the northern basin of Lough Corrib, which contains more oligotrophic and acidic waters. Potential run-off of pollutants to the Clare River during the construction phase of the proposed flood relief works are likely not to impact the Slender Naiad, given its location above the confluence of the Clare River with Lough Corrib.												
Sea Lamprey (<i>Petromyzon marinus</i>)	N/A	Sea Lamprey is one of the qualifying species of Lough Corrib cSAC. There is, currently, no firm evidence that Sea Lamprey, <i>Petromyzon marinus</i> , is present in Lough												

Annex II Species	Measures Likely to Cause Impacts	Construction Impacts
		Corrib and its tributaries, including the Clare River. Therefore it is unlikely that there would negative impacts on Sea Lamprey as a result of the proposed flood relief works.
Brook Lamprey (<i>Lampetra planeri</i>)	Measure 2c Measure 5b Measure 8c Gortadooey Tributary Measure 10	<p>Of the 3 areas identified for maintenance it is considered that lamprey ammocoetes are the most likely Annex II species to be directly affected by maintenance activities. Studies below have shown that maintenance in depositing areas of watercourses, including those with silt and aquatic macrophytes, e.g., <i>Sparganium erectum</i>, <i>Phalaris arundinacea</i> have the potential to remove large numbers of juvenile lamprey and their habitat (King <i>et al.</i>, 2008a; Williams 2009 and 2010). Lamprey ammocoetes would be physically removed during maintenance activities.</p> <p>There is the potential that lamprey utilise Islandmore/Caherlea arterial drainage network given the (albeit limited) presence of gravel/cobble and silt substrates near the confluence with the Clare River.</p> <p>Studies have shown that maintenance in depositing areas of watercourses, including those with silt and aquatic macrophytes, e.g., <i>Sparganium erectum</i>, <i>Phalaris arundinacea</i> have the potential to remove large numbers of juvenile lamprey and their habitat). Lamprey ammocoetes are the most likely to be present in silt removed from the margins of the Clare River. Given the highly selective nature of proposed maintenance works this will affect short stretches in a patchy distribution along the study reach and represents a short-to-medium term, moderate, negative impact locally.</p>
Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>)	N/A	The Lesser Horseshoe Bat is one of the qualifying interests of Lough Corrib cSAC. There are no known Lesser Horseshoe Bat roosts in the vicinity of the proposed works, and thus impacts to this species are considered highly unlikely.
White-clawed Crayfish (<i>Austropotamobius pallipes</i>)	Measure 4b	<p>White-clawed Crayfish is one of the qualifying interests of Lough Corrib cSAC. White-clawed crayfish were not detected during surveys undertaken in July 2011 and the more recent historical data suggests that populations in the lower Clare River may have declined, however, given that water quality is suitable and there are some habitat opportunities, their presence can not be entirely ruled out. If present, population densities within the study area and on the lower Clare River in general, appear likely to be low. It is, however, known to occur within Lough Corrib itself, albeit at locations at least 9km north of the Clare confluence with the lake.</p> <p>Low probability is that crayfish may emerge from refuges within de-watered stretches. Release of sediment may also impact on crayfish.</p> <p>This measure will involve cofferdam construction and dewatering in two Stages as illustrated in Figures 2.5 and 2.6.</p>

Annex II Species	Measures Likely to Cause Impacts	Construction Impacts
	<p>Measure 4d</p> <p>Measure 8b</p> <p>Measure 10</p>	<p>Crayfish, if present, may emerge from refuges within the de-watered stretch, in which case, given the limited length of channel affected and the short duration of the works, the individuals would be removed and relocated in accordance with the OPW EMPs and SOPs (Appendix A). Given that crayfish are widely distributed further upstream and are likely to be probably present at low density around Claregalway Bridge, the habitat disturbance caused by dewatering a relatively small stretch at Claregalway Bridge would not affect their overall conservation status and distribution within the cSAC and the impact on this Annex II species would be imperceptible and slight.</p> <p>Sediment loss can give rise to increased bottom sedimentation, which in turn can damage the gills of white-clawed crayfish.</p> <p>The potential exists for silt to wash off the spoil heap and flow, perhaps via existing drains, along the N17 and into the Clare River. Suspended solids can have negative effects on crayfish respiratory functions and habitat. There is potential for temporary, slight, negative impacts on crayfish as a result of this measure.</p> <p>There is the potential for heavy rainfall to wash sediments removed during channel widening, back into the river. Given the scale of this measure, this could result in high suspended sediment loads in the river leading to short term, significant, negative impacts on crayfish, if present.</p> <p>The creation of new grassy aquatic habitat as a result of the development of the second stage channel may be especially beneficial to white-clawed crayfish depending on the level of submersion. This would be a moderately positive impact in the short term in terms of increased biodiversity and habitat opportunities, though any future maintenance of the 2nd stage channel may lead to recurring and at least moderately negative, medium term impacts as a result of such maintenance.</p> <p>White clawed crayfish utilise muddy habitat with associated aquatic macrophytes (Holditch, 2006; Williams 2009 and 2010) and populations of this species can suffer negative impacts as a result of maintenance (King <i>et al.</i>, 2008b). Given the highly selective nature of proposed maintenance works this will affect short stretches in a patchy distribution along the study reach and represents a short-to-medium term, moderate, negative impact locally.</p>
Shining Sickle Moss (<i>Drepanocladus vernicosus</i>)	N/A	Shining Sickle Moss, one of the qualifying species of the Lough Corrib cSAC, is also protected under the Flora Protection Order (1999). This species was not found during site surveys and is therefore highly unlikely to be impacted by the proposed flood relief works.

6.2.7 Impacts during the Operation Phase

6.2.7.1 Watercourses

The main potential impact on water quality and fisheries associated with the operational phase of the proposed flood relief scheme would be the pollution caused by the ongoing arterial drainage maintenance proposed (Measure 10) for the river and associated drains and changes to the channel velocity in relation to bank widening (Measure 8b). Measure 10 is a function of OPW's statutory maintenance obligation for all scheme channels. All drainage maintenance operations carried out as part of Measure 10 will be carried out in accordance with OPW EMPs and SOPs (**Appendix A**). As part of these protocols OPW will liaise with IFI and NPWS on a bi-monthly basis and employ any relevant work practices agreed with IFI for the control of suspended solids etc.

There are expected to be impacts as a result of changes in channel velocity in relation Measure 8b, bank widening. These include increased sedimentation, changes to fisheries habitat, artificial floodplain creation, new aquatic habitat creation, increased bank and channel erosion and introduction of a fish barrier on the Islandmore Drain.

6.2.7.2 Annex I Habitats

Aquatic

- **3140 Hard oligo-mesotrophic waters with benthic vegetation of Chara spp., 3110 Oligotrophic Waters Containing Very Few Minerals of the Sandy Plains, 3260 Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation**

Operational impacts may include increased flow velocity, release of silt and loss of biodiversity through removal of instream flora and fauna.

Terrestrial

- **6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)**

Operational impacts may include alteration of hydrological regime.

6.2.7.3 Annex II Species

- **Freshwater Pearl Mussel (*Margaritifera margaritifera*)**

Not present, therefore not applicable.

- **Atlantic Salmon (*Salmo salar*)**

Measures which may potentially impact Atlantic Salmon

Measure 4b: Regrade River Clare channel upstream and under Claregalway Bridge, and regrade flood eye

The stretch of the Clare affected by these works is currently a moderately shallow glide over fine and coarse substrates. Deepening here will cause loss of the former habitat type and creation of deep glide or pool type habitat, most likely with less substrate and flow diversity as a result of excavation of bedrock and removal of rubble. The combination of channel deepening and proposed fisheries

enhancements (see below) will remove habitat that supports sensitive macroinvertebrate groups, and is also salmonid nursery habitat. In its place will be habitat more suitable for holding larger salmon and trout and coarse fish (primarily as an angling amenity). Deepening around the bridge is likely to alter flow dynamics upstream of the deepened section depending on how the bed levels are set. There may be a decrease in channel depth and increase in channel velocity/turbulence in a short section at the inflow to newly created pools. This represents a **permanent** impact and given the relative scarcity of nursery habitat on the lower Clare the impact is **significant** and **negative**.

Habitat and Hydromorphological Changes Associated With Fisheries Enhancements

Using historical data for the Clare and similar lowland drained rivers elsewhere, combined with the knowledge of the study reach by local IFI staff in Galway, IFI have recommended an EREP measure that is designed to improve the holding capacity of the Clare study reach for salmon and trout. The approach is to work with the existing channel form in the stretch beneath Claregalway Bridge in order to create a holding pool. This measure is designed to improve angling in the reach. Physical works are to be carried out in conjunction with the channel regrading construction phase. Details of the measures are detailed in Section 7.2.7.1.

Measure 8b: Channel widening from 1.3km upstream of Crusheeny Bridge to immediately downstream of Crusheeny Bridge to form a two-stage channel

Channel velocity changes: A decrease in average velocity would be expected to increase the amount of sedimentation in the affected reaches possibly increasing the amount of fines in any salmon spawning redds in the study reach, which in turn would tend to reduce the survival rates of deposited eggs. On balance, such conditions would tend to favour coarse fish rather than salmonids. These effects are likely to take several years to become apparent and perhaps decades before all alterations to the channel to become fully established. However, the overall character of the reach is unlikely to alter significantly, principally because the average annual flow channel will not be altered by the works. Moreover, the measures proposed to enhance salmonids carrying capacity and spawning potential earmarked for the study area should be able to counteract the potential changes outlined above for salmonids.

Increased sedimentation associated with hydraulic changes

Any of the predicted decreases in average velocity under the different flow conditions, but especially under high flows, would be expected to increase the amount of sedimentation in the affected reaches and be generally beneficial to macrophytes by reducing the mechanical stress on plants and providing more sediment to assist root growth. This is particularly relevant to the stretch from Crusheeny Bridge to just below the first main bend downstream (i.e. section 91-87). Under the existing configuration in the channel, deposited silt or excessive build-up of macrophytes is probably kept in check by the scouring affect of larger floods occurring every couple of years. According to the OPW, the current flow regime in the Clare generally eliminates the necessity for maintenance within the study reach. It is unknown whether this characteristic may change as a result of projected reductions in average velocities.

Increased sedimentation may also increase the amount of fines in any salmon spawning redds in the study reach, which in turn would tend to reduce the survival rates of deposited eggs. On balance, such conditions would tend to favour coarse fish rather than salmonids.

Changes to fisheries habitat associated with hydraulic changes

The area around Crusheeny Bridge (section 89-90) will also see a drop in Froude number during high flows from its current optimum level (0.3-0.4) to below 0.2, suggesting that any spawning that might have occurred there in the past is unlikely to continue. In contrast, the increased velocities downstream of Cregmore Bridge (sections 99-97) result in an increase in Froude number moving these sites farther above the optimum range (0.3-0.4) which may also reduce the attractiveness of this stretch for spawning salmon. Indeed the higher velocity of this stretch during floods will reduce its attractiveness to juvenile salmon at such times and they will require to seek slower velocities closer to the substrate, the margins or further downstream. However, it will remain an important area of salmonid habitat. In general, while the introduction of a two-staged bank from below Crusheeny Bridge to section 96, will result in some reductions in velocity between sections 96-91 at most flows,

the resultant velocity range will still be suitable for juvenile salmon, with 0+ (young-of the-year fish) reported from areas with 20-65cm/s surface velocity and 20-40cm/s mean column velocity (Armstrong *et al.*, 2003). It is worth noting that young salmon cope with faster flows by staying close to the river bed where the velocity is generally slower than in the water column. Furthermore, older parr (1+) will tend to use areas with slightly higher velocities and may cope better at sites where the velocity is predicted to increase. Overall salmon will avoid excessive velocities (>100cm/s) and very slow velocities (<5-15cm/s). The high velocities predicted for the Cregmore Bridge stretch downstream to section 97 during high flows (Q-Bar) are excessive and sub-optimal for salmon and trout.

Overall, the proposed velocity changes in the riffle/run reach of the Clare, between the Islandmore confluence and Cregmore Bridge will not significantly alter the character of the in-channel habitats at that location nor appreciably reduce its high value for juvenile salmon. However without some fisheries enhancement there is potential for **permanent, moderate, negative** impact under high flow conditions there.

The increase in velocity during high flows in this upper part of the reach (100-97) will tend to be offset, however, by a reduction in velocity in the middle to lower section immediately downstream (96-91), i.e., in the slower, deeper glide habitat between the riffle / run habitat and Crusheeny Bridge. In that stretch the impacts of hydraulic change will be **permanent and slightly negative**.

Generally, velocity in the upper part of the reach (97-100) is such that excessive build-up of marginal macrophyte beds is less likely, though increases in sediment deposition and macrophyte growth cannot be ruled out in the lower sections (91-96). Overall the impact of proposed velocity changes, without mitigation, can be described as ranging from **permanent, slight, negative** (in stretches currently consisting of slower, deeper glide) to **permanent, moderately negative** impact in stretches which currently have swifter currents and coarser bottom material.

Artificial floodplain creation

Creation of a two step channel along this reach effectively connects the river to a low floodplain with a stepped bank embankment which can be positive for river ecology. The erosive effects of the high channel velocity are reduced by allowing out-of bank flows. Suspended sediment may tend to settle on the 2nd stage channel (effectively the artificial floodplain) as flood waters recede, rather than within the river channel. In terms of river ecology these effects have the potential for a **permanent, slight, positive** impact,

Increased bank and channel erosion

Limited parts of the channel, in particular the stretch between the end of the proposed widening (at Grange West) upstream towards Cregmore Bridge, may experience increased sediment washout or limited bank erosion during heavy floods, at least in the first few years after the proposed works. The majority of the stretch however, will experience a decrease in average velocities, after the works are complete which should reduce the amount of solids generated from these reaches compared to the existing situation.

Introduction of a fish barrier on Islandmore Drain

There is some, albeit limited, potential for salmonid spawning (and nursery) in the lower (riffle) stretch of the Islandmore drain. Much of this habitat will be removed as part of measure 8b (channel widening), but any remaining riffle will be obstructed by the non-return sluice on Islandmore drain at the downstream end, thus presenting a barrier to any potential fish movement during the operational phase. The type and magnitude of this impact can not be determined unless fisheries values of the lower Islandmore drain are established through an electrofishing survey.

• **Otter (*Lutra lutra*)**

Alteration of flow levels, reduction in prey. Ongoing Arterial Drainage Maintenance (Measure 10) including the management of bank vegetation may impact Otter.

- **Slender Naiad (*Najas flexilis*)**

No operational impacts are expected.

- **Sea Lamprey (*Petromyzon marinus*)**

No operational impacts are expected.

- **Brook Lamprey (*Lampetra planeri*)**

Regular maintenance (Measure 10) of ditches may impact Brook Lamprey.

Introduction of a fish barrier on Islandmore Drain

There is some, albeit limited, potential for lamprey spawning (and nursery) in the lower (riffle) stretch of the Islandmore drain. Much of this habitat will be removed as part of measure 8b (channel widening), but any remaining riffle will be obstructed by the non-return sluice on Islandmore drain at the downstream end, thus presenting a barrier to any potential fish movement during the operational phase. The type and magnitude of this impact can not be determined unless fisheries values of the lower Islandmore drain are established through an electrofishing survey.

- **Lesser Horseshoe Bat (*Rhinolophus hipposideros*)**

No operational impacts are expected.

- **White-clawed Crayfish (*Austropotamobius pallipes*)**

New aquatic habitat creation

At the widened stretch upstream of Crusheeny Bridge the hydromorphology of the Clare River will visibly alter as a result of Measure 8b when compared to the current situation. **Table 6.4** shows the percentage of time that the newly created 2nd stage channel would be predicted to inundate, post-works. It is clear that, in the reach that includes sections 93-94, the new river configuration would result in out of bank flows (onto the 2nd stage channel) a significant amount of the time (i.e., 88% and 95% of the time). The 2nd stage channel in the reach closer to Crusheeny Bridge will be inundated around 65% of the time. The impact is much less dramatic in the upper reaches, (upstream of section 95) where out-of-bank flows that inundate the 2nd stage channel, will be quite rare (7% and 2% of the time at sections 95 and 95.8, respectively). The visual impact of this is permanent and significant in the lower sections (91-94); changing from the current canalised nature to a much wider, largely open waterbody for a considerable amount of the time. It is unknown to what extent aquatic fauna may utilise the new habitat created atop the predominantly submerged reaches of the 2nd stage channel. The sections that are more commonly submerged (93-94) are likely to develop semi-aquatic habitat, most probably stands of Reed Canary Grass which can be utilised by birds and invertebrates, and can be especially beneficial to white-clawed crayfish depending on the level of submersion. This would be a **moderately positive** impact in the short term in terms of increased biodiversity and habitat opportunities, though any future maintenance of the 2nd stage channel may lead to recurring and at least **moderately negative, medium term** impacts as a result of such maintenance.

Regular maintenance (Measure 10) may impact White-clawed Crayfish.

Table 6.4 Predicted % of time that water level of the Clare River will exceed the low flow channel and inundate the 2nd stage channel.

Section	Flow (m ³ /s)	% of time flow equalled or exceeded	Predicted WL (mOD)	Two-stage channel level -upper (mOD)
91	7.0	64%	7.97	8.00
92	6.9	66%	8.15	8.19
93	4.5	94%	8.18	8.20
94	5.5	88%	8.54	8.56
95	16.0	7%	9.37	9.40
95.8	22.5	2%	9.96	10.00

- **Shining Sickle Moss (*Drepanocladus vernicosus*)**

No operational impacts are expected.

6.2.8 In-Combination Impacts with Other Plans / Projects

The Appropriate Assessment requires consideration of the proposal in combination with other plans or projects, which may give rise to cumulative impacts affecting the cSAC. Plans and projects in place or proposed for the study area are identified in **Section 5** and **Table 5.1**. A number of plans and projects may result in in-combination effects on the Lough Corrib cSAC.

6.2.8.1 Roads Projects

M17/N18 Gort to Tuam road (permitted), Claregalway Bypass (proposed), Galway City Outer Bypass (GCOB), N59 Moycullen Bypass and N59 Maam Cross Oughterard Road Project

These road schemes have the potential to impact on Lough Corrib cSAC. If all measures to protect the receiving environment and best practice construction methodologies as developed by the NRA are implemented in line with best practice during the construction and operation of the roads there will be no cumulative impacts. With regard to the other proposed road developments including, N59 Maam Cross Oughterard Proposed Road Development and Galway City Outer Bypass (GCOB), these projects will be subject to statutory approvals and will consider the impacts of this project in combination with their own.

6.2.8.2 Local Development relating to the Clare River

Advance works at Claregalway N17 Bridge, Advanced works at Crusheen Bridge - Clare River Flood Relief Scheme (OPW) and a Riverside Walk, Claregalway

An Appropriate Assessment Screening Report and if deemed necessary, a Natura Impact Statement have been prepared for these developments. These reports found no significant effects on Lough Corrib as a result of all three projects. If best environmental practice is employed during the proposed flood relief works, it is expected that these works will not result in any in combination impacts with the advance works at Claregalway Bridge.

6.2.8.3 Local Planning Applications

A search of the Galway County Council Planning website was conducted. Several applications were made to construct new dwelling houses, septic tanks, etc in the area. If the septic tanks are maintained and operating in accordance with EPA guidelines then there will be no potential for cumulative impacts arising in combination with the current proposals which would be of significance in respect of impacts affecting the conservation objectives or integrity of the Lough Corrib cSAC or Lough Corrib SPA.

6.3 OVERALL IMPACT ASSESSMENT

Table 6.5 Summary of Impacts on the Qualifying Habitats of Lough Corrib cSAC

Habitat Type (Annex I of the Habitats Directive)	Main Threats and Impacts	Direct (isolated, interactive, cumulative, short-term, long-term)	Indirect (isolated, interactive, cumulative, short-term, long-term)
Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.	Fertilisation, grazing, forestry, leisure fishing, hunting, human induced hydraulic changes, eutrophication and invasive species.	No direct effects predicted.	Potential pollution during the construction phase
Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>)	Fertilisation, grazing, forestry, burning, leisure fishing, hunting, peat extraction, dispersed habitation, discharges, sport and leisure structures, pollution, drainage, erosion and invasive species.	No direct effects predicted.	Potential pollution during the construction phase
Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>)	Drainage and burning; afforestation; invasive species; grazing; dumping; fertilisation; restructuring agricultural land; communication routes; cultivation; mowing/cutting; modification of inland water structures; sand and gravel extraction.	No direct effects predicted.	Potential indirect effects on hydrological regime. Potential direct impacts during ongoing maintenance activities (Measure 10)
Active raised bogs*	Peat cutting, grazing, burning.	No direct effects predicted.	No indirect effects predicted.
Old sessile oak woods with Ilex and Blechnum in British Isles	Internal effects include inappropriate grazing levels and invasive species, whereas external threats include clearance for agriculture or felling for timber.	No direct effects predicted.	No indirect effects predicted.
Alkaline fens	Fertilisation, grazing, forestry, burning, leisure fishing, hunting, peat extraction, dispersed habitation, discharges, sport and leisure structures, pollution, drainage, erosion, invasive species.	No direct effects predicted.	No indirect effects predicted.
Calcareous fens with Cladium mariscus and species of the Caricion davallianae	Overgrazing, restructuring agricultural land holding, peat extraction, mechanical removal of peat, water pollution, landfill, land reclamation and drying out in general. Infilling ditches, dykes, ponds, marshes and pits.	No direct effects predicted.	No indirect effects predicted.
Limestone pavements*	Removal of limestone pavement, removal of	No direct effects predicted.	No indirect effects predicted.

Habitat Type (Annex I of the Habitats Directive)	Main Threats and Impacts	Direct (isolated, interactive, cumulative, short-term, long-term)	Indirect (isolated, interactive, cumulative, short-term, long-term)
	scrub, dispersed habitation, stock feeding, agricultural improvement, quarry, disposal inert material, electricity lines, infilling wetlands, routes, abandonment of grazing, agricultural structure, burning, discharges, disposal household waste, dumping dredgings, forestry, grazing, improved access, landfill, nautical sports, paths and restructuring agric land holding.		
Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)(*important orchid sites)	Invasion by a species, undergrazing, fertilisation, agricultural improvement, abandonment of pastoral systems, sand & gravel extraction.	No direct effects predicted.	No indirect effects predicted.
Bog woodland*	Burning, mechanical removal of peat, drainage.	No direct effects predicted.	No indirect effects predicted.
Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation	Fertilisation, grazing, forestry, peat extraction, pollution, drainage, invasive species.	No direct effects predicted.	Potential pollution during the construction phase
Petrifying springs with tufa formation (Cratoneurion)*	Peat cutting, arterial drainage, local drainage, water abstraction, agricultural reclamation.	No direct effects predicted.	No indirect effects predicted.
Degraded raised bogs still capable of natural regeneration	Peat cutting, arterial drainage, local drainage, water abstraction, agricultural reclamation.	No direct effects predicted.	No indirect effects predicted.
Depressions on peat substrates of the <i>Rhynchosporion</i>	Peat cutting; drainage and burning; afforestation; invasive species; grazing; dumping; fertilisation; restructuring agricultural land; communication routes; cultivation; mowing/cutting; modification of inland water structures; sand and gravel extraction.	No direct effects predicted.	No indirect effects predicted.

*Priority Annex I Habitats

Table 6.6 Summary of Impacts on the Qualifying Species of Lough Corrib cSAC

Habitat Type (Annex I of the Habitats Directive)	Main Threats and Impacts	Direct (isolated, interactive, cumulative, short-term, long-term)	Indirect (isolated, interactive, cumulative, short-term, long-term)
Otter (<i>Lutra lutra</i>)	Use of pesticides, fertilization, hunting, trapping, poisoning, water pollution, infilling of ditches, dykes, ponds, pools, marshes or pits, management of aquatic and bank vegetation for drainage purposes, removal of sediments, canalization of inland water course.	Potential disturbance during the construction phase	Potential pollution during the construction phase. Alteration of flow levels may result in the reduction of prey
Slender Naiad (<i>Najas flexilis</i>)	Water pollution, water abstraction, invasive species, forestry and farming.	No direct effects predicted.	Potential pollution during the construction phase
Atlantic Salmon (<i>Salmo salar</i>)	Water pollution, invasive species, forestry, farming and fishing.	No direct effects predicted.	Potential pollution during the construction phase.
Freshwater Pearl-mussel (<i>Margaritifera margaritifera</i>)	Water pollution, water abstraction, invasive species, forestry and farming.	No direct effects predicted.	No indirect effects predicted.
Sea Lamprey (<i>Petromyzon marinus</i>)	Fish passages, water pollution (including discharges), commercial fishing, invasive species, forestry and farming.	No direct effects predicted.	No indirect effects predicted.
Brook Lamprey (<i>Lampetra planeri</i>)	Fish passages, water pollution (including discharges), commercial fishing, invasive species, forestry and farming.	Potential direct effects predicted when clearing drains.	Potential water pollution during the construction phase.
Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>)	Loss of suitable summer and winter roosting sites due to the demolition or renovation of derelict buildings for human occupation, loss of commuting routes linking roosts to foraging sites, and loss of suitable foraging sites are the major threats to this species. The use of insecticides, habitat destruction such as felling of trees and scrub clearance and deterioration of old buildings.	No direct effects predicted.	No indirect effects predicted.
White-clawed Crayfish (<i>Austropotamobius pallipes</i>)	Water pollution, invasive species, forestry and farming.	Potential direct effects predicted when dewatering	Potential water pollution during the construction phase.
Shining Sickie-moss (<i>Drepanocladus vernicosus</i>)	Fertilisation, abandonment of pastoral systems, undergrazing, forestry planting, water pollution, drainage.	No direct effects predicted.	No indirect effects predicted.

Table 6.7 Summary of Impacts on the Qualifying Bird Species of Lough Corrib SPA

Habitat Type (Annex I of the Habitats Directive)	Main Threats and Impacts	Direct (isolated, interactive, cumulative, short-term, long-term)	Indirect (isolated, interactive, cumulative, short-term, long-term)
Common Tern (<i>Sterna hirundo</i>)	Leisure Fishing, Water Pollution, Hunting, Fertilisation, Grazing.	No direct effects predicted.	Potential water pollution during the construction phase
Arctic Tern (<i>Sterna paradisaea</i>)			
Greenland White-fronted Goose (<i>Anser albifrons flavirostris</i>)			
Golden Plover (<i>Pluvialis apricaria</i>)			
Whooper Swan (<i>Cygnus cygnus</i>)			

7 MITIGATION MEASURES

7.1 GENERAL

Mitigation measures are proposed in this section to address any potential adverse effect on the qualifying habitats and species of Lough Corrib cSAC. These measures will allow any potential impacts affecting the conservation status of Lough Corrib cSAC to be avoided.

An over-arching mitigation measure will be for the OPW to draw up a **Method Statement** that includes detailed mitigation measures as outlined below in relation to the implementation of all measures proposed. This method statement will be strictly adhered to by OPW staff and contractors involved in the works and will be overseen by the OPW's site representative/foreman. The OPW EMPs and SOPs will form the backbone of the method statement, supplemented by specific additional measures proposed below. The method statement will detail how these mitigation measures will be monitored for effectiveness by both OPW themselves and independently through water quality monitoring proposed. There will be ongoing consultation by the OPW with IFI and NPWS throughout all phases of the works which will include attendance at progress meetings at stages agreed in advance by the OPW and designated IFI and NPWS representatives. A mechanism for reporting of pollution incidents will be agreed in advance between the contractor(s) and the IFI.

7.2 SPECIFIC MITIGATION MEASURES FOR ANNEX I HABITATS

A poor example of Annex I habitat (*Water courses of plain to montane levels with the Ranunculus fluitantis and Callitriche-Batrachion vegetation*) may be located throughout the study area within the Clare River, and so direct impacts to this habitat is expected. However, the damage would be local, and is considered to be slight, with vegetation expected to re-colonise rapidly.

The changes to the floodplain have been assessed and it is concluded that the hydrology of the Annex I Habitat 6410 *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinia caerulea*) in Kiniska will not be directly impacted through alteration of the hydrological regime.

The potential impacts to Annex I habitats of Lough Corrib cSAC would be indirect effects, i.e. contamination via the release of water- or air-borne pollutants to the aquatic and atmospheric environment during construction activities. Mitigation measures for these possible indirect impacts are described in the section below.

7.2.1 Mitigation Measures for the control of Airborne Pollutants during Construction Activities

To protect sensitive receptors in the vicinity of the proposed flood relief works the following measures are proposed. Measures to mitigate the emission of dust due to construction activities include:

- i. control of vehicle access.
- ii. vehicle speed restrictions.
- iii. bed of gravel at site exit points to remove caked on dirt from tyres and tracks.
- iv. washing of equipment at the end of each work day, if they are to be moved off site.
- v. prevention of on-site burning.
- vi. hard surface roads should be wet swept to remove any deposited materials.
- vii. unsurfaced roads should be restricted to essential site traffic only.
- viii. wheel-washing facilities should be located at all exits from the construction site.

7.2.2 Mitigation Measures for the control of Waterbourne Pollutants during Construction Activities

The proposed project has been identified as potentially giving rise to adverse effects on water quality within the Lough Corrib cSAC. This has further potential for indirect impacts on the water-dependant Annex I habitats or Annex II species adjacent to, or downstream of, the works. The effective protection of water quality within the proposed scheme during construction and operation phases will minimise the risk to the qualifying interests of this site. Water quality mitigation measures for avoidance, reduction and remediation of impacts are prescribed below.

Standard pollution control and mitigation measures, as outlined in **Table 7.1** below, will be employed where relevant when working in and near the watercourse affected by the proposed works to prevent the transport of deleterious substances to Lough Corrib cSAC and its associated water-dependent habitats and species. The method statement will detail how these mitigation measures will be monitored for effectiveness. The IFI will advise on a programme of water quality monitoring, for suspended solids and colour, as agreed with the OPW.

Table 7.1 Potential Impacts and Proposed Mitigation Measures

Potential Impact	Mitigation Measure
General	<ul style="list-style-type: none"> - Prior to any works, all personnel involved with the flood relief works will receive an on-site induction relating to operations within and adjacent to watercourses and the environmentally sensitive nature of working within and in proximity to the Natura 2000 site and re-emphasise the precautions that are required as well as the mitigation to be implemented. - The OPW will ensure that their engineer setting out the works is fully aware of the ecological constraints and mitigation requirements. - All matters relating to the flood relief works within and in the vicinity of the Natura 2000 site or the vicinity of watercourses connected to the Natura 2000 site will be reported on a regular basis to the OPW for ongoing review. - Any incident or observation of anything that may be considered as causing or likely to cause disturbance or damage to the cSAC will be reported to the OPW immediately. - The OPW will take immediate action to prevent or limit the impact and contractors on site will notify the OPW contact of the incident and the actions taken. - The amount of bare ground created by excavation and vegetation removal will be minimised. - In-stream works will be carried out outside of the salmonid spawning season and the times that early life stages of salmonid fish will be present. In-stream work within the period 1st October to 1st May (inclusive) will only be undertaken with the advanced approval of Inland Fisheries Ireland and the NPWS.
Ground Investigation	<p>Ground Investigation (GI) works are proposed at the locations of the construction of the two-stage channel to determine the subsurface conditions at these sites. The identification of ground conditions will dictate the mitigation measures to be applied. Mitigation measures for different scenarios are discussed in Section 7.2.5 and shown in Figure 7.1. The scenarios include for where a mixture of stone and soil, or just soil, is found during excavation, and where just rock is encountered during GI investigations. All other measures discussed in this table will apply to GI works. Traversing Annex I habitats will be avoided where possible, however, if GI works require access across Annex I habitats located within Lough Corrib cSAC, such as the <i>Molinia</i> meadows in Kiniska, matting will be used.</p>
Pollution of watercourses	<p>Drainage Channels & Minor Streams</p> <ul style="list-style-type: none"> - All drainage maintenance operations will be carried out in accordance with OPW's EMPs and SOPs. It should be noted that maintenance of these channels and minor streams means the removal of silt entrenched vegetation and other organic material such that the channel is returned to

Potential Impact	Mitigation Measure
	<p>its design grade and cross section. This material is spread thinly along the bankfull.</p> <p>River Clare</p> <ul style="list-style-type: none"> - It is proposed that a section of the existing Clare River bank will be retained as a dam between the river and the works area (see Figure 7.1). The dimensions of this retained bank or 'dam' will be dependant on the depth of excavations at a given location, i.e. it will be as wide as it is deep. Typically this will be of the order of 2m. - The 'dam' will be maintained during widening of the channel to prevent any loose material from the newly excavated two-stage channel from running into the first stage (existing river) channel during works. The material will be stabilised through compaction. - Excavations will take place behind the dam in year one. In year 2, the dam will be removed, and buried (See Figure 7.1 below for illustration). - The spoil heaps will be seeded to stabilise them. The landspreading areas will be returned fit for purpose to the land owner. - Furthermore, until the stockpiling/landspreading sites have stabilised, surface water runoff will be collected via a shallow interceptor ditch with check dams (inside the dammed off area) to provide short term attenuation and serve as an additional silt-trap. The interceptor ditch will be excavated prior to works commencing for a distance of 100m even if the working area is confined to 20m. The number of check dams to be provided will have to be determined once the ditch is constructed and surveyed to determine the slope. Please refer to Figure 7.2 for illustrative details. - In addition at 100m intervals along the 'dam' retained, a filtered outfall will be provided to accommodate any surface water runoff retained by the works. Similar stone filters will be constructed intermittently along the works area to further filter any runoff (see Figure 7.1) - In year 2 the dam will be excavated and disposed of into the interceptor ditch and covered with washed stone or reseeded as appropriate. The exposed bank at the site of the excavated berm will also be covered in rock to stabilise the bank or reseeded as appropriate. <p>General</p> <ul style="list-style-type: none"> - All access scaffolding used within watercourses and all footwear/ waders, etc used within watercourses must be steam cleaned prior to arrival on site to prevent the spread of invasive aquatic or terrestrial species such as Zebra Mussel or Japanese knotweed in accordance with OPW EMPs and SOPs. A sign off sheet must be maintained to confirm cleaning. - The Contractor shall prevent any silting/erosion of water courses and pollution of the water that may adversely affect the quality or appearance of the water or cause obstruction or interference with the flow. - Establish site boundary markings to safeguard features of interest/value. - Tools and equipment are not to be cleaned in watercourses or near karst features. - Chemicals used shall be stored in sealed containers in the site lockup prior to use. - The chemicals shall be applied in such a way as to avoid any spillage or leakage. Any and all excavated material is not to be temporarily stored adjacent to watercourses or karst features. - Temporary gangways should be erected if required between river banks and working platforms to avoid the need for walking through watercourses or any karst features.
<p>Fuel/Lubricant spillage from equipment</p>	<ul style="list-style-type: none"> - Fuelling and lubrication will not be conducted within 50m of the watercourse or karst feature. - Storage areas, machinery depots and site offices will be located at least 50m from the watercourse and the esteville. - Foul drainage from the site offices and facilities will be properly treated and removed to a suitable treatment facility. - Spill kits will be made available close to streams and all staff will be

Potential Impact	Mitigation Measure
	<p>properly trained on correct use.</p> <ul style="list-style-type: none"> - All fuels, lubricants and hydraulic fluids will be kept in secure bunded areas at a minimum of 50m from the watercourse and the esteville. The bunded area will accommodate 110% of the total capacity of the containers within it. Containers will be properly secured to prevent unauthorised access and misuse. An effective spillage procedure will be put in place with all staff properly briefed. Any waste oils or hydraulic fluids will be collected, stored in appropriate containers and disposed of offsite in an appropriate manner. - All plant shall be well maintained with any fuel or oil drips attended to on an ongoing basis. - Any minor spillage during this process will be cleaned up immediately. Should any incident occur, the situation will be dealt with and coordinated by the nearest supervisor who will be responsible for instructions by the OPW.
Concrete	<p>Measures relating to concrete management will mostly apply to the construction of the footbridge parallel to Claregalway N17 Bridge, although minimum concrete is expected to be required as the footbridge will be constructed off site.</p> <ul style="list-style-type: none"> - Wet concrete and cement are very alkaline and corrosive and can cause serious pollution to watercourses. - Disposal of raw or uncured waste concrete will be controlled to ensure that the watercourse or karst features will not be impacted. - Best practice in bulk-liquid concrete management addressing pouring and handling, secure shuttering / form-work, adequate curing times. - Where shuttering is used, measures should be put in place to prevent against shutter failure and control storage, handling and disposal of shutter oils. - Wash water from cleaning ready mix concrete lorries and mixers may be contaminated with cement and is therefore highly alkaline. Due to the size of the site and the proximity of sensitive watercourses, it is recommended that lorries and mixers are washed out of off site. - Cement dust must be controlled as it is alkaline and harmful to the surrounding ecology. Activities which result in the creation of cement dust will be controlled by dampening down areas. - The timing of the works must be specified and agreed with the IFI in relation to fish migration and spawning periods
Culvert Installation	<ul style="list-style-type: none"> - The pollution prevention controls to be adopted during the installation of culverts for the access road, are critical. If temporary or permanent diversion of any watercourses is required, this should be carried out prior to the removal of bankside vegetation. - Temporary stream diversions should be made on geotextile surfaces with a surface layer of coarse aggregate to hold it in place. Operation of machinery instream should be kept to an absolute minimum. All construction machinery operating instream should be mechanically sound to avoid leaks of oils, hydraulic fluid, etc. Machinery should be steam-cleaned and checked prior to commencement of instream works. Such works would preferentially be done during the dry period of the year when flows are low and the risk of suspended solids release is minimal. All dewatering flow should be passed through settlement ponds as detailed above, to remove sediments.
Noise and vibration from use of equipment	<ul style="list-style-type: none"> - All works at the watercourse should make a 'short-start' to activities to allow salmon and other fish to move away before the full intensity of works begins. - Work will be undertaken during daylight hours, starting no earlier than two hours after dawn and finishing no later than two hours before dusk, between March and October; and to start no earlier than one hour after dawn and finish one hour before dusk from November to February; and shall not continue for periods of more than 12 hours, to prevent disturbance to nocturnal species.

Potential Impact	Mitigation Measure
	<ul style="list-style-type: none">- Specific measures in relation to protected species or habitats where they occur within the proposed works are detailed below.
Exhaust emissions from equipment	<ul style="list-style-type: none">- Vehicles and plant shall be properly maintained and shall not be left idling when not in use.
Contaminated surface and/or groundwater	<ul style="list-style-type: none">- Contaminated surface water runoff will be treated prior to entering the main channel of the Clare River and any drains or watercourses adjacent to flood relief works.
Vegetation and soil protection measures	<ul style="list-style-type: none">- These measures are discussed in greater detail below

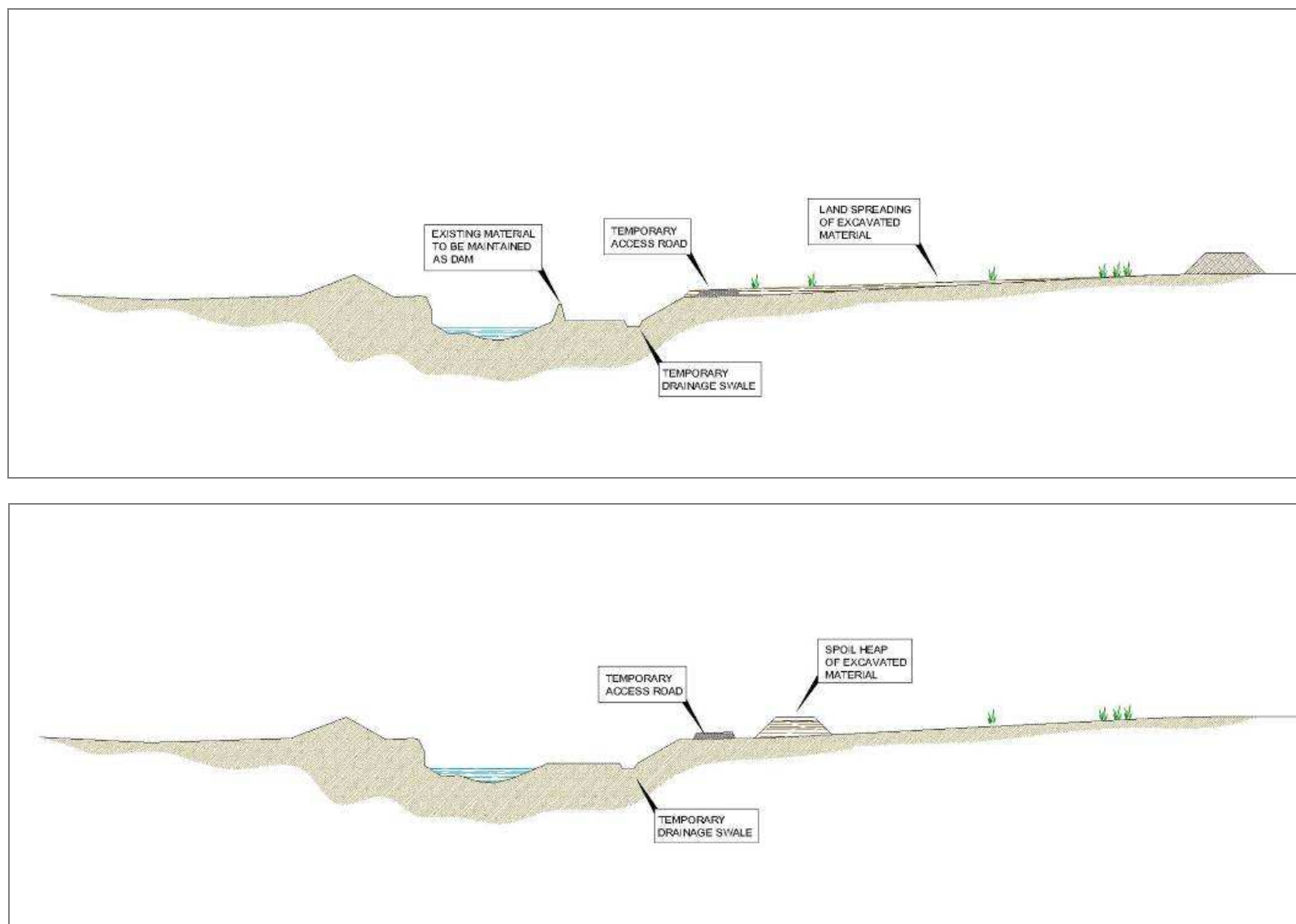
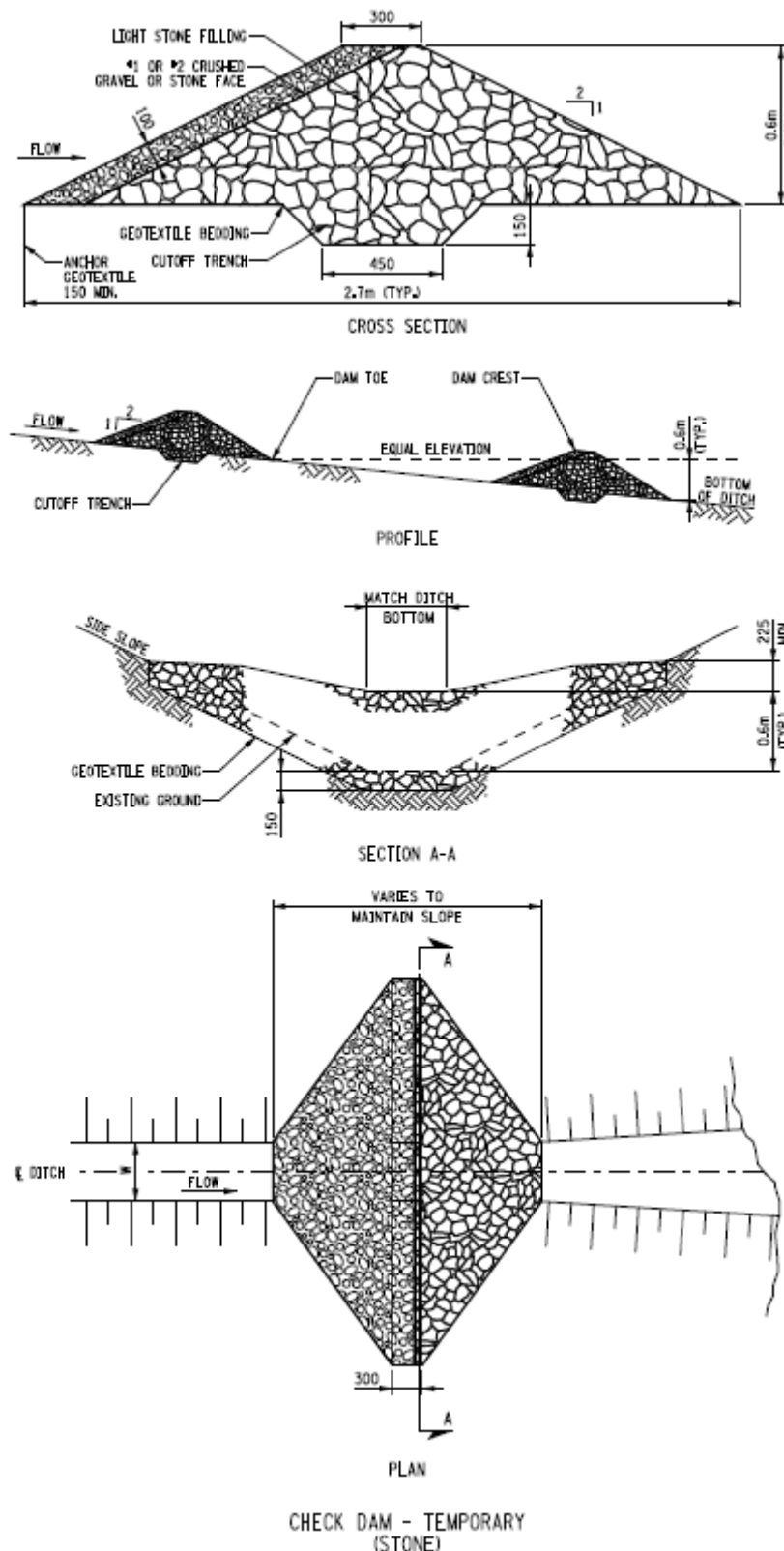


Figure 7.1 Mitigation Measures for the Control of Water Course Pollution during the Construction of the Two-Stage Channel.

The top diagram reflects the mitigation scenario required where a mixture of stone and soil, or just soil, is found during excavation, while the bottom diagram illustrates the mitigation scenario required where just rock is encountered during excavations.

**Notes**

- Maximum drainage area contributing to temporary stone check dam shall be 0.8 ha.
- Measures shall be inspected every (7) calendar days or after each rainfall of 12mm or more within a 24 hour period. Measures shall be cleaned and repaired as required.
- Sediment shall be removed when accumulation reaches one-half of the measure height. Sediment shall be disposed of as unsuitable material
- Coarse aggregate facing material for the stone check dam shall meet the requirement of coarse aggregate filling, and
- Stone filling core material for the stone check dam shall meet the gradation requirements of light stone filling.

Figure 7.2 Structural Measures for Erosion and Sediment Control - Temporary Check Dams in Interceptor Ditches

Table 7.2 Placement of Checkdam within Interceptor Ditch

Stone Check Dam Placement Interval	
Ditch Slope	Temporary Check Dam
	Placement Interval (Based on 0.6m Height)
1%	60m
2%	30m
3%	20m
4%	15m
5%	12m
6%	10m
8%	7.5m
10%	6m

* $I = H/S$

Where

I = Check Dam Spacing Interval

H = Check Dam Height

S = Channel Slope

TEMPORARY CHECK DAM VOLUMES	
DITCH SIDE SLOPE	VOLUME (m ³)
1:2	1.0 m ³ ±
1:3	1.5 m ³ ±
1:4	2.0 m ³ ±
1:6	3.0 m ³ ±

BASED ON V SHAPED DITCH SECTION
 FOR TRAPEZOIDAL DITCH, ADD
 1 CUBIC METER / METER OF DITCH WIDTH

7.2.3 Mitigation Measures for Each Flood Alleviation Area

Specific pollution control and mitigation measures are outlined in **Table 7.3** and **Table 7.4** below for each of the flood relief scheme measures proposed. These will be employed where relevant when working in and near the watercourses affected by the proposed works to prevent the transport of deleterious substances to Lough Corrib cSAC and its associated water-dependent habitats and species.

Table 7.3 Summary of Mitigation Measures at Each Area

Area		Proposed Measures	Mitigation Measures
1	Lough Corrib to Curraghmore Bridge	No channel alteration measures proposed. See Item 10 for Channel Maintenance requirements.	Measures for all activities will mitigate the impacts to receptors downstream.
2	Montiagh South	<p>2a Raise approx. 1.1 km of road</p> <p>2b Upsize existing road culvert</p> <p>2c Clean/Regrade Drains</p>	<p>General good practise in road building with particular respect to silt control, especially at small land drain crossing points. Apply measures detailed in Table 7.1 and Section 7.2.2</p> <p>In order to limit the escape of silt, it is recommended that short, temporary by-pass channels are excavated around the culverts being replaced and that these bypasses are lined with geotextile before the flow is diverted into them. This will allow the new culvert to be inserted in the dry in the existing channel, thereby reducing the quantities of silt generated by the construction. The base of each culvert in accordance with standard OPW Section 50 requirements will be placed below the current bed level. Where appropriate, as directed by IFI, any coarse material present under and around the existing channel will be removed, set aside and then replaced over the base of the new culvert after they have been inserted. This will help preserve the existing habitats as much as possible.</p> <p>General mitigation should involve implementation of the OPW's EMPs and SOPs (OPW, 2011). Given the proximity of these channels to the Lough Corrib cSAC and the potential that they support populations of Annex II species further measures proposed under OPW's EMPs and SOPs with respect to Lampreys and White clawed crayfish should be used, including the requirement to record and report presence of Annex II species (OPW, 2011).</p>
3	Montiagh North	3a Raise approx. 0.430 km of road	General good practice in road building with particular respect to silt control, especially at small land drain crossing points. Apply measures detailed in

Area		Proposed Measures	Mitigation Measures
		3b Raise approx. 0.830 km of road	<p>Table 7.1 and Section 7.2.2 and 7.2.4. Protection of watercrossings with the provision of silt fencing on either side of the road works. Site runoff to be intercepted and attenuated prior to discharge to watercourse.</p> <p>At Gortadooey Tributary, the IFI have an agreement with the OPW with respect to the potential spawning area in the lower stretch near the Clare confluence. This should be respected during any future maintenance. An electrofishing survey is recommended in the lower stretch of the tributary to establish current fisheries values.</p> <p>Works should follow general timing restrictions with respect to lamprey (April through to late July), trout spawning (May – October) and white clawed crayfish (November to June). Overall, works should ideally occur in August and September, but electrofishing surveys in the Gortadooey channel may help expand this window if sensitivities were found to be absent.</p> <p>General mitigation should involve implementation of the OPW's EMPs and SOPs (OPW, 2011). Given the proximity of these channels to the Lough Corrib cSAC and the potential that they support populations of Annex II species further measures proposed under OPW's EMPs with respect to Lampreys and White-clawed crayfish should be used, including the requirement to record and report presence of Annex II species (OPW, 2011).</p>
4	Claregalway Village	<p>4a Install flood eye at Claregalway Bridge (complete)</p> <p>4b Regrade Clare River channel upstream of and under the Claregalway bridge, and regrade flood eye.</p>	<p>Any future maintenance requirements would require consultation with NPWS and IFI and should be carried out using OPW's EMPs and SOPs.</p> <p>The extent of regrading (river deepening) of the river bed is approximately 80m upstream of the existing weir located downstream of Claregalway Bridge, and will include the removal of the weir. The newly constructed flood eye will be used as a temporary diversion during the regrading. The river will be diverted through the flood eye for a period of up to approximately three weeks. The widened channel upstream and downstream of Claregalway Bridge will initially be excavated to a level of approximately 6.1m OD (minimum). A cofferdam will be installed to dewater this area. The cofferdam will be installed such as to dewater part of the southern section of the river</p>

Area	Proposed Measures	Mitigation Measures
		<p>(particularly downstream of the bridge) to allow regrading. The cofferdam will then be relocated to dewater the remaining section of the river with the flow to be diverted through the newly installed flood eye. The river will be deepened to a minimum level of 4.60m OD which will mean deepening of up to 1.2m OD approximately in some areas. The work will be undertaken during the summer months at periods of low flow.</p> <p>To limit cumulative impacts, Measure 4b construction phase should be sequenced to occur a sufficient time after Measure 8b has been carried out in a section of the Clare (0.5-1km) upstream of the Claregalway Bridge. Ideally channel widening could take place in Season 1 of works, with deepening occurring in Season 2.</p> <p>A detailed method statement will be drawn up by the OPW indicating the measures that will be taken, including cofferdam installation, to avoid sediment or soil loss associated with all aspects of the construction and how these will be monitored for effectiveness. Best practice in protection of bare soil or spoil heaps to prevent slumping or wash-off of solids must be stated.</p> <p>The fisheries enhancement (EREP) should include a suitably graded run out section from the pools with gravel / cobble substrates which could compensate for fish nursery and macroinvertebrate habitat lost during deepening and pool creation. The same should occur further upstream of the Bridge, around cross-sections 76.6-75, where a predicted improvement in Froude Number as a result of measure 4b shows that habitat will become more ideal for salmonid production.</p> <p>The Claregalway EPA monitoring station 30C011200 can be relocated slightly into suitable habitat created as part of EREP design. Consideration should be given to inserting the proposed angling pool for Claregalway Bridge at the same time that the channel is restrained within coffer dams in order to reduce the possibility of generating excessive silt.</p> <p>The EREP works should be monitored at stages throughout the construction phase with the approval and co-operation of the</p>

Area	Proposed Measures	Mitigation Measures
	<p>4c Address the gap in the wall at An Mhainistir housing estate</p> <p>4d Provide local embankment at old Nine Arches bridge, and fill old Clare River channel</p>	<p>contractor(s) and the IFI. Post works surveys should be undertaken annually for an agreed period to determine if the new works are giving rise to excessive bank erosion (or deposition) anywhere along the channel.</p> <p>Works are to be carried out between May and September which is acceptable to avoid salmon spawning times. This period will also avoid critical periods for river/brook lampreys and crayfish. The sea lamprey critical spawning period (summer months) will not be avoided by the timing of the works, and though they are unlikely to be spawning in this part of the Clare River, it cannot be entirely ruled out.</p> <p>During regrading works at Claregalway Bridge, OPW SOPs will be applied to respond in the case white-clawed crayfish are present and emerge from refuges at the times of channel dewatering on both banks (2 separate occasions). In the event that significant populations of white clawed crayfish emerge, advice will be sought from IFI and NPWS to facilitate any necessary rescue and relocation.</p> <p>Water quality will be monitored by an independent party at stages throughout the construction phase with the approval and cooperation of the OPW and their contractor(s) and as advised by the IFI.</p> <p>Post works site surveys will be undertaken annually by the OPW to determine if the new works are giving rise to excessive bank erosion or deposition anywhere along the channel.</p> <p>The OPW will draw up a detailed method statement that addresses Best Practice in liquid and/or mortar management addressing pouring and handling, secure shuttering / form-work, adequate curing times and management of spills. No washings should be allowed to enter nearby drains. Works should occur in the dry.</p> <p>Embankment material should be selected that has low silt content. Works should be carried out ideally during a period of settled weather with no flood risk which will allow sufficient time for construction materials to settle. A continuous geo-textile silt curtain at the foot of the embankment heap should be in place surrounding the structure as it</p>

Area	Proposed Measures	Mitigation Measures
		develops and for a settling period following completion. Any currently existing drains that may be direct conduits to the Clare will require additional silt traps. These mitigation measures in combination with the considerable buffer area between the works and the river will to reduce the likelihood of silt mobilization.
5	Kiniska	<p>5a Increase capacity of culverts on OPW C3/5 stream</p> <p>5b Clean OPW stream C3/5</p> <p>Apply measures detailed in Table 7.1 and Section 7.2.2.</p> <p>In order to limit the escape of silt, it is recommended that short, temporary by-pass channels are excavated around the culverts being replaced and that these bypasses are lined with geotextile before the flow is diverted into them. This will allow the new culvert to be inserted in the dry in the existing channel, thereby reducing the quantities of silt generated by the construction. The base of each culvert in accordance with standard OPW Section 50 requirements will be placed below the current bed level. Where appropriate, as directed by IFI, any coarse material present under and around the existing channel will be removed, set aside and then replaced over the base of the new culvert after they have been inserted. This will help preserve the existing habitats as much as possible.</p> <p>Given the proximity of these channels to the Lough Corrib cSAC and the potential that they support populations of Annex II species further measures proposed under OPW's EMPs and SOPs with respect to Lampreys and White clawed crayfish should be used, including the requirement to record and report presence of Annex II species (OPW, 2011).</p> <p>Works in or near the area of the EU Annex I habitat '<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) (6410)' should be minimised. This area should be fenced off and no machinery be allowed to enter. Works in or near this area should be supervised by a suitably qualified ecologist.</p>
6	Lakeview	<p>6a Provide surface water outlet (Open channel and piped culverts) through fields to Clare River at Claregalway Bridge</p> <p>Apply measures detailed in Table 7.1 and Section 7.2.2</p> <p>A detailed method statement should be drawn up by the OPW indicating what measures will be taken to avoid sediment or soil loss associated with all aspects of the construction phase and how these</p>

Area		Proposed Measures	Mitigation Measures
			<p>will be monitored for effectiveness. Excavation of the drain network should be undertaken with the presence of at least 20m of undisturbed buffer section between works and the Clare River. The final section of the drain connecting the conduit to the Clare should occur once all drain construction works are complete and fines and spills have settled or been removed.</p> <p>Guidance and design of Sustainable Urban Drainage Systems⁶ (SuDS) or other proven silt control measures should be incorporated upstream of the outfall to the Clare to help reduce sediment and pollutant loading to Clare River that may arise during more frequent small run-off events. Hydrocarbon interception systems should be included in the drainage design since car-parking areas and roads are contained within the drainage catchment.</p> <p>The specific location of the drain discharge should be decided in consultation with IFI with specific regard to proposed fisheries enhancements.</p>
7	Gortatlewa	No additional measures proposed (Measures for Area 4 apply)	Details of measure provided in Table 7.4 below.
8	Caherlea/Lisheenavalla	8a Replace Crusheeny Bridge (completed)	Advance works at Crusheeny Bridge nearing completion. All works subject to mitigation measures detailed in the NIS for that Project.
		8b Channel widening from 1.3km upstream of Crusheeny Bridge to immediately downstream of Crusheeny Bridge to form a two-stage channel.	<p>Details of measures provided in Table 7.4 below.</p> <p>Fringing reeds should not be removed nor damaged during construction, unless specifically agreed in advance by the IFI. These beds will act as partial protection against erosion of the edges of the new bank and help to trap escaped solids from the earthworks.</p> <p>Works in or near the area of the EU Annex I habitat '<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) (6410)' should be minimised. This area should be fenced off and no machinery be allowed to enter. Works in or near this area should be supervised by a suitably qualified ecologist.</p>

⁶ http://www.irishsuds.com/guidance_criteria.htm

Area	Proposed Measures	Mitigation Measures
	8c Cleaning and regrading of Islandmore OPW C3/7 and F.799/1 arterial drains	<p>Apply measures detailed in Table 7.1 and Section 7.2.2.</p> <p>At Islandmore/Caherlea drainage channel, the stretch upstream of the Clare confluence should also be electrofished to establish fisheries values and this may need to be protected from invasive maintenance particularly since conveyance through the stretch is good.</p> <p>Works should follow general timing restrictions with respect to lamprey (April through to late July), trout spawning (May – October) and white clawed crayfish (November to June). Overall, works should ideally occur in August and September, but electrofishing surveys in the Islandmore channel may help expand this window if sensitivities were found to be absent.</p> <p>Given the proximity of these channels to the Lough Corrib cSAC and the potential that they support populations of Annex II species further measures proposed under OPW's EMPs and SOPs with respect to Lampreys and White clawed crayfish should be used, including the requirement to record and report presence of Annex II species.</p> <p>The upper section of the Islandmore/Caherlea drain network appears to run dry at times probably only being active as a stormwater runoff channel. The extension to this network could be undertaken during a dry period allowing sufficient time for settling of excavated ground before any flooding was likely to occur. Ideally, this upper section of drain should be excavated prior to cleaning and regrading on the main Islandmore/Caherlea drains as in their uncleaned state they would be more efficient at trapping silt generated during the excavation of the new drain.</p>
	8d Raise local road in Caherlea/Lisheenavalla (Future Measure)	<p>Apply measures detailed in Table 7.1 and Section 7.2.2 and 7.2.4. Protection of watercrossing with the provision of silt fencing on either side of the road works. Site runoff to be intercepted and attenuated prior to discharge to watercourse.</p>
9	Carnmore/Cashla	<p>Drainage of floodwater from the affected area via a new drainage pipeline/open drain to a local surface water stream at Islandmore</p>
		<p>Apply measures detailed in Table 7.1 and Section 7.2.2.</p>

Area	Proposed Measures	Mitigation Measures
10	<p>Channel Maintenance</p> <p>The section of the Clare River from Cregmore Bridge to Lough Corrib has not historically required ongoing maintenance but sections of the river upstream of Cregmore Bridge have undergone regular drainage maintenance activities. It is now proposed that the section of Clare River downstream of Cregmore Bridge will also undergo regular maintenance activities.</p> <p>Proposed channel maintenance can be classified under five headings:</p> <ul style="list-style-type: none"> A – Silt and Vegetation Management; B – Aquatic Vegetation Cutting (N/A); C – Bank Protection; D – Bush Cutting / Branch Trimming; E – Tree Cutting, F – Bridge/ Structure Repairs (N/A), and <p>An additional measure was identified by the OPW specific to this scheme as follows;</p> <ul style="list-style-type: none"> G - Rock Removal from Bed 	<p>Details of measure provided in Section 7.2.6 below.</p> <p>Any future maintenance requirements would require consultation with NPWS and IFI and should be carried out using OPW's EMPs and SOPs which include Environmental Drainage Maintenance (EDM) guidance.</p> <p>The OPW's EMPs and SOPs were produced to ensure that the environment is protected during maintenance activities. The Protocols and SOPs were last revised in April 2011 and have been issued to all operational staff. The SOPs include a guidance note detailing 10 steps to Environmentally Friendly Maintenance.</p> <p>If measures in Table 7.1 and Section 7.2.2 and 7.2.4 and in the OPW's EMPs and SOPs) are adopted no additional mitigation measures will be required.</p> <p>Locations where proposed channel maintenance works are to be carried out should be individually assessed to ascertain whether there are potential ecological vectors in the vicinity. For example, any works carried out in proximity to Otter holts or Kingfisher nests should either be avoided, or minimised or timed in order to minimise potential disturbance to these and other species.</p> <p>The OPW and its contractors should ensure that introduction of material such as rock armour and log poles for bank protection should not result in accidental introduction of non-native invasive species.</p> <p>The cumulative effects of ongoing maintenance should also be assessed. For example, removal of stream bank trees may result in a significant reduction in potential habitat for otter holts. Therefore it should be ensured that at least some suitable bank trees are retained as potential otter holts.</p> <p>Ideally, no channel maintenance should be carried out in the stretch upstream of Crusheen Bridge undergoing bank widening (Measure 8b) At the least, any maintenance in this reach, especially silt and vegetation management, should not occur until after the second stage channel has been completed and bedded in, for two reasons: (i) a level</p>

Area	Proposed Measures	Mitigation Measures
		<p>of buffering and sediment filtration will be provided by leaving marginal vegetation in-situ during the 8b construction phase, and (ii) the existing low flow channel of the Clare River will be protected and maintained.</p> <p>The importance of checking spoil for lamprey ammocoetes and crayfish and notifying both IFI and NPWS according to OPW SOPs is emphasised. A suitably qualified aquatic ecologist and / or member of the IFI should be on hand during, at least, the first few hours of silt deposit removal at various places along the channel to determine the magnitude of this potential impact.</p>

7.2.4 Mitigation Measures for Claregalway Footbridge

Area	Proposed Measures	Mitigation Measures
Footbridge	It is proposed to construct a footbridge adjacent to the bridge in Claregalway. The bridge will have no footings in the river channel; therefore no in-stream works are required.	The footbridge will be craned into place, and will have no footings within the river channel; therefore no in-stream works are required. No further mitigation measures are required other than good practice when working adjacent to a watercourse. The main aspects are: best practice in bulk-liquid concrete management addressing batching on site (if that is proposed), pouring and handling, secure shuttering / form-work, adequate curing times. Works should occur during dry weather in a low flow period when there is no chance of flood waters rising onto the 2-stage channel and such timing of works must take into account adequate curing time for concrete. The timing of the works must be specified and agreed with the IFI in relation to fish migration and spawning periods.

7.2.5 Specific Mitigation Measures for Area 8b Channel Widening

The proposed works from downstream of Crusheeny Bridge to approximately 1.3km upstream of Crusheeny Bridge will consist of channel widening to create a 2-stage channel along approximately 1.3km of the Clare River to increase its conveyance capacity during flood events. The excavation will generally consist of a 15m wide 2-stage channel excavated at a level generally a minimum of 0.8m above the first stage channel (existing river bed). The level of the 2-stage channel will be such that it will generally not flood during normal summer flows.

It is anticipated that approximately 88,634m³ of overburden and rock will be removed from the river bank and its surroundings as a result of channel widening. A small amount of deepening of the existing riverbed will occur in the vicinity of the Claregalway Bridge resulting in the removal of approximately 3,380m³ of material. A further 36,854m³ of existing spoil heaps will also be removed from the footprint of the new second stage channel resulting in a total excavation of approximately 128,868m³ of material. Due to the various types of river bank material which will be excavated it is proposed to replace 'like with like', as follows:

1. Where a mixture of soil and rock is encountered, or just soil, it is proposed to stabilise the 2-stage channel through the compaction of the bed material (**Figure 7.1, top diagram**), or reseed and
2. Where rock is encountered during excavations, it is proposed to stabilise the 2-stage channel using recycled crushed stone from the excavation (**Figure 7.1, bottom diagram**).

Various scenarios are presented in **Table 7.4** below for each of the measures proposed and the extent of the river widening works and proposed mitigation measures are illustrated in **Figure 7.1** above.

Table 7.4 Mitigation Measures for Area 8b Channel widening from 1.3km upstream of Crusheeney Bridge to immediately downstream of Crusheeney Bridge

Ref. on Drawings	Works to be carried out	Ecological receptors affected on the North bank	Ecological receptors affected on the South bank	Mitigation Measures
C74 - C90	No channel widening or landspreading and/or stockpiling proposed at these locations.	N/A	N/A	No river widening measures are proposed here therefore no mitigation measures are proposed along this stretch of the main river channel.
C90 - C91	Channel widening on north bank involving the widening of the river at 0.9m above the bed for approximately 10m and widening the banktop by approximately 14m. Landspreading on lands to the north.	Species: Kingfisher Sighting (ER6d) Habitats (within cSAC): Improved Agricultural Grassland GA1 Dry Calcareous and Neutral Grassland GS1 Earth Banks BL2	Species: N/A Habitats (within cSAC): Improved Agricultural Grassland GA1 Scrub WS1 Hedgerow WL1	<p>The working area is to be limited to 20m stretches to reduce the area of exposed river bank.</p> <p>The excavation will commence at the furthest edge of the excavation and work towards the river channel, retaining a dam at the river edge. The second stage channel will be stabilised through the compaction of the bed material. The dam will assist in controlling runoff from the exposed excavation.</p> <p>It is proposed to landspread or stockpile excavated material to the furthest edge of the excavation from the River – on the bank. Standard details of land spreading, stockpiles and the embankment are provided in Figures 2.16, 2.17 and 2.18 respectively.</p> <p>An interceptor ditch with check dams will be provided at the toe of the land spreading areas and/or spoil heaps to collect and treat surface water runoff. Release of suspended solids to all surface waters will be controlled by interception and management of site run-off. Dewatering and surface water runoff discharges from the excavation and landspreading areas will be controlled, collected and routed via appropriate treatment measures. These measures will be in accordance with the CIRIA publication C648, 'Control of Water from Linear Construction Projects' (CIRIA, 2006).</p>

Ref. on Drawings	Works to be carried out	Ecological receptors affected on the North bank	Ecological receptors affected on the South bank	Mitigation Measures
				<p>These facilities will be maintained at least on a daily basis and the maintenance record will be maintained and available for inspection by statutory organisations.</p> <p>The landspreading sites will be reseeded and returned fit for purpose to the land owner. Any fines within the spoil heaps will also wash out and will be collected and treated, prior to discharge to the Clare River. In year 2 the dam will be excavated and disposed of into the interceptor ditch and compacted. The exposed bank at the site of the excavated berm will also be compacted to stabilise the bank.</p> <p>The habitats from C90 to C93 comprise spoil and exposed rock. It is proposed at this location that aggregate stone is washed and stockpiled.</p> <p>Details of the interceptor drain are provided Figure 7.2.</p>
C91 - C92	Channel widening on north bank, including widening of the river at 1.4m above the bed for approximately 17m and widening the banktop by approximately 8m.	Species: N/A Habitats (within cSAC): Improved Agricultural Grassland GA1 Marsh GM1 Earth Banks BL2	Species: Otter Spraint (ER6a) Habitats (partially within cSAC): Improved Agricultural Grassland GA1 Scrub WS1	All other measures as per C90-C91.
C92 - C93	Channel widening and landspreading and/or stockpiling on the north bank eastwards as far the Islandmore drain inlet. Channel widening,	Species: N/A Habitats (Partially within cSAC): Improved Agricultural Grassland GA1 Dry Calcareous and Neutral	Species: N/A Habitats (partially within cSAC): Improved Agricultural Grassland GA1 Scrub WS1	The lower stretch of the Islandmore drain (just upstream of the Clare River confluence) should be electrofished to determine fisheries values in 2 places: (i) within the first 30m stretch to be excavated as part of the channel widening measure, and (ii) within any suitable remaining habitat just upstream of that point that may be affected

Ref. on Drawings	Works to be carried out	Ecological receptors affected on the North bank	Ecological receptors affected on the South bank	Mitigation Measures
	landspreading and/or stockpiling, and construction of embankment on the south bank from the Islandmore drain inlet eastwards.	Grassland GS1 Scrub WS1 (Marsh GM1 habitat excluded from land spreading)		by introduction of the non-return valve flap. All other measures as per C90-C91.
C93 – C94	Channel widening, landspreading and construction of embankment on the south bank.	Species: N/A Habitats (Partially within cSAC): Improved Agricultural Grassland GA1 Dry Calcareous and Neutral Grassland GS1 Wet Grassland GS4 Scrub WS1	Species: N/A Habitats (Partially within cSAC): Improved Agricultural Grassland GA1 Dry Calcareous and Neutral Grassland GS1 Wet Grassland GS4	The area of Molinia Meadow will be avoided and excluded from landspreading. A habitat boundary will be delineated on the ground to prohibit access by machinery. Works in or near this area should be supervised by a suitably qualified ecologist. All other measures as per C90-C91.
C94 – C95	Channel widening and landspreading and construction of embankment on the south bank.	Species: Potential badger sett (ER7b) Animal holes in bank Habitats (Partially within cSAC): Improved Agricultural Grassland GA1 Dry Calcareous and Neutral Grassland GS1 Wet Grassland GS4 Scrub WS1 (Marsh GM1 habitat excluded from landspreading) Possible swallow hole	Species: N/A Habitats (Partially within cSAC): Improved Agricultural Grassland GA1 Dry Calcareous and Neutral Grassland GS1 Wet Grassland GS4	All other measures as per C90-C91.

Ref. on Drawings	Works to be carried out	Ecological receptors affected on the North bank	Ecological receptors affected on the South bank	Mitigation Measures
C95 – C96	Channel widening and landspreading and construction of embankment on the south bank.	Species: N/A Habitats (Partially within cSAC): Improved Agricultural Grassland GA1 Wet Grassland GS4 Turlough FL6	Species: N/A Habitats (Partially within cSAC): Improved Agricultural Grassland GA1 Wet Grassland GS4	<p>Consider introducing coarse gravels into suitable sections of the stretch upstream of Crusheeny Bridge (between sections 95 – 97, for example) to compensate the cumulative impact of loss of channel velocity as a result of bank widening and the dramatic decrease in Froude number around Crusheeny Bridge which is likely to have seriously reduced or eliminated any salmon spawning activity at that point.</p> <p>All other measures as per C90-C91.</p>

7.2.6 Selective Channel Maintenance on Clare River

Mitigations should adhere to the OPW's EMPs and SOPs. Of particular importance in the context of the Clare River Scheme under each element of maintenance proposed are the following:

A – Silt and Vegetation Management

- Carry out this element only during low flows.
- Reed Canary Grass – top the underlying berm, but not below the low flow mark.
- Common Club rush / Branched Burr reed – remove from deeper water along with rootballs and silt.
- Leave marginal vegetation intact on one bank (i.e., avoid clearing both banks/margins) **or**,
- Leave a proportion of vegetation intact on one bank in places where marginal growth is dominant along one bank.
- skipping sections where there are no conveyance issues
- regular checking of spoil for lamprey and crayfish and subsequent adherence to mitigations as stated in OPW SOPs with respect to these species.
- Never remove gravels and other hard substrates as part of this element.

B – Aquatic Vegetation Cutting

None proposed under this scheme

C – Bank Protection

Adhere to OPWs Standard Operating Procedures and Environmental Management Protocols.

D – Bush Cutting / Branch Trimming

Adhere to OPWs Standard Operating Procedures and Environmental Management Protocols.

E – Tree Cutting

- Maintain cover and shade on at least one bank
- Trim lower branches of mature trees to high flow levels while retaining cover.

F – Bridge/Structure Repairs

None proposed under this scheme

The additional measure identified for this scheme as follows;

G – Localised rock removal

- Never remove cobbles or gravels and other finer substrates as part of this element

7.2.6.1 General Mitigation

It is important to avoid cleaning of entire stretches of marginal emergent vegetation. Intermittent stands of emergent marginal vegetation should be left intact to provide cover/ refuge areas for salmonid and coarse fish and other aquatic fauna. This is especially relevant in locations where marginal vegetation is dominant along one bank only, e.g., long glide downstream of the estevelle, downstream of Crusheen Bridge. It is less relevant where the river is either very wide (closer to Curraghmaore Bridge / Lough Corrib) or where a stretch of marginal vegetation can be left intact along the opposing river bank. Works should, therefore, be carried out so that a suitable proportion of marginal vegetation is left intact either along one entire river margin or along at least 30% of one margin in those places where growth is predominantly confined to one side of the river.

Vegetated berms, usually indicated by presence of Red Canary Grass, that have developed within the profile of the channel should be topped to the low flow level only, and not removed, so as to protect and maintain the existing low flow channel which has developed over time.

Stockpiling of any spoil should be placed on flat ground on the Clare River bank or at least 5m from the nearest drainage ditch and preferably in a grassed area, so that any run-off can filter through the grass and prevent sediment run-off. Spoil spread on land should be kept at least 2m back from the edges of land drains and 5m from larger watercourses.

All fuel and hydraulic fuels stored on the worksite should be in a locked and bunded container. Refuelling should only take place well back from the edge of watercourses and all stationary plant should be placed on drip trays to prevent leaking oils reaching the river or entering groundwater.

7.2.6.2 Specific Mitigation

Ideally, no channel maintenance should be carried out in the stretch upstream of Crusheen Bridge undergoing bank widening (Measure 8b). At the least, any maintenance in this reach, especially silt and vegetation management, should not occur until after the second stage channel has been completed and bedded in, for two reasons: (i) a level of buffering and sediment filtration will be provided by leaving marginal vegetation in-situ during the 8b construction phase, and (ii) the existing low flow channel of the Clare River will be protected and maintained.

Random boulders could be placed in the first stretch downstream from Cregmore Bridge (cross-section 100 downstream to about cross-section 97), in order to provide additional cover for juvenile salmon during periods of high flow, when the model predicts significant increases in velocity there. The boulders would also increase microhabitat diversity in the stretch.

The importance of checking spoil for lamprey ammocoetes and crayfish and notifying both IFI and NPWS according to OPW EMPs and SOPs is emphasised. A suitably qualified aquatic ecologist and / or member of the IFI should be on hand during, at least, the first few hours of silt deposit removal at various places along the channel to determine the magnitude of this potential impact.

7.2.7 Specific Mitigation Measures for Annex II Species

The Clare River is targeted for environmental river enhancement works (EREP). Elements of these enhancement works will be carried out in conjunction with the Clare River Flood Relief Scheme, and are detailed below.

All works will be carried out in accordance with OPW EMPs and SOPs (**Appendix A**) together with the mitigation measures presented in this document.

The OPW and their Contractor are required to comply with the Mitigation Measures as outlined in this document. Sign off sheets will be prepared to include site specific Mitigation Measures, which will be signed by the OPW Site Supervisor to ensure that all measures have been implemented satisfactorily. The expected construction period will be phased over four summers (i.e. over four years), with a contract start date anticipated in Summer 2013. The NPWS will be notified of commencement of works and contact details of the relevant site staff will be provided in advance of commencement. The works will be undertaken subject to appropriate weather conditions permitting, with works to cease at times when heavy rainfall is predicted, and when river levels are high or in flood.

7.2.7.1 Atlantic Salmon

To limit cumulative impacts, Measure 4b construction phase should be sequenced to occur a sufficient time after Measure 8b has been carried out. Ideally channel widening could take place in Season 1 of works, with deepening occurring in Season 2. Works are to be carried out between May and

September which is acceptable to avoid salmon spawning times, unless otherwise agreed with IFI and NPWS.

At Claregalway where regrading will be undertaken, fisheries enhancement must include a suitably graded run out section from the pools with fine and coarse substrates which could compensate for fish nursery and macroinvertebrate habitat lost during deepening and pool creation. It may be possible to create similar habitat at the run into the pool at the upstream end since there is likely to be a bed level change at that point where enhancement with fine and coarse substrates may be possible. The Claregalway EPA monitoring station 30C011200 can be relocated slightly into suitable habitat created as part of EREP design. Consideration should be given to inserting the proposed angling pool for Claregalway Bridge at the same time that the channel is restrained within coffer dams in order to reduce the possibility of generating excessive silt.

General Fisheries Enhancements

Using historical data for the Clare River and similar lowland drained rivers elsewhere, combined with the knowledge of the study reach by local IFI staff in Galway, IFI have recommended several EREP measures designed to improve the feeding and holding capacity of the Clare River study reach for salmon and trout and to improve the spawning potential for salmon within the study reach. The approach is to work with the existing channel form, introducing structures and materials in appropriate stretches in order to make it more natural and hence improve its salmonid fish carrying capacity. Some enhancement measures are also designed to improve angling in the study reach. Some or all of the following measures have been proposed and the details are as follows:

- Development of angling pools (upgrading of existing pool areas and creation of new pools),
- Excavation of lateral scour pools along meander bends,
- Creation of rubble mats (along high points of existing river bed),
- Addition of spawning gravels,
- Addition of random boulders,
- Construction of paired stone deflectors,
- Construction of a series of alternating stone deflectors, and
- Angler access across the new flood berm at intervals of approximately every 100m.

The following paragraphs paraphrased from O'Grady (2006) give a brief outline of each measure and its intended outcome:

Creation of centre channel pools. Central channel pools provide lies for larger fish as well as being an important site for angling. During periods of low flow they also act as fish refuges. Where the conditions are suitable spawning gravels can be placed below such pools, see **Figure 7.3** below

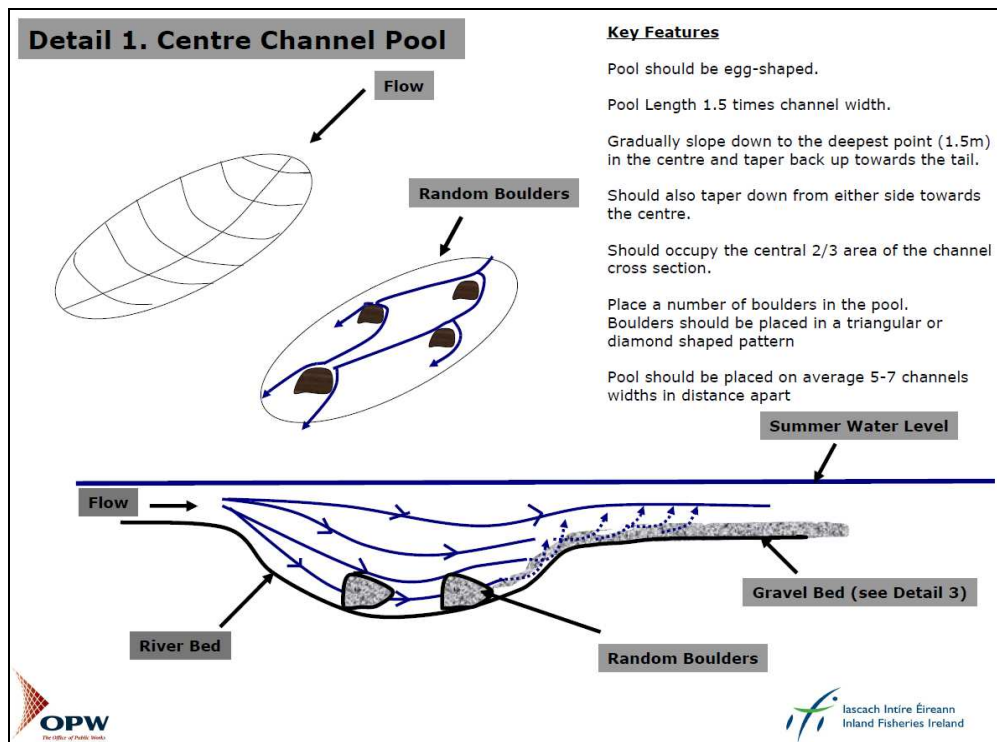


Figure 7.3 Creation of Centre Channel Pools

Gravel is often scarce or lacking in drained river stretches because it may have been completely removed down to unsuitable bed material (e.g. boulder clay or bed rock) and the new bed material may be unsuitable to allow new gravels to be eroded. Thus the necessity to re-introduce gravels in some drained rivers. Any spawning gravel placed in this part of the Clare will probably be coarse and aimed at enhancing salmon rather than trout spawning; coarser gravel is also more likely to remain in place for longer in the main channel. It will be introduced below pools where upwelling water from the pool will help to keep deposited eggs aerated and silt free, see Figure 7.4 and 7.5 below.

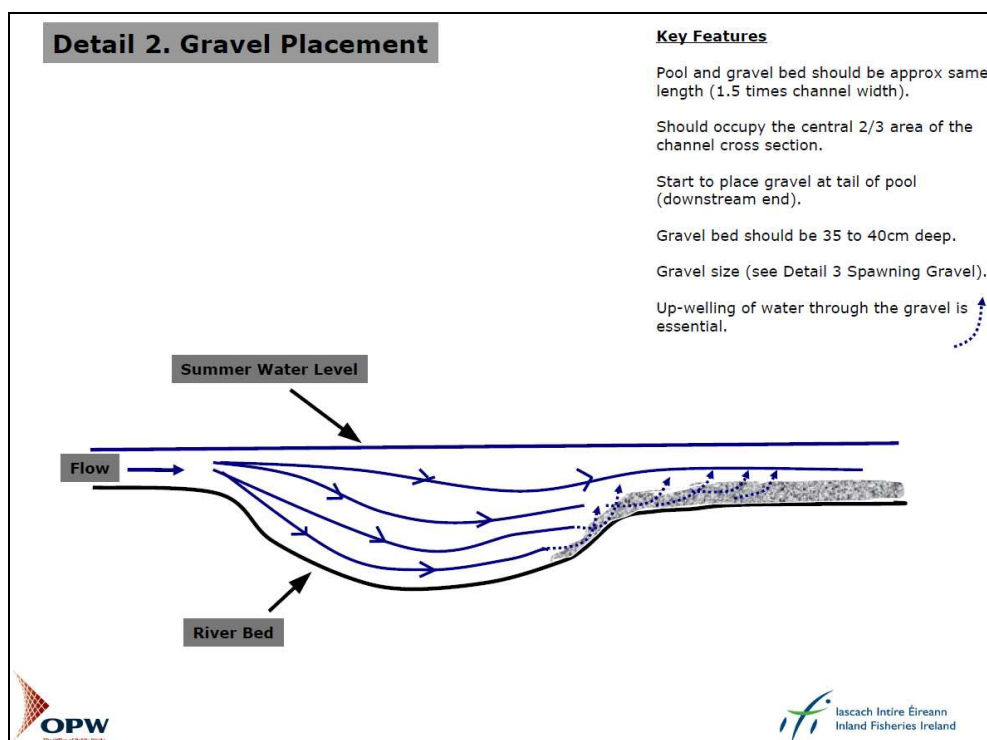


Figure 7.4 Pool and Gravel Bed

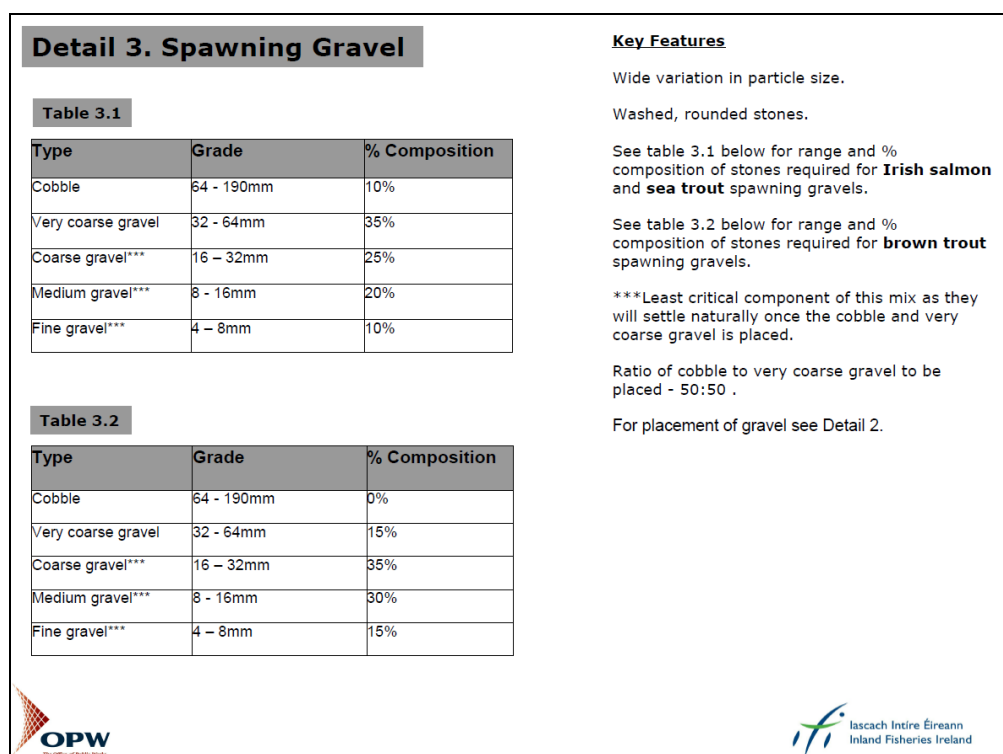


Figure 7.5 Spawning Gravel Size

Random boulders strategically placed can have several positive impacts e.g. providing lies for salmon and trout in their lee, result in the excavation of small scour pools downstream, or increase deposits of fine gravel immediately below which can be used by trout to spawn. Essentially they can create more dynamic flows and microhabitats in otherwise uniform stretches with favourable outcomes for salmonids.

Water quality will be monitored by an independent party at stages throughout the construction phase with the approval and cooperation of the OPW and their contractor(s) and the IFI.

Post works site surveys will be undertaken annually by the OPW to determine if the new works are giving rise to excessive bank erosion or deposition anywhere along the channel.

7.2.7.2 White-clawed Crayfish

During regrading works at Claregalway Bridge, OPW EMPs and SOPs will be applied to respond in the case white-clawed crayfish are present and emerge from refuges at the times of channel dewatering on both banks (2 separate occasions). In the event that significant populations of white clawed crayfish emerge, advice will be sought from IFI and NPWS to facilitate any necessary rescue and relocation. Works are to be carried out between May and September which will also avoid critical periods for crayfish.

Additional on-site mitigation measures should include the following, (further details in King, 2008b):

- Bucket management - Increased draining times and holes,
- Bucket management – trial sweeps with bucket and jib,
- Checking spoil and reporting,
- Returning crayfish to the channel, and

- Enhancements.

7.2.7.3 Brook Lamprey

The OPW has EMPs and SOPs in place (see **Appendix A**) for lamprey. Works are to be carried out between May and September which will avoid critical periods for river/brook lampreys (The sea lamprey critical spawning period (summer months) will not be avoided by the timing of the works, and though they are unlikely to be spawning around the Claregalway section of the Clare River, it cannot be entirely ruled out).

Additional on-site mitigation measures should include the following (further details in King, 2008a):

- Bucket management - Increased draining times and holes: Allowing the water to drain from the excavation bucket, while suspended over the channel, for longer periods of time before the spoil is placed on the bank full/slope would permit a potentially greater degree of escapement by juvenile lamprey displaced into the bucket,
- Checking spoil and reporting - Increased checking of the spoils by driver crews is essential for the identification of new lamprey habitats and populations,
- Returning lamprey to the channel - It is important that lamprey found on spoil heaps are returned to the channels, especially in channels which have been designated as candidate Special Areas of Conservation (cSACs). This mitigation requires that one team member of the OPW machine crew picks over spoil excavated by his/her colleague, placing any lamprey into a bucket of fresh water, and
- Deep waters - Potential lamprey habitats are often not detectable during walkover surveys due to water depth. In cases like these the excavator bucket can be used as a sampling device in order to check for lamprey. If good numbers of lamprey are detected during maintenance then a strategy could be implemented whereby if >10 lamprey per m^2 are detected in sediment then the areas should be avoided. If <10 lamprey per m^2 are found then the area should receive appropriately sensitive maintenance.

7.2.7.4 Otter

The otter holts found within the study area should be monitored, excluded (if necessary) and excavated under licence from the NPWS, prior to the commencement of the flood relief works. Mitigation measures should be undertaken to avoid the potential impacts.

- Direct Habitat Loss,
- Severance,
- Loss of Life,
- Physical disturbance, and
- Noise disturbance.

The OPW EMPs and SOPs (see **Appendix A**) were produced to ensure that the environment was protected during maintenance activities. The SOPs were last revised in April 2011 and have been issued to all operational staff. The SOPs include a Guidance Note detailing 10 steps to Environmentally Friendly Maintenance. Four of these steps significantly lessen the potential impacts of proposed works on otters.

These include:

1. Leave section untouched (if channel capacity is not effected, then leave intact and only maintain if environmental works are required) - This will ensure that unnecessary impacts are avoided, and overall potential impacts on otter will be minimised.
2. Management of trees (leave intact if no reduction in channel capacity is caused, remove overhanging branches to flood level and use a saw or secateurs for removal, not an excavator). This will ensure that suitable riparian habitat, for otters, will not be removed unnecessarily, and potential destructive impacts on otter sites from machinery will be avoided.
3. Replace boulders (reinstate boulders and gravels as removed by maintenance operations, reinstate boulders into channel from spoil heaps, and place boulders below low flow level and staggered) - This will ensure that features are available for otters to use as territorial sign posts, and substrate is available for fish (spawning/hiding places). Sustaining populations of fish will provide a valuable food source for otters.
4. Steps to enhance fisheries (loosen bed gravels and if channel bed is composed of suitable material, excavate pools and create riffles). This will ensure that fisheries habitat, fish populations and food availability for otters are improved.

7.2.8 Specific Mitigation Measures for Hydrology and Drainage

Appropriate mitigation measures have been proposed in order to minimise each of the identified impacts both during the construction and operational phases of the proposed flood relief works. The following documents were referenced during the preparation of the mitigation measures:

- Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites. North Western Regional Fisheries Board,
- CIRIA (Construction Industry Research and Information Association) guidance on '*Control of Water Pollution from Linear Construction Projects*' (CIRIA Report No. C648, 2006), and
- Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites. EPA 833-R-060-04 May 2007.

7.2.8.1 Drainage and Flooding

During Construction

The following mitigation measures are proposed to manage flooding and storm water drainage during the construction phase of the works:

- To avoid any water logging in the lands adjacent to the river banks, it is proposed to maintain the existing surface water flow paths by providing regular breaks in any temporary or permanent stockpiles to ensure overland surface water flow is not restricted;
- Any spoil stockpiles must be stabilised through reseeding, to prevent spoil collapsing during high rainfall events;
- An examination of historical flood records for the Clare River at Claregalway and Corofin hydrometric stations shows that most of the worst fluvial flooding in this catchment occurs during the winter months as would be expected. It is therefore recommended that the works be undertaken when flooding risks are low.
- Any impact of the proposed works on river water quality should be kept minimal. Mitigation measures have been specified above for both terrestrial and aquatic features and should be adhered to, and

- IFI should be informed prior to channel widening works commencing. All works will be carried out in accordance with the “Requirements for the Protection of Fisheries Habitat during Construction and Development Works at River Sites, North Western Regional Fisheries Board” and the OPW SOPs (**Appendix A**).

During Operation

The completed scheme will reduce the extent of flooding in Claregalway, Crusheeny, Caherlea/Lisheenavalla and Carnmore/Cashla. There will be minimal impacts on the existing drainage regime during the operational phase of the works. The completed scheme will however result in changed velocities along the river stretch during all flow conditions. The potential impacts of these changed velocities are discussed in detail in **Appendix E**. On completion the Clare River will remain an OPW scheduled channel, and as such its maintenance will form part of OPW statutory obligations under the 1945 Arterial Drainage Act.

7.2.8.2 Low-flows

During Construction

Any impact on the low-flow rate (reduction) in the river likely to be caused during the construction stage of the works will be minimised by maintaining the normal lateral surface water flow path to the river by providing regular breaks in any temporary or permanent stockpiles to ensure overland surface water flow is not restricted.

During Operation

Any impacts of the proposed flood relief scheme on the low-flow regime of the river during the post construction stage are expected to be minimal, since the proposed works will not include any deepening and widening of the existing low-flow channel of the river (with the exception of minor works at Claregalway Bridge and EREP works).

8 CONCLUSIONS

8.1 INTEGRITY OF THE SITE

From the Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC (EC, 2002), the meaning of integrity is described as follows:

‘The integrity of a site involves its ecological functions. The decision as to whether it is adversely affected should focus on and be limited to the site’s conservation objectives’ (MN2000, paragraph 4.6(3)).

A Conservation Management Plan has not been prepared for the Lough Corrib cSAC. The following conservation objectives have been provided by the NPWS for Lough Corrib cSAC:

Objective: To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the cSAC has been selected (see **Table 3.7** and **Table 3.8**).

A Conservation Management Plan has not yet been prepared for the Lough Corrib SPA. The following conservation objectives have been provided by the NPWS for Lough Corrib SPA:

Objective: To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA (see **Table 3.9** and **Table 3.10**).

From the information gathered and the predictions made about the changes that are likely to result from the construction and operation stages of the project, the integrity of site checklist is completed in **Table 8.1**.

Table 8.1 Integrity of Site Checklist

Conservation objectives		
Does the project have the potential to:	Yes or No	Comment
Cause delays in progress towards achieving the conservation objectives of the site?	No	Annex I Habitats: The potential for loss and/or disturbance to habitats will be minimised and will not cause delays in achieving the conservation objectives of the site. Required mitigation measures are outlined in Section 7. Annex II Species: The potential for loss and/or disturbance of key species will be avoided and will not cause delays in achieving the conservation objectives of the site. Required mitigation measures are outlined in Section 7.
Interrupt progress towards achieving the conservation objectives of the site?	No	Annex I Habitats: The potential for loss and/or disturbance to habitats will be minimised and will not cause delays in achieving the conservation objectives of the site. Required mitigation measures are outlined in Section 7. Annex II Species: The potential for loss and/or disturbance of key species will be minimised and will not cause delays in achieving the conservation objectives of the site. Required mitigation measures are outlined in Section 7.
Disrupt those factors that help to	No	Potential impacts affecting water quality (a key

Conservation objectives		
Does the project have the potential to:	Yes or No	Comment
maintain the favourable conditions of the site?		indicator of conservation value) within the localised area of the proposed development will be mitigated against. Likewise, the risk of introduction and/or dispersion of non-native invasive species will be minimised by following the <i>OPW Arterial Drainage Maintenance Service Environmental Management Protocols & Standard Operating Procedures (OPW, 2011)</i> . Required mitigation measures are outlined in Section 7.
Interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site?	No	Potential impacts affecting water quality (a key indicator of conservation value) within the localised area of the proposed development will be mitigated against. Likewise the risk of introduction and/or dispersion of non-native invasive species will be minimised by following the guidelines provided on the Invasive Species Ireland website and best practice. Required mitigation measures are outlined in Section 7.
Other objectives: does the project or plan have the potential to:		
Cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem?	No	Potential impacts may occur through pollution of watercourses during the construction phase. However these impacts can be effectively mitigated. Required mitigation measures are outlined in Section 7.
Change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site?	No	Potential impacts may occur through pollution of watercourses during the construction phase. This could impact on protected habitats and species downstream of the proposed development. Required mitigation measures are outlined in Section 7.
Interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)?	No	Potential impacts may occur through pollution of watercourses during the construction phase. This could impact on protected habitats and species downstream of the proposed development. Required mitigation measures are outlined in Section 7.
Reduce the area of key habitats?	No	There will be no direct loss of key habitats within the Natura 2000 sites. However, potential indirect impacts may occur through pollution of watercourses during the construction phase and trampling of habitats to gain access to the sites. These could impact on protected habitats downstream of the proposed development. Required mitigation measures are outlined in Section 7.
Reduce the population of key species?	No	There are potential short term impacts to Annex II species such as Otter, Atlantic Salmon, Brook Lamprey and White-clawed Crayfish during the construction period only, from potential run-off of pollutants. Mitigation measures to minimise these short term local impacts are proposed to avoid impacts to the integrity of the site, these measures are outlined in Section 7.
Change the balance between key species?	No	Otter preys on trout and other fish. Therefore any impacts to fish species may impact on the

Conservation objectives		
Does the project have the potential to:	Yes or No	Comment
		balance of the key species within the effected catchments. There is also potential for impacts to Atlantic Salmon and White-clawed Crayfish during the construction period only, from potential run-off of pollutants. These impacts can be effectively mitigated and measures are outlined in Section 7.
Reduce diversity of the site?	No	There is potential for loss of Otter, Atlantic Salmon, Brook Lamprey and White-clawed Crayfish, during the construction period only, from potential run-off of pollutants. Required mitigation measures are outlined in Section 7.
Result in disturbance that could affect population size or density or the balance between key species?	No	There is potential for loss of Otter, Atlantic Salmon, Brook Lamprey and White-clawed Crayfish, during the construction period only, from potential run-off of pollutants. Required mitigation measures are outlined in Section 7.
Result in fragmentation?	No	No impacts have been identified that would result in fragmentation of species or habitats for which the Natura 2000 site has been designated.
Result in loss or reduction of key features (e.g. tree cover, tidal exposure, annual flooding, etc.)?	No	No key features of the Natura 2000 sites will be lost as a result of construction or operation of the proposed development.

Source: "Assessment of Plans and Projects Significantly Affecting Natura 2000 Sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC"

This Natura Impact Statement for the proposed Flood Relief Scheme has been carried out in accordance with Article 6 (3) of the 'Habitats' Directive 92/43/EEC. This Statement provides a professional scientific examination of the project and the relevant Natura 2000 sites, identifying and characterising any possible implications for the Natura 2000 site in view of the conservation objectives, taking account of in-combination effects.

Robust and effective mitigation measures have been proposed for the avoidance of any impacts affecting water quality within Lough Corrib cSAC. Specific mitigation measures have been proposed for the prevention of impacts to Atlantic Salmon, Brook Lamprey, White-clawed Crayfish and Otter. Likewise, precautions will be taken in relation to non-native invasive species during the construction phase.

With regard to downstream impacts on Lough Corrib the primary concern would be sediment loss associated with individual flood relief scheme measures. The timing and sequencing of upstream flood relief scheme measures coupled with mitigation applied with respect to each measure will reduce the potential for silt generation at source and stem the potential for losses. Moreover, all of the instream works will be undertaken during the May to September low flow period but even then only when water levels allow. It is worth noting that all of the study area has a very low gradient so that a substantial amount of silt generated by instream works associated with drainage channel cleaning and regrading will tend to settle within the channels themselves. Furthermore, most activities will be situated several kilometres upstream of the lake, allowing for dilution and settlement within the main channel, before reaching the lake. Finally, it should be remembered that the Clare River drains a very extensive catchment about 30% of the whole Lough Corrib cSAC, such that during floods, the additional solids load from the area of the works is likely to form only a small contribution to the total load. That, combined with the episodic nature of suspended solids transport suggests that the proposed works, after mitigation, are unlikely to have an adverse impact on the receiving waters of Lower Lough Corrib and any qualifying interests present in the lake. Impacts to the wider Corrib cSAC from the proposed measures are not expected once the mitigation measures recommended are implemented in full.

The OPW EMPs and SOPs will form the backbone of the method statement, supplemented by mitigation measures provided in **Section 7**. The method statement will detail how these mitigation measures will be monitored for effectiveness by both OPW themselves and independently through water quality monitoring proposed. There will be ongoing consultation by the OPW with IFI and NPWS throughout all phases of the works which will include attendance at progress meetings at stages agreed in advance by the OPW and designated IFI and NPWS representatives. A mechanism for reporting of pollution incidents will be agreed in advance between the contractor(s) and the IFI.

The conclusion of this Natura Impact Statement is that there will be no potential for cumulative impacts arising in combination with any other plans or proposals, with the implementation of best practice and the recommended mitigation measures, it is considered that the proposed Flood Relief Scheme will not adversely affect the integrity of Lough Corrib cSAC and SPA, as no reasonable scientific doubt remains as to the absence of such effects.

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APPENDIX A

OPW Arterial Drainage Maintenance Service Environmental Management Protocols & Standard Operating Procedures (OPW, April 2011)



The Office of Public Works

Arterial Drainage Maintenance Service

Environmental Management Protocols

&

Standard Operating Procedures

The Office of Public Works
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West Region Drainage Maintenance
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The Office of Public Works Arterial Drainage Maintenance Environmental Management Protocols & Standard Operating Procedures

Contents:	Current Version
Environmental Management Protocols	April 2011
Environmental Drainage Maintenance Guidance Notes (10 Steps to Environmentally Friendly Maintenance)	April 2011
Lamprey Standard Operating Procedure	V2 April 2009
Crayfish Standard Operating Procedure	V2 April 2009
Otter Standard Operating Procedure	V2 April 2009
Mussels Standard Operating Procedure	V2 April 2009
Invasive Species Standard Operating Procedure	V2 March 2009
Zebra Mussel Standard Operating Procedure	V2 May 2009
Blank OPW/ EREP Audit Form	April 2011
NPWS Local Contact Details	May 2009
Fisheries Contact Details	April 2011
OPW Bridges on National Primary Roads	March 2009

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ENVIRONMENTAL MANAGEMENT PROTOCOLS

ARTERIAL DRAINAGE MAINTENANCE SERVICE (APPLICABLE TO ENGINEERS, TECHNICIANS AND FOREMEN)



PART I – OPERATIONS MANAGEMENT

COMMUNICATIONS - STATUTORY STAKEHOLDERS

- By the end of September of each year, each Drainage Region to forward a ***draft*** copy of its Annual Works Programme for the coming year to OPW's Environment Section, and to the Inland Fisheries Ireland (IFI) EREP Project Manager who will review it for appropriate sites and study locations for the Environmental River Enhancement Programme 2008 -2012.
- By end of November of each year, each Drainage Region to forward the relevant sections of the Finalised Annual Maintenance Programme for the coming year with a copy of appropriate scheme maps, to the National Parks & Wildlife Services (NPWS) Regional Managers and the IFI Directors.
- When compiling the programme the type of works proposed should be indicated for each channel under the headings A-F to facilitate the Screening for Appropriate Assessment (AA).
 - A – Silt & Vegetation Management
 - B – Aquatic Vegetation Cutting
 - C – Bank Protection
 - D – Bush Cutting/Branch Trimming
 - E – Tree Cutting
 - F – Bridge/ Structure Repairs
- Ideally, approximate timing (season/month) and approximate duration of works should be included for each channel.
- Works that fall within SACs, SPAs or NHAs are to be highlighted on the programme.
- As a follow up, the Drainage Regions offer the opportunity for a meeting with the stakeholders to discuss the programme and where a meeting is requested, preferable for this to take place as early as possible in the year.
- Prior to entry onto a channel contained wholly or partly within an SAC, SPA or NHA, three weeks notice in advance of entry, and for SAC & SPA an AA Screening Statement/Conclusion Statement must be completed and forwarded through the NPWS District Conservation Officer.

INTERIM STAKEHOLDERS MEETINGS

- In addition to the start of the year stakeholder meeting to overview the Annual Works Programme, Regional Offices will offer and facilitate a schedule of more frequent and catchment focused meetings.
- The need and the frequency of these meetings will be determined on a regional basis in partnership with the relevant stakeholders.
- Typically a frequency of every 2-3 months to discuss the following 2-3 months work on the catchment, identifying any further environmental sensitivities, appropriate mitigating measures, follow up joint site visits where deemed beneficial and flagging any opportunities for added benefit in proposed River Enhancement works.
- Typical attendance includes a range of OPW Management Staff, i.e. Engineer, Technician and/or Foreman, NPWS Rangers and/or DCO and IFI Officers.
- OPW Engineer will compile minutes of the meeting to record attendance and a brief account

of main decisions and follow up actions.

- Any channel specific information resulting from these meetings, such as timing requests should be entered into the Records Database in accordance with the National Recording Process.
- Fruitful consultations with statutory stakeholders such as NPWS and IFI are of critical importance to continuously improving environmental performance. However, in the interest of maximising the efficiency of stakeholders input, Management Staff are as far as practical, to plan their consultative requirements and address a range of aspects in any one discussion forum. Interim Stakeholder Meetings or similar forums offer good opportunities to maximise consultation efficiencies.

CORRESPONDENCE

- All Environment related correspondence/complaints should be logged on the Engineering Services Correspondence Database as per normal protocol. Complaints received should be forwarded to the Environment Section should assistance be required.

WALKOVER SURVEYS

- As a component to the EREP Project, on a number of channels, EREP team will request for Walkover Surveys as an opportunity to discuss in detail on site the environmental options for a particular channel with a range of relevant stakeholders.
- Typical attendance will be an IFI EREP representative, a range of OPW Management Staff and relevant Operational Crew if deemed beneficial, local IFI Officer and/or NPWS Ranger or DCO.
- OPW Management Staff to liaise with EREP team and coordinate the site visit with local IFI and NPWS to facilitate their participation if these stakeholders wish to attend.
- Environmental procedures as agreed on-site will be recorded by IFI EREP team and issued to the OPW Engineer as part of the design guidance for the particular Enhanced Maintenance works.
- Regional Management Staff to ensure that Operational Staff carry out the works in accordance with the agreed procedures.

NATURA 2000 SITE ASSESSMENTS

- All scheduled maintenance operations in the vicinity of a Natura 2000 Site i.e. an SAC or SPA, will require Screening for Appropriate Assessment and Stage II Appropriate Assessment where required.
- By the end of September of each year, each Drainage Region to forward a ***draft*** copy of its Annual Works Programme for the coming year to OPW's Environment Section to facilitate this process.
- Environment Section will procure the Ecological Consultant, collate all the channel lists and issue completed AA Screening Statements/Conclusion Statements to the respective OPW engineers as completed.
- The Ecological Consultant will consult with OPW management to define the precise extents of proposed works in each Natura 2000 Site.
- In addition, the Ecological Consultant will be carrying out walkover surveys for pre and post maintenance works for a representative number of the sites and OPW Management will be required to facilitate the same.
- OPW Management Staff will issue the relevant completed Assessments directly to the NPWS District Conservation Officer. In addition, Environment Section will issue all of the Assessments to the Development Applications Unit, DEHLG, Dun Sceine, Harcourt Lane,

Dublin 2.

- Preferably for the Assessments to be forwarded to the DCO as soon as it is completed, but in any case with a minimum of three weeks notice before commencement of the works.
- Management Staff to implement all prescribed mitigating measures and ensure that Operational Staff are made aware of all relevant site specific mitigating measures.

Current version of Designated Sites GIS Layers available on Socialtext

Environmental River Enhancement Programme (EREP)

- After reviewing the draft Annual Works Programme, IFI EREP team will revert to the respective Regional Engineers Office and request follow up meetings as required to discuss aspects of the programme in relation to the EREP.
- Enhancement sites require ground truthing to ensure they are technically feasible as envisaged. This is to be coordinated by the IFI EREP team with local IFI and OPW personnel as required.
- Sites shortlisted by IFI EREP team for Capital Enhancement works are emanating from a screening process of technical feasibility in terms of gradient and water quality. In the future, sites selected will increasingly be resulting from other requirements such as the Water Framework Directive Programme Of Measures under Morphology.
- IFI EREP team in consultation with the local IFI and OPW, will prioritise sites on a basis of best return for investment. IFI EREP team will liaise with the Regional Offices to assist in identifying channels deemed suitable for capital enhancement which should be integrated with the following years work programme. In some cases, a situation may arise where the site selected is not overlapping with the current Annual Works Programme but where feasible and subject to any third party agreement, OPW will accommodate these works.
- Similarly for enhanced maintenance works, IFI EREP team in consultation with the local IFI and OPW, will select sites again that are technically feasible and offer best return for investment. These sites will normally be from channels on the current Annual Works Programme.
- IFI EREP team will coordinate all the scientific monitoring works, provide the enhancement design details and guidance to OPW Management Staff and maintain a reasonable level of site supervision, proportional to the complexity of the works and the experience of the OPW Staff involved.
- Consultations with local IFI through the Interim Stakeholder meetings are encouraged to identify sites suitable for Enhancement works and in some cases the local IFI may also be in a position to produce an enhancement design. All enhancement designs and works are to be coordinated through the IFI EREP team to facilitate formal recording into the national EREP project and allow for biodiversity and/or hydromorphology monitoring if required. Local IFI may coordinate with IFI EREP team or alternatively OPW Regional Staff coordinate directly with the EREP team.
- A small portion of channels have more infrequent maintenance cycles and these cases can offer particularly good opportunities for enhanced maintenance type works. Channels programmed where maintenance works have not being carried out for in excess of 10 years, to be flagged to IFI EREP team for possible Walkover Surveys and guidance on appropriate EDM procedures.
- Management Staff to ensure that as far as practical, all Operational crews have an opportunity to get experience on these projects.

- Each Regional Engineer is to make provision in the Annual Works Programme for Plant & Labour resources in addition to provisions in the Annual Budget for materials subject to expenditure constraints. Typical resources are as follows:

Capital Enhancement

Region	Target (Km)	Capital Costs	Machine Weeks	ManWeeks
East Region	20	€200,000	30	60
South West Region	14	€140,000	21	42
West Region	16	€160,000	24	48
	50	€500,000	75	150

Enhanced Maintenance *(in conjunction with routine maintenance)*

Region	Target (Km)	Capital Costs	Machine Weeks	ManWeeks
East Region	20		15	0
South West Region	14		11	0
West Region	16		12	0
	50		38	0

- Progress targets for EREP to be shown on monthly production reports.
- OPW are the primary contact point for liaison with landowners including the organising of access and egress for machinery and materials. Brochures on EREP are available in all Regional Offices. Additional copies can be obtained through OPW Environment Section.
- Management Staff are encouraged to maximise the use of all available on-site materials such as stone from historical spoil heaps as opposed to importing materials at a higher cost.
- In addition, Management Staff are encouraged to maximise synergies with other funding sources such as Fisheries Development grants attained by local Angling Clubs which could combine with OPW plant and labour to supply materials.
- In all cases, Inland Fisheries Ireland are the statutory authority to give design guidance to OPW. Angling Clubs or other sectoral funding sources to liaise with the Fisheries authorities in respect of all design and environmental monitoring requirements.
- As-Built plans are to be completed by the IFI EREP team for all enhancement works. This will entail a site visit by IFI and relevant OPW Staff where requested. These will be retained by IFI as well as any relevant design information.
- IFI EREP team will forward a copy of the As-Built plans to Environment Section who will upload the same to Socialtext for access to the information by all Staff.
- At the end of the year, IFI EREP team will forward Environment Section a GIS layer of that year's works for uploading to OPWs GIS records.

Current version of Enhancement GIS Layer available on Socialtext

NATIONAL RECORDING PROCESS

- Weekly Record Cards can contain information on Lamprey, Crayfish, Kingfisher, Mussels, Otter and other site specific environmental information as arises.
- Environmental information on Cards will be recorded onto the Records Database by each Drainage office. The latest Records Database has been revised to integrate environmental records.
- On an interim basis, a copy of all Cards with environmental information to be copied and

forwarded to Environment Section by each Drainage Office. This is to allow Environment Section to review the detail of information being recorded, feedback to the Operational crews through the Management Staff and attain a national consistency in the style of information being recorded.

- All relevant information to be uploaded to GIS by Environment Section.
- All other relevant environmental information sourced by Management Staff whether from direct observations or through stakeholder consultations, should be entered into the Records Database.
- Relevant environmental information sourced through the EREP project and related research will be forwarded by IFI EREP team to Environment Section directly for centralised GIS uploading.
- On an annual basis, Environment Section will compile an update of Weekly Records Cards species records and make available to all Staff via Socialtext to assist in tracking progress.
- On an ongoing basis, Environment Section will make available the various OPW compiled species records to other authorities to assist in contributing to any appropriate national conservation knowledge.
- As described above, each drainage office will upload onto the Records Database all environmental information from the Weekly Record Cards and all other broader environmental information attained by Management Staff. Within a few years, it's envisaged that multiple regional Staff will be able to use the new Records Database, and then environmental information from all sources will be uploaded directly by a whole host of Staff. Typically this will include any mitigating agreements for particular channels agreed with stakeholders or any other individuals observation such as protected species presence noted during a separate site visit.

SALMONIDS

- As far as practicable, the maintenance works are to be scheduled to accommodate salmonid (Salmon & Trout) spawning areas, as is in place across all regions for many years. This is a widespread measure on many catchments and is most applicable to medium gradient channels with gravel substrate.
- Prior to works commencing, consult with local IFI. Ideally, consultations to be conducted through Interim Stakeholder Meetings or alternatively, direct contact in respect of the specific site.
- Maintenance operations on salmonid spawning beds typically carried out between July and September but timing subject to adjustment due to local knowledge of IFI.
- Raking of spawning gravels to improve spawning capacity also typically carried out between July and September.
- River enhancement works to enhance both the fisheries and the broader ecology of the drainage channel are covered under the EREP project.
- In the future, as the extent of completed enhancement works increases, there is a risk of damage to structures due to future maintenance. All channels scheduled for maintenance to be checked against GIS records for presence of previous enhancement works. Where a presence is indicated, carry out a site visit as appropriate and in consultation with IFI, devise on-site procedures to protect or enhance existing instream structures.

Current version of Enhancements & Spawning GIS Layers available on Socialtext.

LAMPREY (BROOK, RIVER & SEA) & CRAYFISH

- All channels scheduled for maintenance to be checked against GIS records for presence of Lamprey or Crayfish.

- In accordance with the SOPs, Operational Staff will closely observe the spoil three times daily and report to the Foreman any Lamprey or Crayfish located.
- Mitigating procedures to apply when:
 - GIS records indicate species presence, or
 - Operational Staff locate Lamprey or Crayfish during operations, or
 - Where particularly suitable habitat is identified by an environmental stakeholder.
- If significant populations are encountered, notify IFI EREP team and facilitate scientific studies if site deemed suitable by IFI.
- If significant populations are encountered, notify NPWS Ranger and local IFI Officer and conduct site visit as necessary.
- Combination of Mitigating Measures to be selected as applicable to the site while balancing the Flood Risk Management requirements and a sustainable approach to the conservation of Lamprey and/or Crayfish.
- Identify extent of channel applicable and the mitigating measures to apply.
- Inform Operational Staff of mitigating requirements.

Suite of relevant Mitigating Measures as follows:

On site measures

- Skip sections to retain intact habitat either in one long reach or multiple short reaches.
- Maintenance in an upstream direction to avoid secondary disturbance of a species moving downstream. Balance with the advantage of maintenance in a downstream direction where instream vegetation minimises siltation.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective. This is effective for Lamprey juveniles as they are in the silt. For Crayfish, cutting of “Flaggers” type vegetation is effective but cutting of “water celery” mat type vegetation is less effective as it can result in Crayfish being removed within the weed mass.

Forward planning measures

- Annual maintenance of the channel in shorter segments sequentially completing the same over a number of years. Balance with maintaining reasonably operational efficiency in terms of machinery moving, transport, access and egress.
- Longer time periods between maintenance cycles e.g. move from 4-6 years to 7 to 8 years. Balance with overall river ecology as longer maintenance cycles will lead to more heavy-scale works.
- Timing of maintenance to accommodate Lamprey spawning. Stakeholder consultations between OPW and local IFI for salmonid mitigating purposes, to include consideration of Lamprey spawning. This is to be applied to channels where Lamprey spawning habitat is known as informed by IFI or other stakeholder. For River & Brook Lamprey, no works on relevant spawning channel from end March to start of June subject to adjustment due to local knowledge of IFI. For Sea Lamprey, as they spawn during the summer months, restrictions from late April to early July are required. To be applied to channels where Sea Lamprey spawning is known as informed by IFI or other stakeholder and timing subject to adjustment due to local knowledge of IFI. Note that Sea Lamprey are much less widespread so envisaged that the scale of this mitigation will be very limited.
- Loosening spawning bed gravels. Stakeholder consultations between OPW and IFI for salmonid gravel loosening purposes, now to include consideration of Lamprey spawning as above.
- Enhance channel profile such as skewed cross section and promote deposition of silt along margins. Integrate with IFI discussions on planning the EREP to avail of enhancement

- opportunities particularly for channels where Lamprey or Crayfish presence is recorded.
- Modification of OPW structures which impede upstream migration. Identification of weirs as barriers to be as informed by IFI or other stakeholder. Where modification designs required, liaison with IFI EREP team to integrate the improvement works into the EREP project. Identification of a bridge apron step attained through ongoing site inspections by OPW Management Staff or other stakeholder. In consultation with IFI, steps at bridges to be modified by a rock armour type ramp or similar. Envisaged that these measures will be of a limited scale on drained channels.

GIS Records:

- Where Lamprey or Crayfish are discovered, Operational Staff will have recorded the same on the Weekly Record Cards. Cards with species location information will be uploaded to the Records Database as stated in the National Recording Process.
- All new Lamprey spawning location information attained through stakeholder consultation to be recorded on the Records Database in accordance with the National Recording Process.
- All database records of species location will be uploaded to GIS by Environment Section.
- IFI EREP team conducting ongoing research on Lamprey & Crayfish as a component of the EREP works. Scientific data calculating species density for some sites will be developed and to be supplied by IFI to OPW and uploaded to GIS by Environment Section.

Current version of relevant SOPs: V2 April 2009

Current version of relevant GIS Layers available on Socialtext.

OTTER

- Research to date indicates that Otters are widespread across all sizes of drainage channels nationally, hence it is prudent to assume that Otter use any particular site.
- In accordance with the Otter SOP, Operational Staff will walkover the works area one week in advance in conjunction with the Health & Safety assessment noting dense cover with access directly to the water that is to be avoided where feasible.
- In addition, any recognisable signs of Otter presence observed such as Spraints, Footprints or suspected Holts, will be recorded on the Weekly Record Cards. These signs were identified in Otter Awareness Training carried out across all regions in 2008.
- While holts are usually well concealed, where Operational Staff observe a suspected holt such as a burrow opening, in consultation with Management Staff, subject to flood risk management functions, no works to within a 50m buffer each side.

Bridge mammal crossing enhancement

- As a component of ongoing consultations with NPWS and other stakeholders, evidence may arise from time to time as to a particular spot for Otter road kill. Typically this can arise where the Otter always traverses the roadway as opposed to going through the bridge. While this scenario is not known to be a widespread issue in Ireland, the highest risk locations are on the National Primary Roads which have the heaviest traffic volumes.
- There are 170 National Primary Road bridges on OPW channels as listed in the table referenced below and Management Staff are to have particular regard to these locations if evidence arises on a possible road kill “hot spot”.
- Enhancement works will typically take the form of a bolt-on wildlife ledge or similar. Design and configuration is to be carried out in consultation with NPWS and relevant Local Authority.
- On an annual basis, Environment Section will review the national website www.biology.ie which records Otter road kill reports from the public. Any road kill location which overlaps with an OPW channel will be flagged by Environment Section to the relevant Management

Staff.

- Current understanding is that Otter road kill is not a significant issue in Ireland. It's envisaged that while the justification for bridge mammal crossing works may arise for some scenarios, these measures will be of a limited scale on drained channels.

Current version of Otter SOP:

V2 April 2009

Current version of National Primary Roads & OPW Bridges: March 2009

FRESHWATER PEARL MUSSEL

- GIS records from NPWS show the locations of the 91 known FWPM populations in Ireland.
- The following OPW channels have been identified as containing FWPM:

Channel	Scheme	Location	Most Recent Record
CH9	Corrib Headford	Oughterard	2009
C1/21/3	Moy	Approx 500yds from outfall to into L. Cullin	2004
C1 Sect M&N	Moy	Ballygallagart	2004
C1/21/14	Moy	Crossmolina	2008
C1	Dunmanway FRS	d/s of the Long Bridge	2003
C1	Owvane	Approx 1400 yds from outfall	2002
C1	Feale	d/s Listowel near Scartleigh cemetery	2006
**Owenaher	Moy	u/s of C1/54	1996
**Brown Flesk River	Maine	Trib of C1 Maine near Farranfore	1987
**Galey River	Feale	Approx 1400yds u/s of C1/18 near Ahavoher Br.	1950
**River Liffey	Ryewater	(Lucan) Approx 3.5km d/s C1 Ryewater outfall	1894

** Although not on OPW channels - these channels may or may not contain populations of FWPM. Works in the vicinity which could impact on a possible population need to be considered in close consultation with local NPWS knowledge.

- While highly unlikely to have instream works in a FWPM habitat, if a new population located by Operational Staff during operations, works to cease.
- Notify NPWS and in consultation with NPWS, area to be skipped or non in-stream works carried out as agreed for the specific site.
- For operations in the vicinity of known populations, mitigating procedures to apply:
- Consult with NPWS and local IFI and conduct site visit as necessary.
 - Typically only selective non in-stream works adjoining the population.
 - Works such as removal of a fallen tree is to be completed by lifting clear of the channel to minimise any channel bed disturbance due to the branches being dragged.
 - Assess need for silt management procedures for works upstream of the population and implement in consultation with NPWS.

Current version of relevant SOPs:

V2 April 2009

Current version of FWPM GIS Layer available on Socialtext.

SWAN & DUCK MUSSELS

- Swan and Duck Mussels are not strictly a protected species, however they are of conservation interest.
- Both species are similar in appearance and habitat requirements and distinguishing between them is not necessary unless local environmental stakeholders can identify the exact species.

- As the Mussel SOP, if Operational Staff locate the same, Management Staff will be notified.
- Where significant populations are encountered notify NPWS Ranger and local IFI Officer, and where they are interested in visiting the site, facilitate a site visit as necessary.
- Identify extent of channel applicable and the mitigating measures to apply.
- Typical Mitigating Measures include:
 - Operational Staff to observe spoil and return any Mussels to the channel whom are expected to recolonise the channel bed.
 - Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.
 - Skip sections to retain intact habitat either in one long reach or multiple short reaches.
 - Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Record species presence on the Weekly Record Cards which will be recorded on the Records Database.

Current version of relevant SOPs: V2 April 2009

KINGFISHER

- Avoid disturbing nesting sites in banks.
- Visual sightings of Kingfisher by Operational Staff to be recorded on the Weekly Record Cards.
- Sightings by Management Staff to be recorded on the Weekly Record Cards where works in progress or on other occasions, record by separate map or channel reference format.
- All sightings to be recorded on the Records Database in accordance with the National Recording Process.
- All database records of species location will be uploaded to GIS by Environment Section.
- On an annual basis, Environment Section will issue the records to Birdwatch Ireland whom will add to the national Kingfisher database.

Current version of Kingfisher GIS Layer available on Socialtext.

BIRDS

- Removal of any abnormally dense layer of vegetation is to be executed between September and February (inclusive) to minimise impacts on nesting birds unless there are other overriding requirements such as Health & Safety.
- For SPAs containing important over-wintering bird populations, in consultation with the NPWS, regard to be given to timing or phasing of the works to minimise potential disturbance.

BATS

- While the removal of large mature trees is not typically a requirement of maintenance works, where the case arises, in consultation with NPWS, regard to be given to the likelihood of bat roosting habitat.
- Typical mitigating measure would be to leave tree in fallen position for 24hrs to allow any bats vacate.
- Masonry bridges offer niches and crevices suitable for bat roosts and where masonry bridges are scheduled for maintenance works, regard to be given to the likelihood of bat roosting habitat. Typical maintenance works at low level such as wing wall repair or underpinning foundations have limited potential to impact on bat roosts. Where the case arises that repair works are to be above the high water level such as the upper arch, in consultation with

- NPWS, assess the potential for the works impacting on bat roosts.
- Typical mitigating measure would be to contract a bat specialist to survey for bat presence before works commence, to avoid entombment of any bats.

WETLANDS - BOGS, FENS & TURLOUGHs

- All channels scheduled for maintenance which overlap SAC designations to be checked against the list of channels that impinge on Raised Bog, Fen habitat or Turloughs and have regard to any NPWS agreements noted *.
- OPW Management Staff to consult with NPWS for expert opinion as to any evidence of ongoing ecological decline of the Bog, Fen or Turlough and judgement on, if the drainage datum set by the Drainage Scheme and its maintenance is an ongoing contributing factor by affecting the hydrological regime of the same.
- Where a likely impact is identified, conduct site visit as necessary and in consultation with NPWS, mitigating measures to be selected such as:
- Skipping the channel in question while taking cognisance of the flood risk management requirements.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.
- Inspection by OPW line management to assess the possibility of over digging the channel below the original design datum. Presence of an existing water level control such as a bridge floor to be established and alternative reference datum to be installed if deemed warranted.

** Environment Section currently developing a list of channels which overlap with Raised Bog, Fen habitat and Turloughs within SACs. Channels that are subject to a previous NPWS agreement /understanding of the extent of maintenance will be recorded.*

Current version of Wetlands channels list available on Socialtext.

INVASIVE SPECIES – PLANTS

- Multiple invasive plant species are widespread nationally as described in the SOP and prudent to assume that one or more of these plants can be present on any works site.
- At present the OPW does not have any direct responsibility for the management of Invasive species. However to ensure OPW operations are not a vector for these invasives, measures are required to reduce the risk of spread.
- Ensure machine washing equipment transported to site for all appropriate machinery movements as described in the Invasive Species SOP.
- Ongoing EDM site audits by Environment Section will include confirmation that machine washing was executed in accordance with the SOP for the last applicable machine transfer.
- In some cases, OPW will assist other authorities in the control of invasive species. In these projects, the works are typically carried out in partnership between a number of authorities such as IFI, NPWS and relevant Local Authority. As scenarios arise where OPW are requested to assist in an invasive species control project, Management Staff are encouraged to support the multi-authority partnership model which will maximise resource efficiencies for all parties while still achieving a broader environmental good.

Current version of relevant SOP:

V2 March 2009

INVASIVE SPECIES – ZEBRA MUSSEL

- Zebra Mussels are present in the River Shannon, Grand Canal and are in many lakes such as

L Derg, L Ree, L Garra, L Key, L Derragh, Derravaragh, L Sheelin and L Corrib. This species is spreading and it is prudent to assume that works in any large sluggish river or near a lake has potential to contain Zebra Mussel.

- For any proposed works in the vicinity of potential Zebra Mussel waters, flag for Operational Staff and ensure particular attention to cleaning procedures for all equipment prior to removal from site.
- Any new location of Zebra Mussel uncovered during operations, notify NPWS and IFI for their information.
- Record on Weekly Record Sheet which will be uploaded on the Records Database in accordance with the National Recording Process.
- On an annual basis, Environment Section will collate the records nationally and issue to any relevant authorities to assist in tracking the species spread.

Current version of relevant SOP:

V2 May 2009

TREE MANAGEMENT

- A small portion of channels have more infrequent maintenance cycles typically where self cleaning gradients are present. These sites can entail abnormally dense tree cover which may be required to be managed for conveyance or fisheries purposes. Removal of any abnormally dense layer of vegetation is to be executed between September and February (inclusive) to minimise impacts on nesting birds unless there are other overriding requirements.
- IFI requests to reduce “tunnelling” on drainage channels to be accommodated where feasible. OPW Management Staff to facilitate a site visit with the IFI Officer as required and devise a selective approach to the tree removal so as to retain a dappling of shade along the channel length.
- Excess woody vegetation to be collected and utilised by the following in order of preference:
 - Reused by adjoining landowner for domestic firewood.
 - Subject to landowners agreement, stockpile excess to form natural cover and niche habitat, preferably with some connection of cover to the channel e.g. along a hedge leading to the water.
 - Shred and spread along the adjoining top of bank allowing the material to degrade rapidly and recolonisation of the underlying vegetation.

ENVIRONMENTAL DRAINAGE MAINTENANCE (EDM) GUIDELINES

- A portion of operational crews will be audited annually for implementation of the EDM Guidelines and other standard environmental procedures as adopted.
- Auditing will be carried out separately by both IFI and OPW Environment Section on a rotational basis to ensure all operational crews are audited at least once every three years.
- Audit results will be recorded on a standard format with the following feedback:
 - All audit results will be forwarded to the relevant Engineer for that Drainage Scheme within two working weeks.
 - In the event of an audit showing elements of unreasonable non-compliance with procedures, the relevant Engineer will be notified within one working day.
 - Audit results will be forwarded to OPW Systems Co-ordinator for inclusion in monthly regional benchmarking reports.
 - IFI EREP team will compile an overall summary of their findings in their end of year report under the EREP project.
- Design for Enhanced Maintenance works under EREP will include a design element for full

scale implementation of the EDM Guidelines such as Boulder Replacement and Excavating Pools.

- Management Staff to ensure that as far as practical, all Operational crews have an opportunity to get experience on these projects.

Current version of EDM Guidelines: April 2011

Current version EDM Audit Sheet: April 2011

PART II – DEPOT MANAGEMENT

DEPOT WASTE MANAGEMENT

- 12 Waste Management Plans are available on Socialtext covering the 12 Drainage Offices.
- Environment Section will review 2 plans per annum and audit implementation.
- Updated Plans together with an overview of findings will be forwarded to the relevant Coordinator and uploaded to Socialtext.

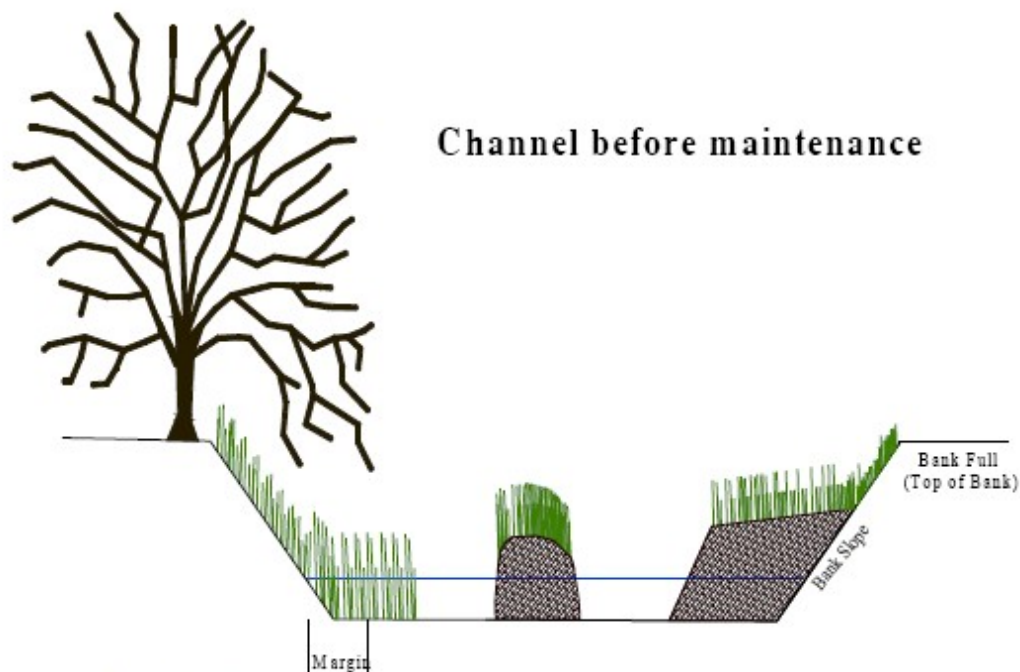
FUTURE REVISIONS

- Envisaged that this set of Protocols will be a fluid document and will be periodically updated as procedures are revised or new procedures introduced. In addition, to be used as a framework document for quality control purposes to reference the latest versions of all supporting information.

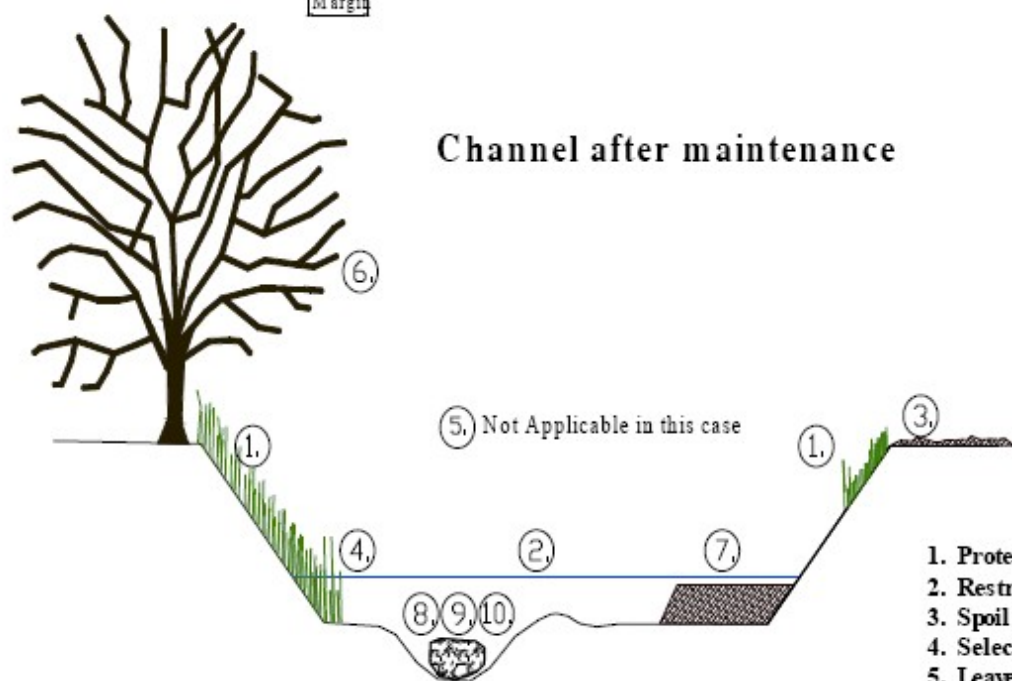
Environmental Drainage Maintenance Guidance Notes



10 Steps to Environmentally Friendly Maintenance



Channel before maintenance



Channel after maintenance

1. Protect bank slopes
2. Restrict maintenance to channel
3. Spoil management
4. Selective vegetation removal
5. Leave section untouched
6. Management of trees
7. Manage berm to form two stage channel
8. Replace stones and boulders
9. Loosen gravel beds
10. Re-profile channel bed

Environmental Strategies for Channel Maintenance



1. Protect bank slopes

- 1.1 Do not disturb the non-working bank slope
- 1.2 Minimise any effect on working bank
- 1.3 Leave margin of vegetation at foot of each bank slope



2. Restrict maintenance to channel

- 2.1 Remove only necessary silt – **no new diggings**
- 2.2 Remove instream material only
- 2.3 Retain marginal vegetation
- 2.4 Check spoil regularly. *See Lamprey & Crayfish SOPs*

3. Spoil Management

- 3.1 Maximise spoil placement on bank full line or spoil heaps **and**
- 3.2 Minimise spoil placement on bank slopes
- 3.3 Spread spoil as thinly as possible
- 3.4 Allow water to drain out of bucket over the water – lets small fish, lamprey and crayfish escape



Environmental Strategies for Channel Maintenance



4. Selective Vegetation Removal

- 4.1 Retain a band of vegetation on both sides at water's edge
- 4.2 Selectively manage instream vegetation
- 4.3 Maximise use of weed-cutting bucket
- 4.4 Avoid maintenance in coarse fish channels from 1st April to 1st July



- 4.5 Retain 1/3 to 1/2 of instream floating type vegetation, such as *Ranunculus* (water crowfoot) – see photo to right



5. Leave sections untouched

- 5.1 If channel capacity is not affected, leave section alone



Environmental Strategies for Channel Maintenance



6. Management of Trees

- 6.1 Remove trees that are blocking the flow
- 6.2 Tree-cutting window 1st September to 28th February



- 6.3 Remove overhanging branches to known flood level

- 6.4 Use saw secateurs for removal, not excavator bucket

- 6.5 Manage Trees to reduce very heavy shading
- 6.6 Manage briars and scrub.
See Otter SOP



7. Manage berms to form two-stage channels

7.1 Retain berm where channel capacity is not affected

7.2 Remove top of berms to low flow levels

7.2 Remove vegetation and soil from gravel berms

7.3 Replace sod to the berm where feasible

7.4 Only narrow berms if 'excessively' wide for the channel (i.e. greater than a third of the channel width)



8. Replace stone and boulders

8.1 Reinstatement boulders and gravels as removed by maintenance operations

8.2 Reinstatement suitably sized boulders into channel from spoil heaps where feasible

8.3 Boulders should be placed at or below low flow level and spaced out

9. Work in gravel bed channels

9.1 Loosen or toss bed gravels to wash out fines

9.2 Only considered between 1st July and 30th September

9.3 No work in gravel bed / spawning channels in fisheries 'closed season'
Note: This varies locally check with local IFI



Environmental Strategies for Channel Maintenance



10.1 Excavate bed to form deeper pool areas and shallow riffles



10.2 Overdeepen the channel along one side and place spoil on opposite side –particularly on curves and bends

10.3 Use existing boulders to form simple low-level structures



10.4 Record where such works are carried out

BROOK, RIVER & SEA LAMPREY STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

Actions during Maintenance Operations

- Machine gangs to closely observe the spoil three times daily for Lamprey (and Crayfish).
- Where Lamprey encountered:
 - Contact area Foreman immediately.
 - Foreman to contact Engineering Staff in line with the Environmental Management Protocols.
 - Record the location and abundance of Lamprey on the time card.

Measures as directed by Foreman to minimise impact may include:

- Skip a defined stretch of channel.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.



Lamprey in the spoil

RIVER, BROOK & SEA LAMPREY IDENTIFICATION CARD



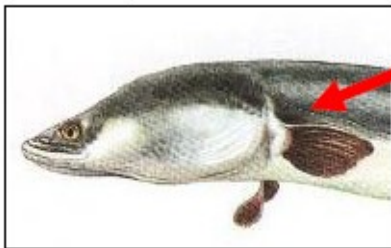
Gill Pores



Lamprey and young eels can look very similar. These key identifying features can be used to distinguish the two species

Lamprey:

- Gill Pores (Holes)
- No Fins
- No Jaw
- Average length 8 to 15cm (3 to 6 inches)



No Gill pores

Eels: No Gill Pores

Paired Fins

Jawed Mouth

Average length 65cm (26 inches)

Juvenile Lamprey:

- Juvenile Lampreys live in the sediment.
- It is in this juvenile phase that they can be removed from the sediment during maintenance.



Adult Lamprey:

- Largest is the Sea Lamprey species.
- Also are River and Brook Lamprey
- Length from 30 to 60cm (12 to 24 inches).



WHITE-CLAWED CRAYFISH

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

Actions during Maintenance Operations

- Machine gangs to closely observe the spoil three times daily for Crayfish (and Lamprey).
- Where Crayfish encountered:
 - Contact area Foreman immediately.
 - Foreman to contact Engineering Staff in line with the Environmental Management Protocols.
 - Record the location and abundance of Crayfish on the time card.

Measures as directed by Foreman to minimise impact may include:

- Skip a defined stretch of channel.
- Confine maintenance to 2/3 of channel width leaving marginal vegetation and silt intact.
- Maximise use of weed cutting bucket particularly where aquatic vegetation removal is the primary objective.



Crayfish in the spoil

WHITE-CLAWED CRAYFISH

Identification

- Resemble small lobsters.
- Colour varies from light to dark green-brown, with large front claws.
- Adults typically 7cm - 10cm (3" - 4") long.
- Juveniles can be as small as 2cm (1") long.
- Prefer channels with
 - dense weed cover (flaggers / watercelsery) or
 - with a mixture of rocks / gravels that provide crevices for cover.



OTTER

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

Week before Maintenance Operations begin:

- Operational staff will walkover works area one week in advance in conjunction with the PRA noting areas of dense cover with access directly to the water. (As identified during Otter Awareness Training)
- These areas of suitable cover should be avoided where feasible during maintenance.
- Suspected presence of an Otter holt to be reported immediately to area Foreman, who will contact Engineering Staff in line with the Environmental Management Protocols.
- Signs of Otter presence observed such as Spraints, Footprints or suspected Holts, to be recorded on the Weekly Record Cards.

Measures to minimise disturbance may include:

- Retain suitable cover where possible.
- Areas of dense scrub to be avoided by large plant.
- Skip stretch of channel in proximity of suspected holt.



Otters

- Widespread presence on OPW channels.
- Shy animals and not normally seen.
- Adults 1 metre long and weigh 10kg.
- Streamlined profile.

OTTER

Holts

- Usually well concealed.
- Typically burrows, or spaces under banks, tree roots or dense cover.



Spraints

- Found on rocks, paths, channel junctions.
- Dark, oily, sweet smelling.

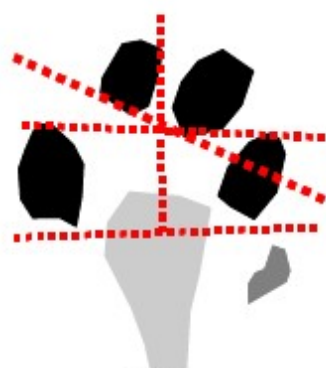


Suitable areas of cover

Dense bankside vegetation, particularly where there is direct covered access to the water.
Any isolated clumps of dense vegetation giving cover along an open length of channel.

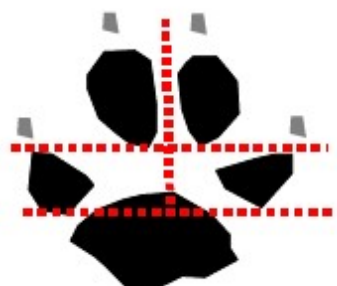


Foot-prints



Otter

(Non-symmetrical toes)



Dog

(Symmetrical toes)



Fox



Badger



Mink

MUSSELS

STANDARD OPERATING PROCEDURE - ARTERIAL DRAINAGE MAINTENANCE

FRESH WATER PEARL MUSSELS

Before Maintenance Operations begin:

- Maintenance must not commence where a known population of Fresh Water Pearl Mussel exists (as listed in the Environmental Management Protocols).
- In the unlikely event of new population of Fresh Water Pearl Mussel being encountered during maintenance,
 - **All works must cease immediately.**
 - Contact area Foreman.
 - Record the location of Mussels on the time card.

Measures to minimise disturbance may include:

- Placing of straw bales to prevent movement of silt.
- Any exceptional / emergency works to be carried out in close consultation with the NPWS.
- For exceptional / emergency works e.g. fallen tree obstruction – these to be lifted clear of the channel to prevent disturbing the channel bed.

MUSSELS

Fresh Water Pearl Mussels (*Margaritifera margaritifera*)

- Shells very thick & heavy – shaped like a kidney.
- Shell colour is dark-brown – black, to blue & black.
- Adults range in length from approx. 6 cm – 12 cm (2.5 – 5 inches) and can live for over 100 years.
- Suitable rivers are reasonably fast flowing, with very clean, good quality water, gravel bed, preferably with large cobbles.



Not to be confused with Duck & Swan Mussel

- Egg-shaped shells 12 -16cm (5-6 inches) long.
- Thin shiny shells, usually brownish yellow with traces of green.
- Found in slow moving water.
- If encountered, contact area Foreman and return Mussels to channel.
- Record location of Mussels on time card



INVASIVE SPECIES STANDARD OPERATING PROCEDURE – ARTERIAL DRAINAGE MAINTENANCE

Measures to reduce the risk of spread of invasive species

All excavators, weed cutting boats, tractors, dumpers & other machinery employed on maintenance must be thoroughly cleaned down using a power washer unit prior to being;

- (a) transported by Low- Loader**
- (b) moving to another catchment within the Region**
- (c) moving to another Region.**

Notify your supervisor immediately if you see any of the invasive species listed.

*Full details of all species are available in the CFB's
Field guide to the Identification of Aquatic Invasive Species*



Giant Hogweed

Found on the banks of many rivers throughout Ireland.

Can grow to a height of 4 metres.

Seeds are carried by water and spread very quickly.

!!!Avoid contact with the sap of this plant as it can cause extensive lesions or blistering of the skin.



Japanese Knotweed

Grows up to 2-3m in height along roadsides and river corridors throughout the country.

Even a tiny piece of this plant can produce a new plant.

Leaves are heart-shaped with a pale stripe down the centre.

In Summer cream flowers arise from the top of the red-flecked stems.



Himalayan Balsam

Grows in dense strands up to 3m high, and is found widespread across Ireland along banks of rivers.

Seed pods explode scattering seeds.

Dies back in Autumn exposing bare banksides and erosion.

White or pink flowers, smooth hollow stem, oval shaped pointed leaves with jagged edges.



Curly waterweed – *Lagarosiphon major*

Found in lakes and slow flowing waterways up to 6m deep.

Spread by fragmentation from one watercourse to another on boat hulls, trailers, outboard motors or angling equipment.

Significant weed stands located in Lough Corrib.



Zebra Mussels

Distinctive stripy shell, very small (1-3cm).

Attach in clusters to hard surfaces – boats, pipes, buoys.

Refer to the [Zebra Mussel Standard Operating Procedure](#).

All photographs courtesy of Central Fisheries Board

Actions for Maintenance Operations**1) Zebra Mussels detected on site**

- Where Zebra Mussels are found, remark on the extent of Mussels on the Weekly Report Card and notify the Foreman/Technician.
- Technicians/Engineers to notify Environment Section of location and grid reference.
- Environment Section to update the National Database.

2) Maintenance close to R. Shannon or infested lakes

- Where a machine is working close to the R. Shannon or an infested lake, ensure that prior to the machine transferring to a new site, buckets and tracks are thoroughly cleaned of any material such as silt or vegetation.
- Ganger / Driver to visually inspect the bucket, tracks and any equipment that was in the water to ensure no Mussels are present.

3) Maintenance close to outlets/inlets of any lakes

- Where a machine is working close to any lake, ensure that prior to machine transferring to a new site, buckets are clean of any material such as silt or vegetation.
- Ganger / Driver to visually inspect the bucket and other equipment that was in the water to ensure no Mussels are present.

4) Boats and other equipment

- Boats or other water based equipment that is to be transferred between river catchments should be thoroughly cleaned on the outside, drained of any bilge water and inspected for the presence of Mussels.
- If it's suspected that the equipment was in contact with Zebra Mussel waters, steam clean the hull and trailer and leave the boat or equipment out of water for four weeks prior to moving.

OPW Role

Although it is a relatively low risk, OPW could spread Zebra Mussels if aquatic vegetation or excavated material containing Mussels is inadvertently transported to another non-infested channel. Adult Mussels can survive for up to four weeks out of water hence its critical not to transport the same. Larvae are tiny and barely visible but will not survive on a machine bucket if there is no silt, stones or vegetation to shelter it.

**Environmental Threat**

Zebra Mussels are thumbnail-sized black & orange striped shellfish. They grow into dense clusters and attach to any underwater hard surface. They are an invasive species that damage the natural ecology of the infested waters. They expand into catchments through been transported by man's activities e.g. transferring fishing boats. Once in a particular lake or river, if conditions are favourable, they will multiply and spread with the currents. It is envisaged that they will keep expanding their territory unless man makes a concerted effort to prevent transport of the Mussels into non-infested waters.

OPW Site Audit Form

Region: _____ **CDS:** _____
Channel (name & code): _____ **Section (chg – chg):** _____
Foreman: _____ **Driver(s):** _____
Auditor: _____ **Date:** _____
 Site surveyed from- working bank: ☐ non-working bank: ☐
GPS Reference: _____ **Photographs:** Yes ☐ No ☐
Weather Conditions: _____ **Water levels:** _____
Wetted/Base width: 0-3m ☐ 3-6m ☐ 6-10m ☐ 10-15m ☐ >15m ☐
Velocity Rating: Slow ☐ Moderate ☐ Fast ☐ Torrential ☐
Bed Type: _____ **Machine Number:** _____

OPW SOP AWARENESS / COMPLIANCE

Invasive Species SOP: Poor / Fair / Good / Excellent
 Protected Species SOP's: Poor / Fair / Good / Excellent
 Spill Kit Present: YES / NO

Environmental Drainage Maintenance Constraints

Maintenance Constraints		Working Bank	Non Working Bank
Ownership:	Woodland		
Ownership:	Tillage		
Ownership:	Position of Fencing		
Availability of suitable stone			
Placement of spoil			
Time of year:	Tree cutting		
Time of year:	Wildlife		
Time of year:	Fisheries		
Potential Habitat for Annex II Species	Lamprey		
	Crayfish		
	Otter		
	Pearl mussel		
	Salmon		

Comments on Audit Findings

Maintenance Strategies Achieved - (based on section recently maintained)							
Maintenance Options		Working Bank		Non-working Bank		Instream Channel	
		Suitability	Compliance*	Suitability	Compliance*	Suitability	Compliance*
1	Protect Bank Slopes						
	Non-working bank left intact						
	Protect working bank slope						
2	Restrict Maintenance to Channel						
	Restrict maintenance to open channel						
	Use of SOPs for lamprey and crayfish						
3	Spoil Management						
	Best practice placement of spoil						
	Spread spoil thinly						
	Let water drain from bucket over channel						
4	Selective Vegetation Removal						
	Manage instream vegetation (Attn SOPs)						
	Retain marginal vegetation both sides						
	Potential for weed cutting bucket						
	Outside coarse fish spawning (April 1 st to July 1 st)						
5	Leave Sections Intact						
	Sections skipped						
6	Management of Trees						
	Remove trees blocking flow						
	Observe tree cutting window						
	Remove low hanging branches to known flood level						
	Use chainsaw/secuturs for tree removal or thinning						
	Tree thinning management						
	Manage scrub - Otter & Birds SOP						
7	Manage Berms to form 2 Stage Channels						
	Retain berms (no maintenance)						
	Top berm to just over summer water flow						
	Re-sod berms where suitable						
	Only narrow berms if OVER-WIDE						
8	Replace Stone & Boulders						
	Replace stone and gravel coming out in digging bucket (No New Diggings)						
	Replace large stones/boulders into channel from old spoil						
9	Working in Gravel Bed Channels						
	Loosen/toss gravels (between July 1 st & Sept. 30 th)						
	No instream works outside of Fisheries Window (between July 1 st & Sept. 30 th)						
	Use of silt barriers in winter/spring						
10	Re-profile Channel Bed						
	Dig pool - riffle sequences						
	Reprofile cross-section						
	Use existing stone to create 'simple' instream structures						

*based on rating system: 0-10, with 0=no compliance and 10=full compliance

Total Compliance (%)

OVERALL COMPLIANCE (%)

Department of the Environment, Heritage and Local Government / An Roinn Comhshaoil, Oidhreacht agus Rialtais Áitiúil

National Parks & Wildlife Service (NPWS) / An tSeirbhís Páirceanna Náisiúnta agus Fiadhúlra, 7 Ely Place, Dublin 2.
Regional Information/Eolas Reigiúnach (01) 888 2000
Locall/Glaoch Áitiúil: 1890 20 20 21
Fax/Faics: (01) 888 3272
Internet/Idirlíon: www.npws.ie & www.environ.ie
E-mail/Ríomhphost: natureconservation@environ.ie

Eastern Division / Rannán an Oirthir

Divisional Manager: (01) 8883243
Divisional Ecologist: (01) 6678256

South Eastern Region/Réigiún an Oirdheiscirt

(Carlow, Kilkenny, Wexford & Wicklow (incl. Wicklow Mountains National Park))

Regional Office: (0404) 45800
Regional Manager: (0404) 45802
Deputy Regional Manager: (0404) 45801
Education Centre: (0404) 45656
Information Office (Wicklow Mtns Nt Park): (0404) 45425
District Conservation Officer:
(North Wexford & Wicklow) (0404) 45807
District Conservation Officer:
(Carlow, Kilkenny & Wexford) (056) 7722135

North Eastern Region/Réigiún an Oirthuaiscirt

(Dublin, Kildare, Laois, Louth, Meath & Offaly)

Regional Manager: (045) 520 622
Deputy Regional Manager: (045) 520 644
District Conservation Officer:
(Kildare, Laois & Offaly) (045) 521 713
District Conservation Officer:
(Dublin, Louth & Meath) (046) 909 3506

Western Division/Rannán an Iarthair

Divisional Manager: (091) 704 206
Divisional Ecologist: (091) 704 208

Western Region/Réigiún an Iarthair

(Mayo, Galway West)

Regional Manager: (095) 41054
Deputy Regional Manager: (098) 49996

District Conservation Officer: (Galway West) (095) 41054
District Conservation Officer: (Mayo) (098) 49996

Mid Western Region/Réigiún an Lár-Iarthair

(Clare, Galway (except Galway West above))

Regional Office: (091) 704200
Regional Manager: (091) 704 201
Deputy Regional Manager: (091) 870341
District Conservation Officer:(Clare) (065) 682 2711
District Conservation Officer:
Galway (except Galway West above) (091) 739654

Southern Division/Rannán an Deiscirt

Divisional Manager: (021) 4619901
Divisional Ecologist: (021) 4619903

Mid Southern Region/Réigiún an Lár-Deiscirt

(East Cork, Limerick, Tipperary NR, Tipperary SR & Waterford)

Regional Manager: (067) 44287
Deputy Regional Manager: (021) 4619904
District Conservation Officer:
(East Cork, Tipperary SR & Waterford) (021) 4619905
District Conservation Officer:
(Limerick & Tipperary NR) (067) 44135

South Western Region/Réigiún an Iardheiscirt

(West Cork & Kerry)

Regional Office: (064) 31440
Regional Manager: (064) 70145
Deputy Regional Manager: (064) 70143
District Conservation Officer:
(North Cork & Kerry) (064) 33567
District Conservation Officer:
(South & West Cork and South & West Kerry) (028) 37347

Northern Division/Rannán an Tuaiscirt

Divisional Manager: (071) 966 6020
Divisional Ecologist: (071) 966 6928

Northern Region/Réigiún an Tuaiscirt

(Donegal, Leitrim West & Sligo)

Regional Office: (074) 913 7090
Regional Manager: (074) 972 1837
Deputy Regional Manager: (074) 913 7090
District Conservation Officer:
(Donegal Nth & Glenveagh National Park) (074) 913 7440
District Conservation Officer:
(Donegal, Leitrim West & Sligo) (071) 966 6178

North Midlands Region/An Réigiún Lár Tíre Thuaidh

(Cavan, Leitrim East, Longford, Monaghan, Roscommon & Westmeath)

Regional Office: (071) 9666178
Regional Manager: (071) 966 6934
Deputy Regional Manager: (044) 934 2661
District Conservation Officer:
(Cavan, Leitrim, Longford & Monaghan) (049) 433 5750
District Conservation Officer:
(Roscommon & Westmeath) (044) 933 7007

National Parks & Nature Reserves/Páirceanna Náisiúnta

Ballycroy National Park County Mayo, Lagduff More, Ballycroy, Westport, Co. Mayo (098) 49996
Burren National Park, NEPS Building, St. Francis Street, Ennis, Co. Clare (065) 6822662
Connemara National Park, Letterfrack, Co. Galway (095) 41054
Coole Park Nature Reserve, Gort, Co. Galway (091) 631 804
Glenveagh National Park, Church Hill, Letterkenny, Co. Donegal (074) 9137090
Killarney National Park, Muckross House, Killarney, Co. Kerry (064) 31440
Wexford Wildfowl Reserve, North Slob, Wexford (053) 9123129
Wicklow Mountains National Park, Kilafin, Laragh, Co. Wicklow (0404) 45800

Inland Fisheries Ireland March 2011

IFI Region	Director	Address	Telephone	Region/Scheme
IFI Blackrock	William Walsh	15a Main Street Blackrock Co. Dublin	01 2787022	East: Glyde & Dee, Boyne, Blackwater, Bally-Teigue
IFI Ballina	John Connelly	Ardnaree House Abbey Street Ballina Co. Mayo	096 22788	West: Moy, Bonet
IFI Ballyshannon	Dr. Milton Matthews,	Station Road Ballyshannon Co. Donegal	071 9851435	West: Donegal schemes, Kilcoo, Duff
IFI Limerick	Sean Ryan	Ashbourne Business Park Dock Road Limerick	061 300238	East: Inny, Brosna West: Boyle, Ballyglass South: Killimor, Carrighahorig, Nenagh, Groody, Maigue, Deel, Feale
IFI Macroom	Dr. Patrick Buck	Sunnyside House, Macroom Co. Cork	026 41221	South: Maine, Owvane
IFI Clonmel	Suzanne Campion	Anglesea Street Clonmel Co. Tipperary	052 80055	East: Brickey
IFI Galway	Amanda Mooney	The Weir Lodge Earl's Island Galway	091 563118	West: Corrib Headford, Mask,
IFI	Dr. Ciaran Byrne	Unit 4 Swords Business Campus Balheary Rd Swords Co. Dublin	01 8842600	All
EREP Project Manager	Dr. Karen Delanty	Unit 4 Swords Business Campus Balheary Rd Swords Co. Dublin	01 8842624	All

(Note: Completed flood relief schemes are not listed but proposed works should be discussed with the relevant local IFI)

OPW Bridges (numbering 170) intersecting National Primary Roads.

Scheme	Channel ID	Bridge No.	National Route type	Bridge Name
Glyde and Dee	C2 (7C)	B80	N01	
Glyde and Dee	C2 (7E1)	B839	N01	
Glyde and Dee	C2 (7E1)	B840	N01	
Broadmeadow and Ward	C2/1	B230	N02	
Broadmeadow and Ward	C2/1	B239	N02	
Broadmeadow and Ward	C2	B204	N02	Coolatrath br.
Broadmeadow and Ward	C2/3	B243	N02	
Broadmeadow and Ward	C1/6/1	B86	N02	
Broadmeadow and Ward	C1/6/1/1	B96	N02	
Broadmeadow and Ward	C1/6	B68	N02	
Broadmeadow and Ward	C1	B16	N02	
Boyne	C1	B4	N02	Slane br.
Glyde and Dee	C2 (7H)	B101A	N02	
Glyde and Dee	C2 (17)	B179	N02	
Glyde and Dee	C2 (14B)	B118	N02	
Glyde and Dee	C2 (14)	B867	N02	
Glyde and Dee	C2 (1)	B30	N02	
Glyde and Dee	C2 (13)	B111	N02	
Glyde and Dee	C2 (16B4)		N02	
Glyde and Dee	C1 (1)	B15	N02	Aclint Br
Glyde and Dee	C29 (2)	B441	N02	
Glyde and Dee	C29 (3)	B443	N02	
Glyde and Dee	C25 (8)	B341	N02	
Glyde and Dee	C25 (7D1)	B672	N02	
Monaghan Blackwater	C1/1/5	B7	N02	
Monaghan Blackwater	C1/1/5/6/1	B1	N02	
Monaghan Blackwater	C1/3/5/2	B8	N02	
Monaghan Blackwater	C1/3/6/3	B1	N02	Hoaf Br
Boyne	C1/8/24	BX1	N03	
Boyne	C1/8/23	B733	N03	
Boyne	C1/8/21	B723	N03	
Boyne	C1/8/16	B644	N03	
Boyne	C1/8	B126	N03	Clavens Br
Boyne	C1/8/8	B294	N03	
Boyne	C1/12/1	B875	N03	Dillon's Br
Boyne	C1/12/7	B915	N03	
Owenmore	Behy Bridge	BX1	N04	
Boyle	C6/7/5	B2	N05	Ballanagare Br
Boyle	C6/7/1/4	B2	N05	
Boyle	C6/7/1	B3	N05	Cloonshanville Br
Boyle	C1/3/2/1	B4	N05	
Boyle	C1/9/1	B1	N05	
Boyle	C1	B4	N05	Old Lung Bridge
Boyle	C1/8	B1	N05	New Lung Bridge
Boyle	C1/45	B8	N05	
Moy	C1/31/2	B3	N05	
Moy	C1/31	B4	N05	
Moy	Not on a channel	B2	N05	Trimoge
Moy	Not on a channel	B2	N05	
Moy	Not on a channel	B1	N05	
Moy	C1/30/3/1	B1	N05	
Moy	C1/28/2	B3	N05	
Moy	C1/28/1	B4	N05	
Moy	C1/25	B6	N05	
Moy	C1/23/3	B2	N05	
Moy	C1/23	B9	N05	
Moy	Not on a channel	B1	N05	
Moy	C1/21/1/5/2/2	B3	N05	
Moy	C1/21/1/5/2/11	B2	N05	
Moy	C1/21/1/5/1/15	B1	N05	

Moy	C1/21/1/5/2/18	B1	N05	
Moy	C1/21/1/5/2/19	B2	N05	
Moy	C1/21/2/5/2/20/4	B1	N05	
Boyle	C1/44/15	B2976	N06	
Boyle	C1/44/17	B2984	N06	
Boyle	C1/64/1/11/6	B3337	N06	
Boyle	C1/64/1/11	B3303	N06	Miltownpass Br.
Boyle	C1/64/1/11/4	B3319	N06	
Boyle	C1/64/1/11/4/2	B3331	N06	
Boyle	C1/64/1/13/2	B3330	N06	
Boyle	C1/64/1/13	B3372	N06	Rochfort Br.
Boyle	C1/64/1/13/4	B3384	N06	
Brosna	C27 (1)	B150	N06	
Brosna	C1 (1)	B11	N06	Kilbeggan Br.
Brosna	C17 (1)	B143	N06	
Brosna	C17 (SE)	B726	N06	
Brosna	C17 (5)	B138	N06	New Br
Brosna	C17 (4)	B135	N06	
Corrib Clare	C1	B3	N06	Quincentennial Br.
Nenagh	C1/9	B23	N07	Ollatrim Br
Nenagh	C1/9/24	B4	N07	
Monaghan Blackwater	C1/1/6/1	B11	N12	Tyholland Br
Blanket Nook	C1/3	B23	N13	
Swilly embankments	E9	B1	N14	
Swilly embankments	C1/5	B9	N14	
Deele and Swillyburn	C1	B6	N14	
Deele and Swillyburn	C1/11	B19	N14	
Deele and Swillyburn	C2	B20	N14	
Abbey	C1/4	B39	N15	
Abbey	C1/4	B31	N15	
Abbey	C1/3A	B30B	N15	
Abbey	C1/2	B21 - B23	N15	
Abbey	C1/1	B18	N15	
Duff	C1	B1	N15	
Bonet	C1/12/3	B1	N16	
Bonet	C1/12	B5	N16	
Bonet	C1/12	B4	N16	
Bonet	C1/12	B2	N16	
Bonet	C1	B5	N16	
Bonet	C1/13/2	B1	N16	
Bonet	C1/13	B1	N16	
Moy	C1/50/2	B3	N17	
Moy	C1/50	B4	N17	
Moy	C1/48/3	B2	N17	
Moy	C1/48	B3	N17	
Moy	C1/45/4	B2	N17	
Moy	C1/45	B13	N17	
Moy	C1/30/5/9	B3	N17	
Moy	C1/30/5/9	B15	N17	
Corrib Mask	CM4/43/4	B2	N17	
Corrib Mask	CM4/34	B10	N17	
Corrib Mask	CM4/34/2	B2	N17	
Corrib Clare	C3/30	B8	N17	
Corrib Clare	C3/30/4	B1	N17	
Corrib Clare	C3/26	B2	N17	
Corrib Clare	C3/26/9	B1	N17	
Corrib Clare	C3/26/1	B3	N17	
Corrib Clare	C3/12/2	B1	N17	
Corrib Clare	C3	B14	N17	
Corrib Clare	C3	B2	N17	Claregalway bridge
Fergus	D7	B3	N18	
Owenagarney	C2	B1	N18	
Owenagarney	C4	B3	N18	
Coonagh Embankments	C10	B9	N18	

Coonagh Embankments	D13	B113	N18	
Coonagh Embankments		B1	N18	
Maigue	C1/36	B1	N20	Helena's br.
Maigue	C1/37/1	B3	N20	
Maigue	C1/37	B1	N20	
Maigue	C1	B23	N20	Creggane br.
Maigue	C1/33	B1	N20	Cappanafaha br.
Maigue	C1/30	B2	N20	Ballynabanoge br
Maigue	C1/26	B1	N20	
Maigue	C1/15	B10	N20	
Maigue	C1/10/5	B3	N20	
Maine	C1/28	BX1	N21	
Maine	C1/34	B117	N21	
Maine	C1/35	BX2	N21	
Deel SR	C12/2/2	B125	N21	
Deel SR	C12/2/2/2	B127	N21	
Deel SR	C12/2/1	B123	N21	
Deel SR	C10	B95	N21	Ballyfraleay br.
Deel SR	C8	B76	N21	Reens br.
Maigue	C1/17/10	B1	N21	
Maigue	C1/17/8	B2	N21	
Maigue	C1/17/5	B1	N21	
Maigue	C1	B1	N21	Adare br.
Maigue	C1/15	B5	N21	
Maine	C1	B3	N22	Maine br.
Maine	C1/32	B110	N23	Dysert br.
Maine	C1/33	B114	N23	Killfinnaun br.
Maine	C1	B9	N23	Herbert br.
Groody	C1/4	B29	N24	
Groody	C1	B4	N24	
Groody	C1/7	B53	N24	
Groody	C1/9	B56	N24	
Moy	C1/9/1	B1	N26	
Moy	C1/9	B2	N26	
Moy	F/282	B	N26	
Moy	C1/14	B1	N26	
Moy	RIVER	B3	N26	
Moy	C1/37	B1	N26	
Moy	C1/38	B1	N26	
Moy	RIVER	B2	N26	Cloongullaun br.
Moy	C1/39	B3	N26	
Moy	C1/39	B6	N26	
Moy	C1/39	B9	N26	
Moy	C1/39/3	B1	N26	

Otter Wildlife Passes and OPW Drainage Channels

- It has been brought to the attention of the OPW that there may be a need for small mammal passes on some of the maintained channels.
- The National roads constitute less than 6 percent of roads in this country, approx. 3 National Primary and 3 percent National Secondary. In spite of this they carry over 42 percent of the traffic. It is for this reason that the focus will be on the National Primary road crossings.
- The national road kill survey was analysed and the data from the web site "www.biology.ie" was cross-referenced against OPW channel locations and the results were inconclusive, as the web page is not widely used. It appears for now that OPW channel road crossings have no effect on the deaths of otters as per this information.

Next Steps:

- 1) Consult NPWS throughout all regions to review any evidence of otter road kills on National Primary roads or are they aware of any other such road deaths.

1. Where there appears to be mammal deaths on National Primary roads that intersect OPW channels it will be seriously considered to install in the bridge (where possible) a small mammal pass to allow ease of access for otters.

Otter Habitat Disruption

- Otters, along with their breeding and resting places, are protected under the provisions of the Wildlife Act, 1976, as amended by the Wildlife (Amendment) Act, 2000. They are also included in Annex I and Annex IV of the Habitats Directive, which is transposed into Irish Law in the European Communities (Natural Habitats) Regulations (S.I. 94 of 1997), as amended.

Otter Pass Details

- Mammal Ledges and underpasses should be constructed parallel to the watercourse.
- Underpasses should be of a diameter of 600mm up to a length of 20m. Where lengths exceed this the pipe should be increased to 900mm diameter
- An underpass should be no more than 50m of the watercourse with channels or fencing guiding the animals to it.

Where there is sufficient space under the bridge for a ledge the following should be provided:

- Fencing: See "figure 1; Specification for Mammal Resistant Fencing" in the NRA, National Roads Authority, Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes, for more detail. Also, Design Manual for Roads and Bridges, DMRB Volume 10, Section 1, Part 5, Chapter 9.
- A bolt on ledge can be used under a bridge where there is no dry passage. The bolt on ledge should provide otters with a dry walkway of between 300mm and 450mm wide, constructed from 4.5mm Durbar patterned galvanised plate.
- At some sites, considerations of responsibility, cost, aesthetics or practicality might indicate the use of a solid ledge; this is most likely where an existing otter-ledge has proved to be sited too low to offer dry passage at spate conditions. A solid ledge can be created in 3 ways; concrete bagging, shuttering plus new concrete and concrete blocks.
- See (OPW, 2007), (DMRB, 2001) and (NRA 2006) for further Details



References

- NRA (2006) – National Roads Authority, Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes.
- NRA (2005) – National Roads Authority, Guidelines for the Crossing of Watercourses During the Construction Of National Road Schemes.
- OPW (2007) – Series of Ecological Assessments on Arterial Drainage Maintenance No. 4, Ecological Impact Assessment (EclA) of the Effects of Statutory Arterial Drainage Maintenance Activities on the Otter (*Lutra lutra*).
- OPW (2006) – Screening of Natura 2000 Sites for Impacts of Arterial Drainage Maintenance Operations. Environment Section, Engineering Services, Office of Public Works.
- DMRB (2001) - Design manual for roads and bridges (DMRB). Volume 10, Section 4 Environmental Design and Management Nature Conservation. Part 4 HA 81/99 Nature conservation advice in relation to otters. Section 1, Part 9 HA 81/99.

APPENDIX B

Consultation Responses



7th June 2011

Dr Bernadette Ní Chatháin,
RPS Group,
Lyrr Building,
IDA Business & Technology Park,
Mervue,
Galway

Your Ref: MGE0262LT004

Our Ref: G2011/214

Re: Clare River (Claregalway) Flood Relief Scheme – Environmental Consultancy Services

A Chara,

I refer to your correspondence of 11th May 2011 regarding the proposed Clare River (Claregalway) Flood Relief Scheme. Outlined below are the nature conservation recommendations of the Department. A list of relevant guidance and circulars is included in Appendix 1 and these should be taken into account and followed as appropriate, in addition to the OPW's own assessment reports for various ecological receptors.

Appropriate assessment

The overall project and any advance elements will require appropriate assessment in line with Article 6(3) of the Habitats Directive (see Appendix 1).

A Natura Impact Statement (NIS) or appropriate assessment screening report should accompany each approval stage or application for consent. Screening will suffice only if it can be concluded, based on objective criteria and the necessary scientific evidence, that the project, alone and in combination with other plans and projects, poses no risks of having significant effects on a Natura 2000 site in view of its conservation objectives.

The NIS should be relevant to the project in question, and should assess the likely significant effects in combination with those of other plans and projects, at each successive stage.

The appropriate assessment should focus on the likely impacts on Natura 2000 sites in view of their conservation objectives. The scope of the assessment will depend on the qualifying interests of the Natura 2000 site, and the details of the project at site preparation, construction and operation stages (see below). The following is an extract from the Departmental guidance: *AA is a focused and detailed impact assessment of the implications of the plan or project, alone and in combination with other plans and projects, on the integrity of a Natura 2000 site in view of its conservation objectives. There is no prescribed method for undertaking AA, or form or content for reporting. Case law has established that assessments should be undertaken on the basis of the best scientific evidence and methods. Accordingly, data and information on the project and on the site and an analysis of potential effects on the site must be obtained and presented in a Natura Impact Statement (previously known as a Statement for Appropriate Assessment). Ecological*

specialists will be required to undertake the surveys, research and analysis, with input from other experts (e.g. hydrologists or engineers) as necessary to prepare the Natura Impact Statement.

Mitigation measures should be set out in detail, as necessary, to avoid any potential impacts. Details of specialist supervision and monitoring to ensure the proper and successful implementation of mitigation measures should also be specified.

The NIS should conclude with a clear statement on whether or not significant effects on the SAC in view of its conservation objectives will occur, taking the precautionary principle into account.

Natura 2000 sites

The Natura 2000 sites, Lough Corrib cSAC (site code 000297) and Lough Corrib SPA (site code 004042), occur within the study area. Information about these sites, including location, site synopses, Natura 2000 standard data forms and qualifying interests/special conservation interests, is available from www.npws.ie.

SACs have been selected for the conservation of a range of Habitats Directive Annex I habitats and Annex II species. These are the qualifying interests for the site from which the conservation objectives are derived. The latter include i) maintaining or restoring the area and structure and function of relevant Annex I habitats, and populations of typical species of these habitats, and ii) maintaining or restoring the population and range of Annex II species, and their habitats. Structure and function include water quality and hydrological regime.

SPAs have been selected for the conservation of a range of Birds Directive Annex I species and regularly-occurring migratory species, and their habitats, particularly wetlands. The overarching conservation objective for each SPA is to ensure that target bird populations (i.e. the special conservation interests) and their habitats are maintained at, or restored to favourable conservation condition. This includes, as an integral part, the need to avoid deterioration of habitats and significant disturbance such that site integrity is maintained. The long term population trend for each relevant species should be stable or increasing.

EIS or other assessment

It should be noted that appropriate assessment (including screening) is specifically intended to determine the likely significant effects on Natura 2000 sites in view of their conservation objectives, and to ensure that no plan or project that would have adverse effects on the integrity of a Natura 2000 site is approved or adopted (unless in exceptional circumstances where the requirements of Article 6(4) of the Habitats Directive can be met). Appropriate assessment does not deal with all significant ecological issues of relevance to proper planning and sustainable development, nor does it address all legal requirements in relation to the conservation and protection of ecological sites, habitats and species.

An EIS or other ecological assessment will be required to determine the potential effects on:

- Nature conservation sites not covered above, including Kiltullagh Turlough proposed NHA (site code 287)
- Species of flora and fauna that are strictly protected under wildlife legislation – see NPWS Circular Letter 2/07
- '*Protected species and natural habitats*', as defined in the European Liability Directive (2004/35/EC) and European Communities (Environmental Liability) Regulations, 2008, including:
 - Birds Directive – Annex I species and other regularly occurring migratory species, and their habitats (wherever they occur)
 - Habitats Directive – Annex I habitats, Annex II species and their habitats, and Annex IV species and their breeding sites and resting places (wherever they occur)

- Other habitats of ecological value in a national or local context, e.g. other wetlands and woodlands
- Stepping stones and ecological corridors covered by Article 10 of the Habitats Directive.

The assessment should also inform the planning and design of the scheme, and the details of mitigation measures necessary. In line with the COST 341 guidelines¹, "*project planning and design should aim to avoid ecological damage first and foremost, especially for protected or sensitive habitats and/or species, before employing mitigation techniques. Compensatory measures should only be employed as a last resort where avoidance is impractical, and the mitigation measures are considered insufficient*".

The flora and fauna section of the EIS, or other ecological impact assessment, should include survey, description and evaluation of the following:

- Habitats of the receiving environment, including a habitat map of the site and surrounds with the footprint of the development and all works areas overlain. A standard scheme such as Fossitt² (2000) should be used for habitat nomenclature. Any EU Habitats Directive Annex I habitats should be identified as such and should be clearly mapped, described and evaluated, including in terms of the vegetation communities, flora and fauna they support;
- Flora of the receiving environment, including any rare or protected species;
- Fauna that use the site and surrounding areas, including any rare or protected species.

The receiving environment should be defined to include all areas that may be impacted directly or indirectly by the proposed development. Cumulative impacts must also be taken into consideration. Impacts should be assessed on the basis of a full project description.

Project description

All aspects of the project at site preparation (including advance works), construction and operation stages should be taken into account in undertaking assessments, whether occurring inside or outside nature conservation sites, or on a temporary or permanent basis, including: road access; site access; site clearance; works areas; development footprint (including temporary traffic management measures or diversions); construction methods; machinery involved; storage and disposal sites; emissions; water management; landscaping or reinstatement. Maintenance requirements should also be taken into account.

In combination projects

The following plans and projects may give rise to in combination effects: Claregalway Local Area Plan 2005-2011; existing flood relief and flood prevention measures; new wastewater treatment plant (Cahergowan) (permitted); M17/N18 Gort to Tuam road (permitted); Claregalway riverside walkway (proposed); Claregalway bypass road (proposed).

Kindly forward any further information to the following address as soon as it issues:

The Manager,
Development Applications Unit,
Department of Arts, Heritage and the Gaeltacht,
Newtown Road,
Wexford

¹ Trocmé, M. ed. (2002) *COST 341. Habitat Fragmentation Due to Transport Infrastructure: The European Review*. European Commission, Brussels.

² Fossitt, J.A. (2000). *A guide to habitats in Ireland*. Heritage Council, Kilkenny.

Alternatively, documentation associated with the above can be referred electronically to the DAU at the following address:

manager.dau@environ.ie

In addition, please acknowledge receipt of these observations by return.

Is mise le meas,

A handwritten signature in blue ink, appearing to read 'David Tuohy', is written over a horizontal line.

David Tuohy,
Development Applications Unit
Tel: (053) 911 7380
E-mail: david.tuohy@environ.ie

Appendix 1

List of key guidance documents and relevant circulars

Appropriate assessment

DoEHLG (2009) *Appropriate Assessment of Plans and Projects in Ireland: Guidance for Local Authorities* (revision 10/02/10) (available from www.npws.ie)

European Commission (2000) *Managing Natura 2000 sites: the provisions of Article 6 of the 'Habitats' Directive 92/43/EEC*

European Commission (2002) *Assessment of plans and projects significantly affecting Natura 2000 sites: Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC*

European Commission (2006) *Nature and Biodiversity Cases. Ruling of the European Court of Justice*

European Commission (2007) *Guidance document on Article 6(4) of the 'Habitats Directive' 92/43/EEC. Clarification of the concepts of: Alternative Solutions, Imperative Reasons of Overriding Public Interest, Compensatory Measures, Overall Coherence, Opinion of the Commission*

Departmental/NPWS Circulars (available from www.npws.ie)

Circular NPWS 1/10 & PSSP 2/10: *Appropriate Assessment under Article 6 of the Habitats Directive: guidance for Planning Authorities*

Circular Letter NPWS 2/07: *Guidance on Compliance with Regulation 23 of the Habitats Regulations 1997 – Strict Protection of Certain Species/Derogation Licences.*

Circular Letter PD 2/07 and NPWS 1/07: *Compliance Conditions in respect of Developments requiring (1) Environmental Impact Assessment (EIA); or (2) having potential impacts on Natura 2000 sites*

Circular L8/08: *Water Services Investment and Rural Water Programmes – Protection of Natural Heritage and National Monuments*

EIA

EPA (2002) *Guidelines on Information to be Contained in Environmental Impact Statements*

EPA (2003) *Advice Notes on Current Practice (on the preparation of Environmental Impact Statements)*

DoEHLG (2003) *Environmental Impact Assessment (EIA) Guidance for Consent Authorities regarding Sub-threshold Development*

Flooding

DoEHLG (2009) *The Planning System and Flood Risk Management – Guidelines for Planning Authorities* [including Technical Appendices]

13th May 2011.

Ms. Ni Chathain,
Associate
R.P.S,
Lyrr Building,
IDA Business & Technology Park,
Mervue,
Galway.

Recipient	Bernie Ni Chathain
Register No.	5
RPS	16 MAY 2011
Project No.	M6E0262
File Ref.	360
PM	Bernie Ni Chathain

14/5/11

Dear **Ms. Ni Chathain,**

CLARE RIVER (CLAREGALWAY) FLOOD RELIEF PROJECT.

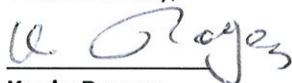
The main constraints/issues arising from a fisheries perspective are summarised hereunder.

- (a) Impact on resident/migratory fish populations.
- (b) Establishment and mapping of existing baseline conditions, identification of existing pools/glide and riffle zones.
- (c) Timing to avoid impacting salmonid ova, smolt or elvers or other fish species.
- (d) Disruption of angling.
- (e) Access to the River from the main road and access to the proposed low bank and flood berm.
- (f) Impact of sediment release and transport.
- (g) Changes to low flow regime as a result of the level at which the base of the flood berm is set in relation to the new proposed river bed level.
- (h) Car parking for anglers
- (i) Plan for remediation of channel and riparian zone.
- (j) Integration with River Clare walkway project.

The seriousness of the flooding that occurred in November 2010 is acknowledged. It is assumed that the project which is aimed at alleviating this problem will be undertaken in accordance with E.R.E.P methodology which aims to protect and enhance all water dependent habitats and species.

We discussed the project with OPW and requested that in the context of the scheme that the creation of a fish holding pool at a suitable location downstream of Claregalway bridge should be considered and which would be positioned adjacent to the proposed angling platform which is to be integrated into the river walkway project. The existing pool previously selected is too far downstream for disabled anglers to traverse in complete safety. See appendix 1, map 2.

Yours sincerely,

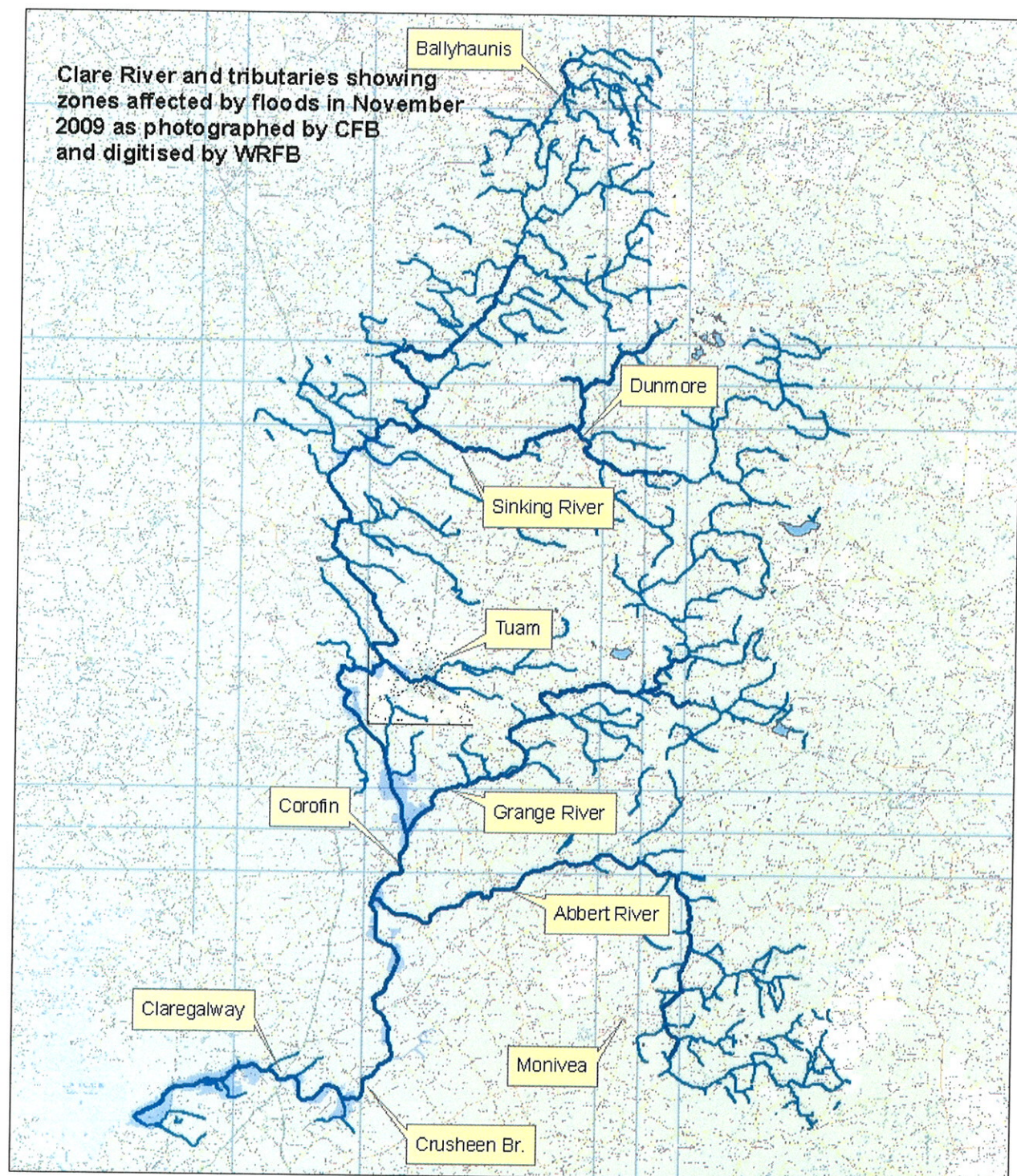


Kevin Rogers

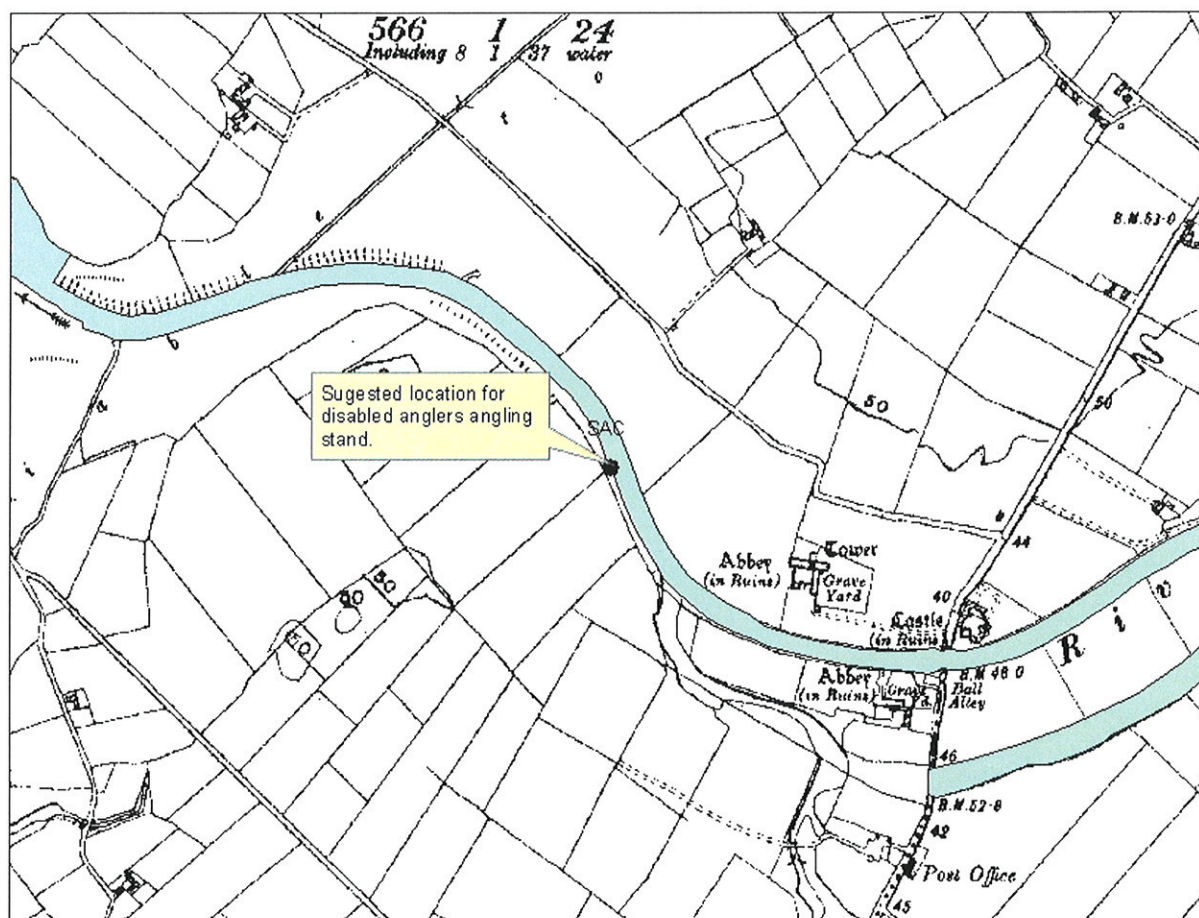
Senior Environmental Officer.

Appendix 1.

Map 1: Clare River Catchment water bodies.



Map 2: Original location proposed for disabled anglers stand.



19th September 2011.

Ms. Bernadette Ni Chathain,
Associate,
R.P.S.,
Lyrr Buiding,
IDA Technology Park,
Mervue,
Galway.

Recipient	Borne
Register No.	4
RPS	22 SEP 2011
Project No.	MGE0262
File Ref.	360.
APPROPRIATE ASSESSMENT SCREENING	

Dear **Bernadette,**

CLARE RIVER (CLAREGALWAY) FLOOD RELIEF SCHEME - APPROPRIATE ASSESSMENT SCREENING REPORT.

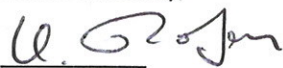
I refer to the above document as received on the 19th August 2011.

Since then, meeting have taken place between IFI and RPS on the 22nd August 2011 and IFI and OPW on the 8th September 2011.

At the meeting with RPS, it was noted that the levels of the flood relief channels as proposed were set at approximately the median flow which means they would overtop 50% of the time. Arising from the meeting with OPW, reference was made to setting the level of the secondary channel such that it is dry 75% of the time during the summer months (based on the 2011 summer rainfall and flow data). This appears to constitute an improvement on the original situation but would mean that in practise the berms would be flooded for 23 days during the summer of 2011. Further clarification has been sought from OPW and in the meantime I.F.I researchers are examining the project with a view to making recommendations in respect of river enhancement and remediation.

It is assumed that R.P.S are also examining the project from this perspective.

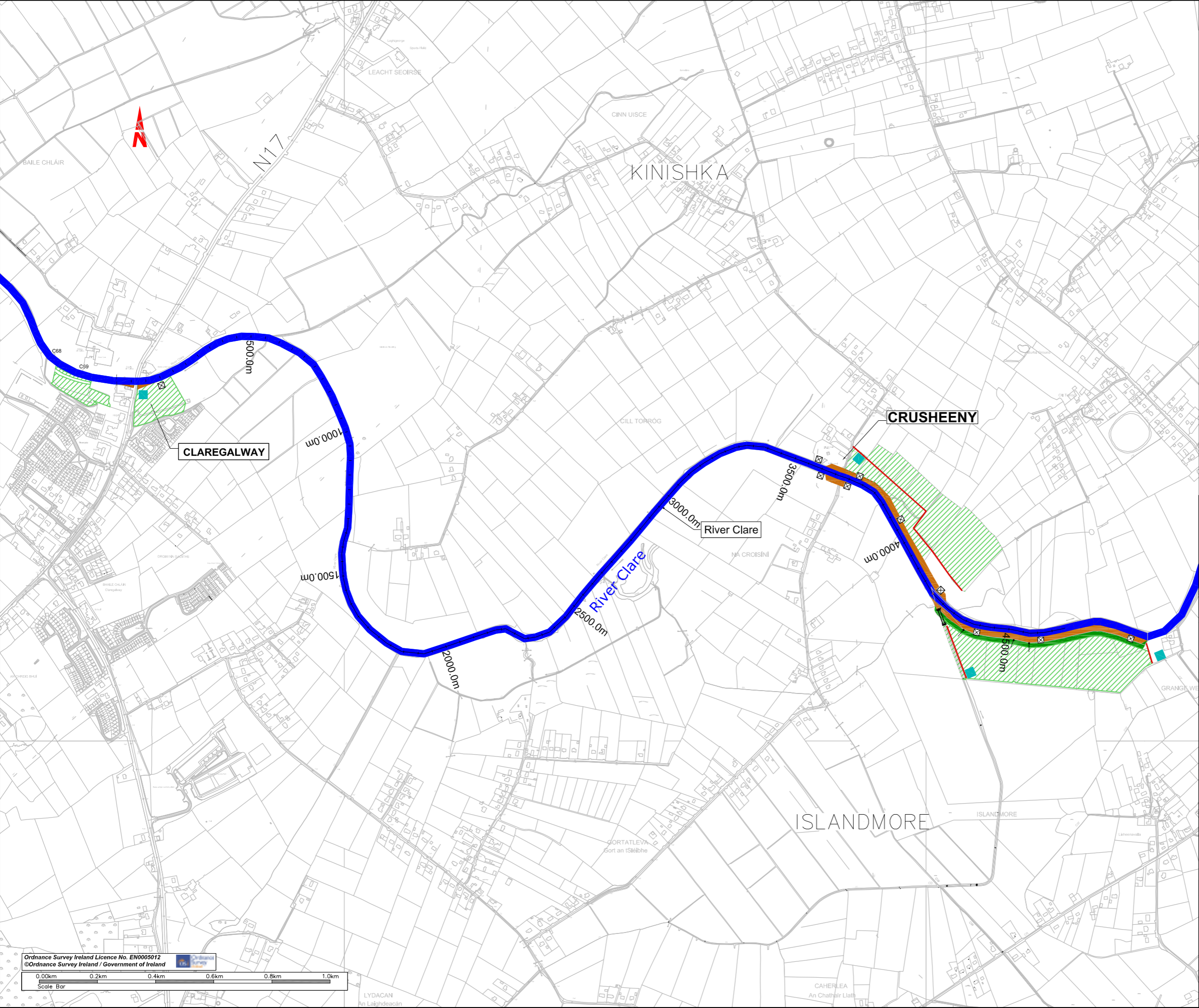
Yours sincerely,



Kevin Rogers
Senior Environmental Officer.

APPENDIX C

Drawings



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 5. Datum: Ordnance Survey Datum, Malin Head

LEGEND

Area to be excavated	
Embankment	
Land identified as being potentially required for excavated spoil	
Access Road	
Trial Pits	
Proposed Compounds	

F01	07.11.12	MM P/G	PUBLIC EXHIBITION	COS
A01	15.11.11	DK P/G	ISSUE FOR APPROVAL	COS
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Mervue, Galway E ireland@rpsgroup.com







Client

Project
**CLARE RIVER (CLAREGALWAY)
DRAINAGE SCHEME**

Title
**FIGURE 6.11
CHANNEL WIDENING MEASURES
POTENTIAL SPOIL SPREADING
LOCATIONS AND SITE INVESTIGATION WORKS**

Scale 1: 12500 @ A3	Date Nov 2012
Drawing Number MGE0262/CS0001-01	Rev F01
Drawn By MC	Checked By PJG
Approved By COS	



5. Datum: Ordnance Survey Datum, Malin Head	
LEGEND	
Area to be excavated	
Embankment	
Land identified as being potentially required for excavated spoil	
Access Road	
Trial Pits	
Proposed Compounds	

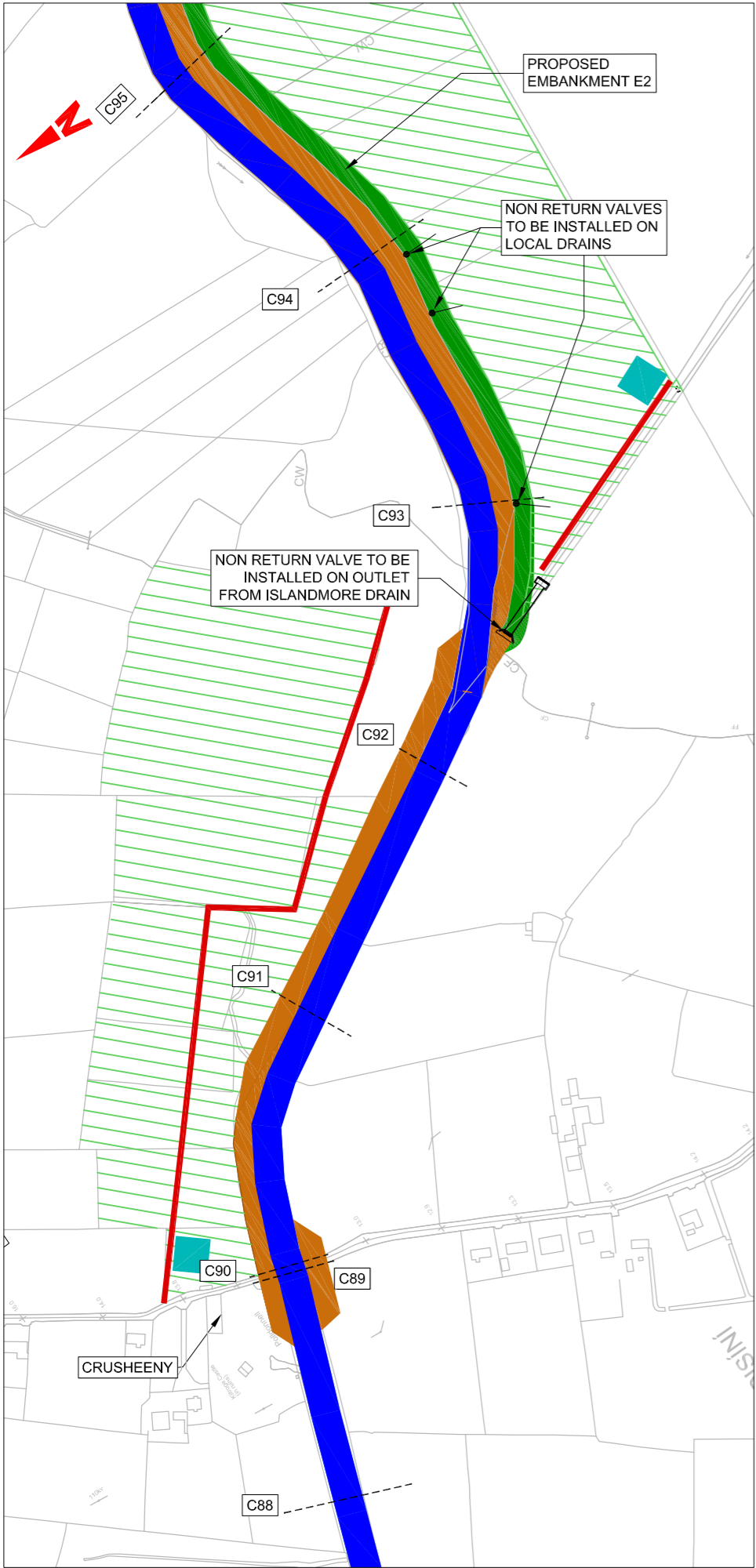
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Project
CLARE RIVER (CLAREGALWAY)
DRAINAGE SCHEME

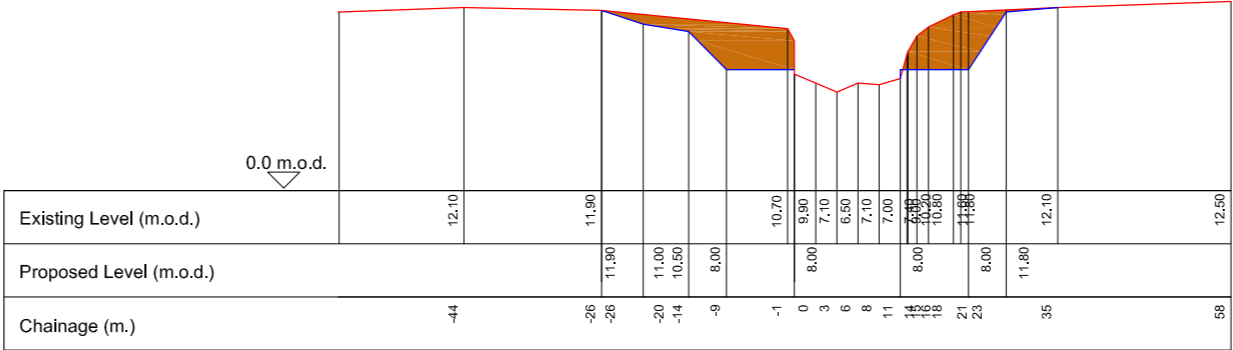
Title

CROSS SECTIONS
(Sheet 1 of 3)
FIG. 6.12a

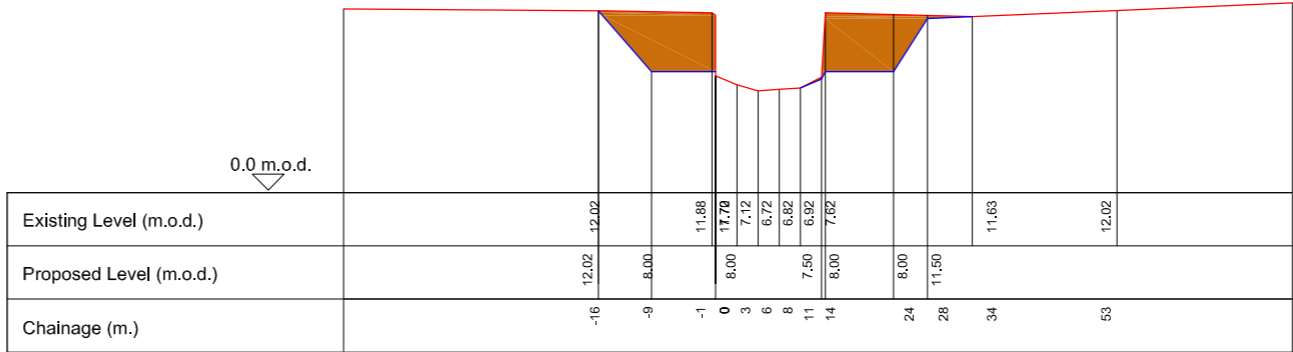
Scale As Shown	Date Nov 2012
Drawing Number MGE0262/CS0001-02	Rev F01
Drawn By MC	Checked By PJG
	Approved By COS



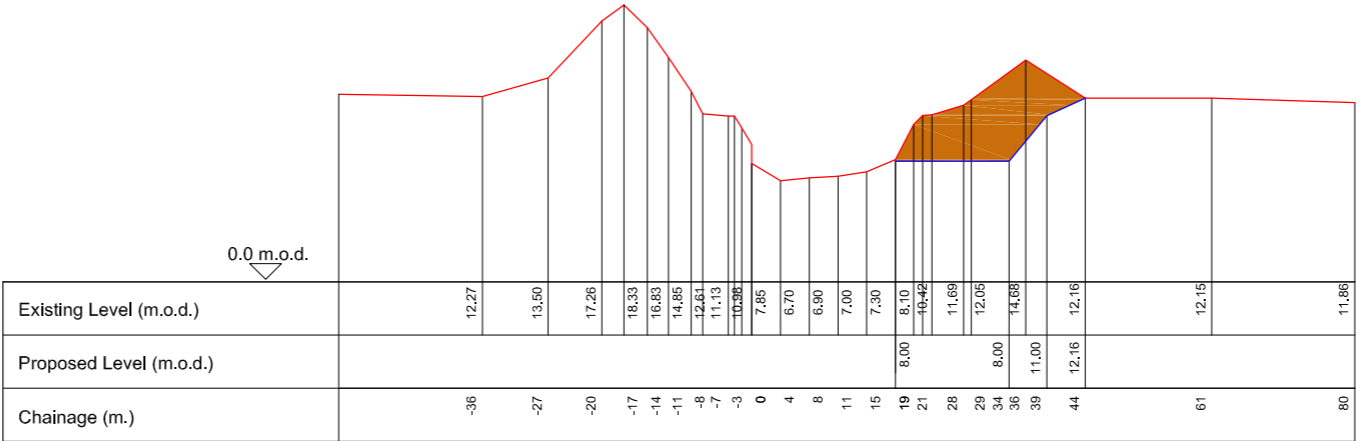
PLAN VIEW OF RIVER SECTIONS SCALE 1:5000



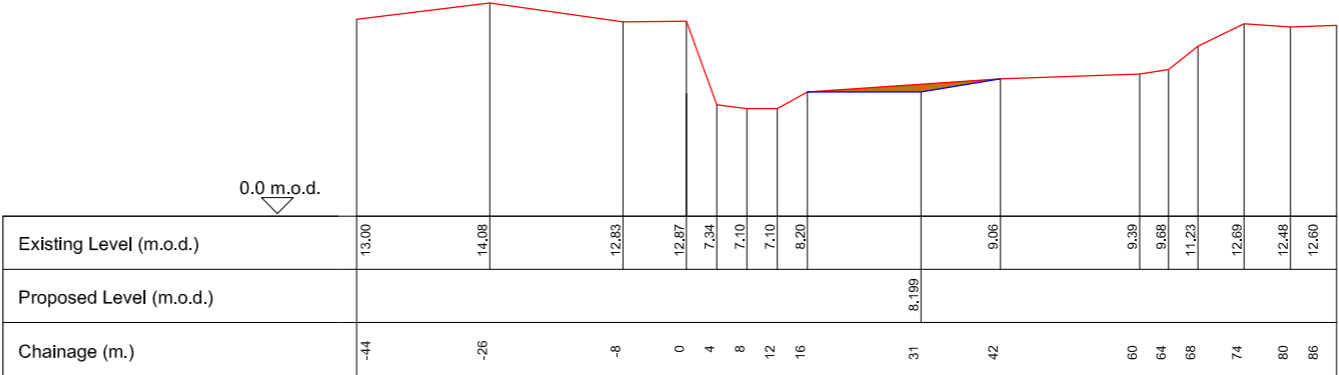
SECTION C89



SECTION C90



SECTION C91



SECTION C92 (BREAK IN SPOIL HEAP)

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5. Datum: Ordnance Survey Datum, Malin Head

LEGEND

Area to be excavated

Embankment

Land identified as being potentially required for excavated spoil

Access Road

Trial Pits

Proposed Compounds

No.	Date	Drn. Chk.	Amendment / Issue	App
F01	07.11.12	MM P/G	PUBLIC EXHIBITION	COS
A01	15.11.11	MC P/G	ISSUE FOR APPROVAL	COS

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Client

Project
**CLARE RIVER (CLAREGALWAY)
DRAINAGE SCHEME**

Title
**CROSS SECTIONS
(Sheet 2 of 3)
FIG. 6.12b**

Scale
As Shown

Date
Nov 2012

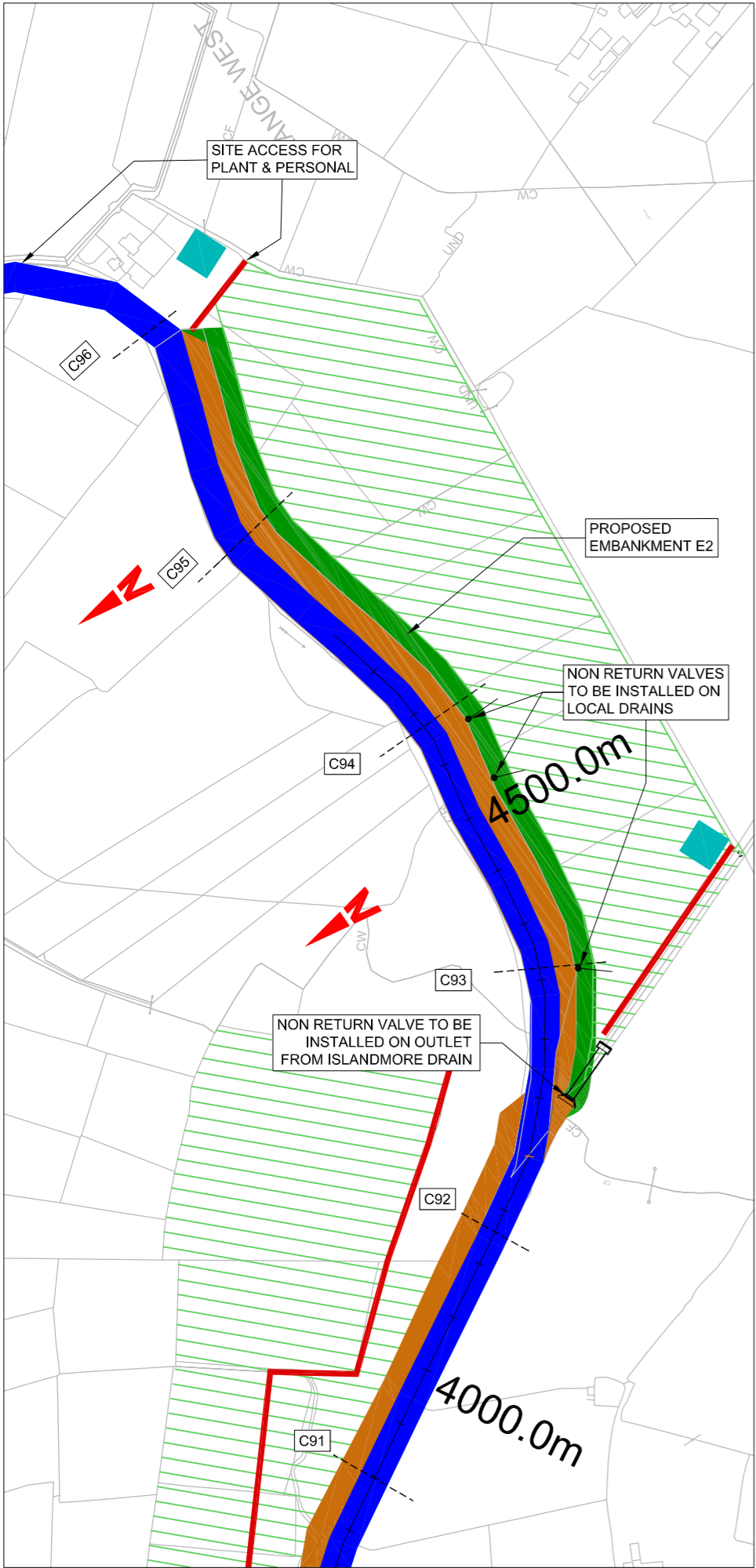
Drawing Number
MGE0262/CS0001-03

Rev
F01

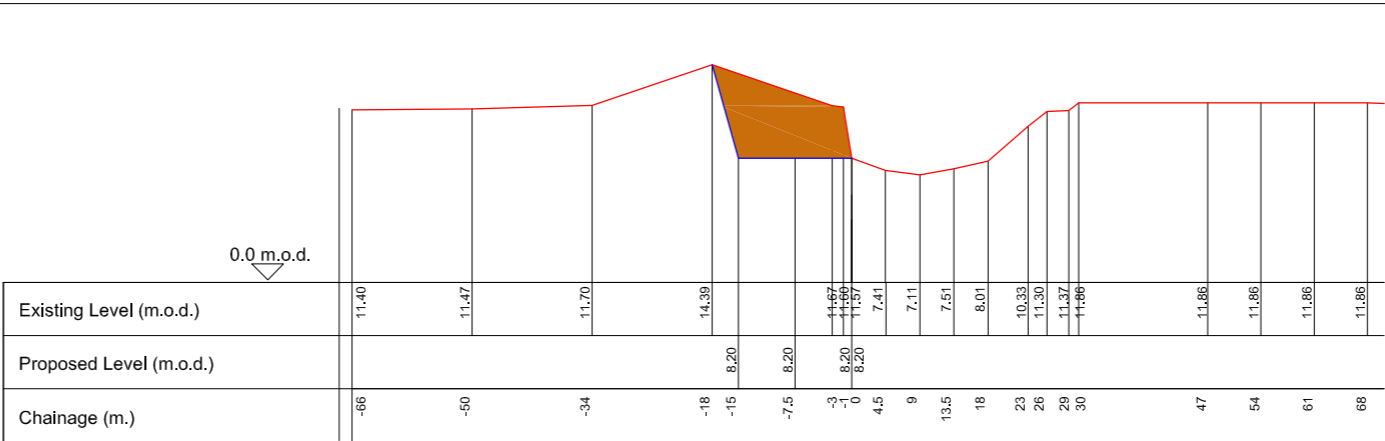
Drawn By
MM

Checked By
PJG

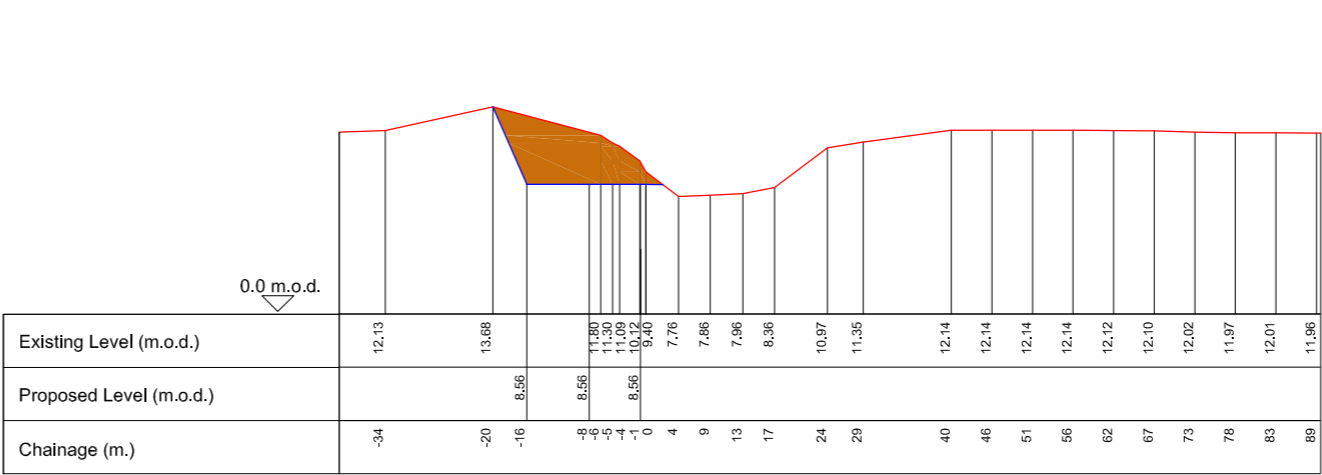
Approved By
COS



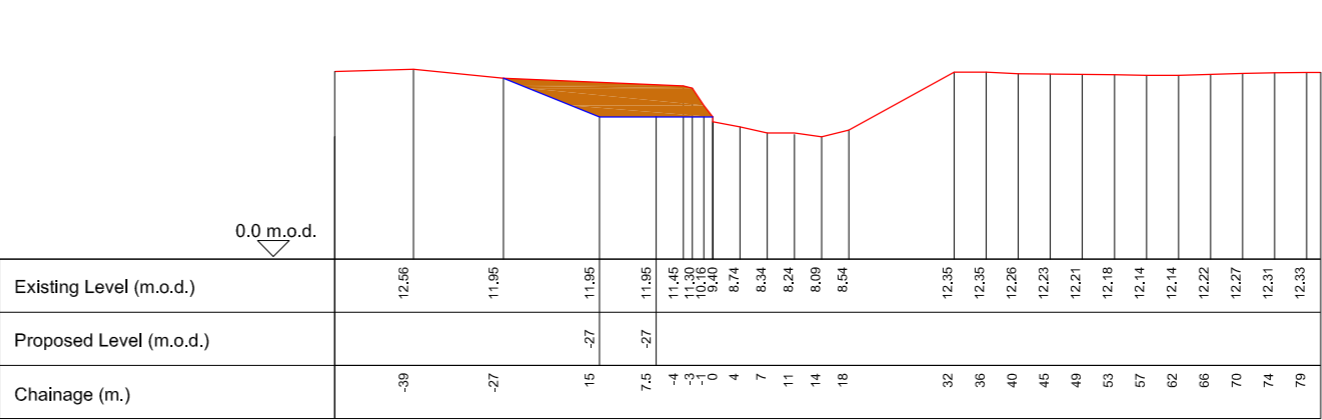
PLAN VIEW OF RIVER SECTIONS SCALE 1:5000



SECTION C93



SECTION C94



SECTION C95

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5. Datum: Ordnance Survey Datum, Malin Head

LEGEND

Area to be excavated	
Embankment	
Land identified as being potentially required for excavated spoil	
Access Road	
Trial Pits	
Proposed Compounds	

No.	Date	Drn. Chk.	Amendment / Issue	App
F01	07.11.12	MM P/G	PUBLIC EXHIBITION	COS
A01	15.11.11	MC P/G	ISSUE FOR APPROVAL	COS

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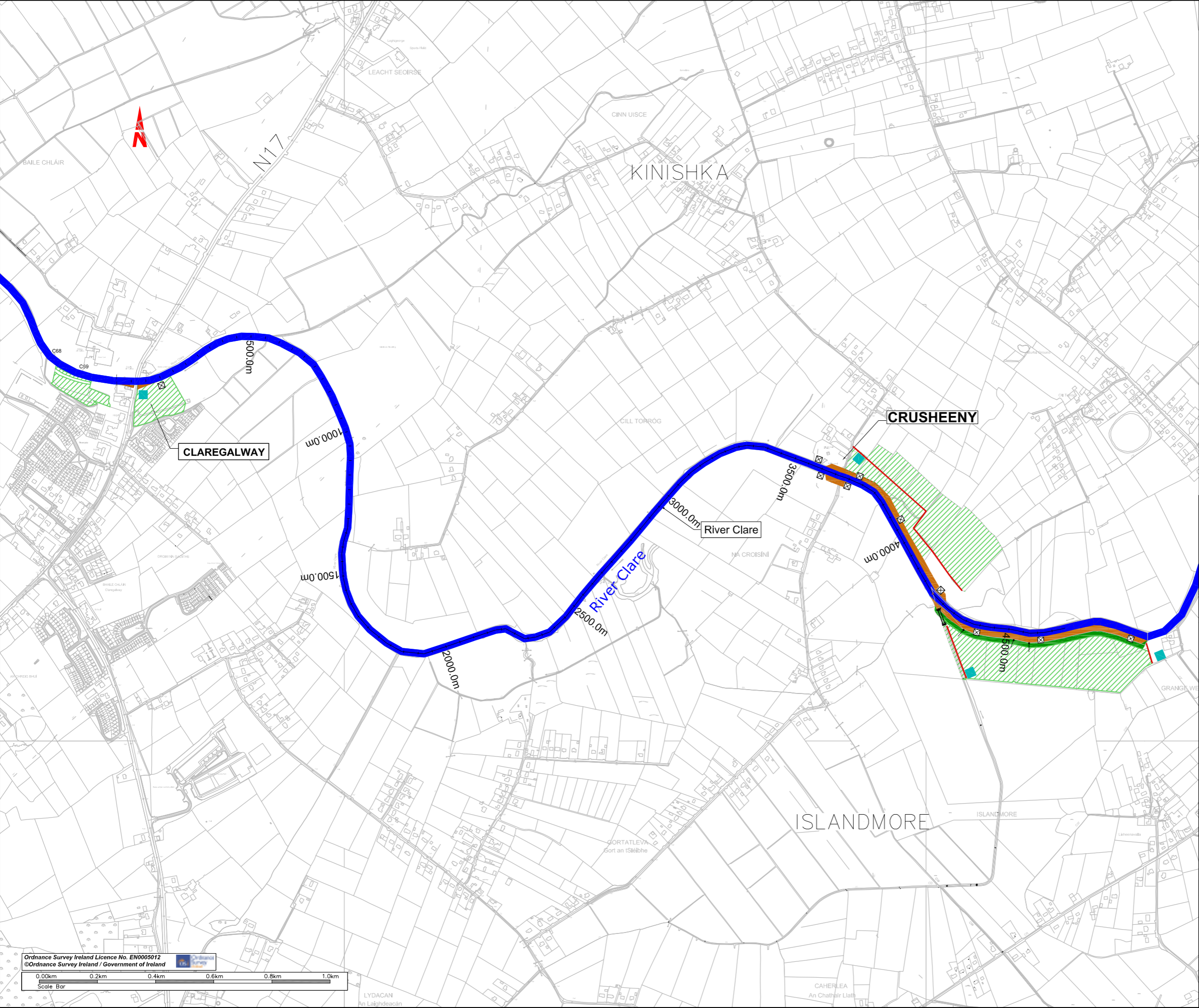
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Client

Project
**CLARE RIVER (CLAREGALWAY)
DRAINAGE SCHEME**

Title
**CROSS SECTIONS
(Sheet 3 of 3)
FIG. 6.12c**

Scale As Shown		Date Nov 2012
Drawing Number MGE0262/CS0001-04		Rev F01
Drawn By MM	Checked By PJG	Approved By COS



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LEGEND	
Area to be excavated	
Embankment	
Land identified as being potentially required for excavated spoil	
Access Road	
Trial Pits	
Proposed Compounds	

F01	07.11.12	MM P/G	PUBLIC EXHIBITION	COS
A01	15.11.11	DK P/G	ISSUE FOR APPROVAL	COS
No.	Date	Dr. Cmk.	Amendment / Issue	App

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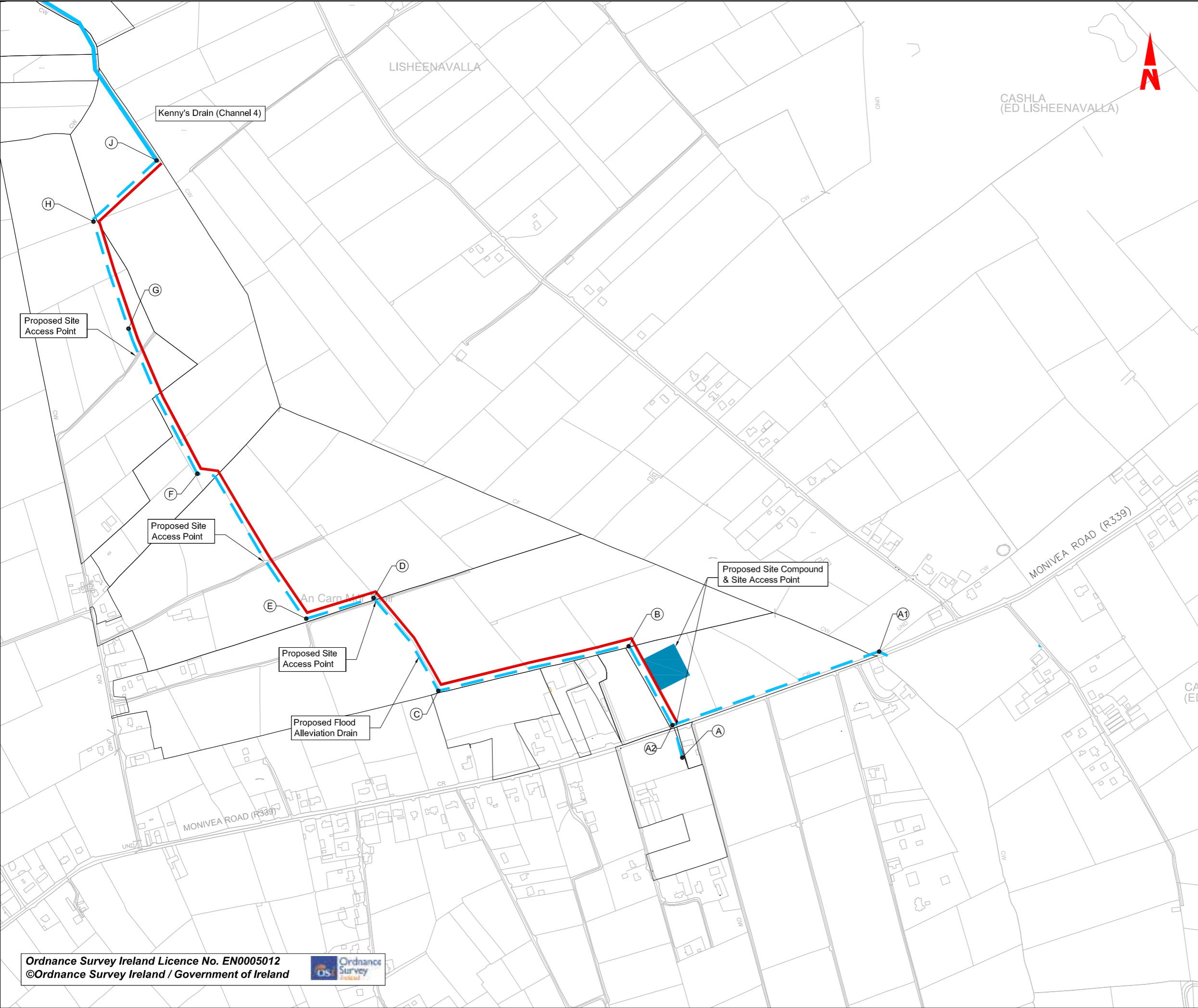
Project
CLARE RIVER (CLAREGALWAY) DRAINAGE SCHEME

Title
**SITE ACCESS & COMPOUNDS
FIG. 6.21a**

Scale 1: 12500 @ A3	Date Nov 2012
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Drawing Number MGE0262/CS0001-05	Rev F01
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Drawn By MC	Checked By PJG	Approved By COS
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5. Datum: Ordnance Survey Datum, Malin Head

LEGEND	
Existing Drain	
Proposed Flood Alleviation Drain	
Regional/ Local Road	R339/ L31013
Proposed Site Compounds	
Temporary Site Access Road	
Folio Numbers	1, 2, 3

F01	07.11.12	MM PJG	PUBLIC EXHIBITION	COS
A01	23.10.12	PC PJG	ISSUE FOR APPROVAL	COS
D02	23.01.12	PC PJG	ACCESS ROAD & LEGEND ADDED	COS
D01	18.12.11	LP PJG	DRAFT ISSUE	COS
No.	Date	Dr. Chk.	Amendment / Issue	App

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Client

Project
**CLARE RIVER (CLAREGALWAY)
DRAINAGE SCHEME**

Title
**SITE ACCESS & COMPOUNDS
FIG. 6.21b**

Scale Not to Scale	Date Nov 2012
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Drawing Number MGE0262/DG0008-01	Rev F01
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Drawn By MC	Checked By PJG	Approved By COS
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APPENDIX D

NPWS Site Synopses

SITE NAME : LOUGH CORRIB cSAC

SITE CODE : 000297

Lough Corrib is situated to the north of Galway city and is the second largest lake in Ireland with an area of approximately 18,240 ha (the entire site is 20,556 ha). The lake can be divided into two parts: a relatively shallow basin, underlain by Carboniferous limestone, in the south and a larger, deeper basin, underlain by more acidic granite, schists, shales and sandstones, to the north. The surrounding lands are mostly pastoral farmland, to the south and east, and bog and heath, to the west and north. Rivers, mainly to the east of the site are included within the cSAC as they are important for Atlantic Salmon. These rivers include the Clare, Grange, Abbert, Sinking, Dalgan and Black to the east, as well as the Cong, Bealanabrack, Failmore, Cornamona, Drimneen and Owenriff to the west. In addition to the rivers and lake basin, adjoining areas of conservation interest, including raised bog, woodland, grassland and limestone pavement, have been incorporated into the site.

This site is of major conservation importance and includes 14 habitats listed on Annex I of the E.U. Habitats Directive. Six of these are priority habitats - petrifying springs, *Cladium* fen, active raised bog, limestone pavement, bog woodland and orchid-rich calcareous grassland. The other annexed habitats present include hard water lakes, lowland oligotrophic lakes, floating river vegetation, alkaline fens, degraded raised bogs, Rhynchosporion vegetation, *Molinia* meadows and old Oak woodlands. Species present on the site that are listed on Annex II of this directive are Sea Lamprey, Brook Lamprey, Atlantic Salmon, White-clawed Crayfish, Freshwater Pearl Mussel, Otter, Lesser Horseshoe Bat, Slender Naiad and the moss *Drepanocladus vernicosus*.

The shallow, lime-rich waters of the southern basin of the lake support one of the most extensive beds of Stoneworts (Charophytes) in Ireland, with species such as *Chara aspera*, *C. hispida*, *C. delicatula*, *C. contraria* and *C. desmacantha* mixed with submerged Pondweeds (*Potamogeton perfoliatus*, *P. gramineus* and *P. lucens*), Shoreweed (*Littorella uniflora*) and Water Lobelia (*Lobelia dortmanna*). These *Chara* beds are an important source of food for waterfowl. In contrast, the northern basin contains more oligotrophic and acidic waters, without *Chara* species, but with Shoreweed, Water Lobelia, Pipewort (*Eriocaulon septangulare*), Quillwort (*Isoetes lacustris*), Alternate Water-milfoil (*Myriophyllum alternifolium*) and Slender Naiad (*Najas flexilis*). The last-named is listed under the Flora (Protection) Order, 1999 and is an Annex II species under the EU Habitats Directive.

Large areas of reedswamp vegetation, dominated by varying mixtures of Common Reed (*Phragmites australis*) and Common Club-rush (*Scirpus lacustris*), occur around the margins of the lake. Reedswamp usually grades into species-rich marsh vegetation characterised by Slender Sedge (*Carex lasiocarpa*), Water Mint (*Mentha aquatica*), Water Horsetail (*Equisetum fluviatile*) and Bog Bean (*Menyanthes trifoliata*). Of particular note are the extensive beds of Great Fen-sedge (*Cladium mariscus*) that have developed over the marly peat deposits in sheltered bays, particularly in the south-east corner of the lake. Alkaline fen vegetation is more widespread around the lake margins and includes, amongst the typically diverse range of plants, the Slender Cottongrass (*Eriophorum gracile*), a species protected under the Flora (Protection) Order, 1999. Wet meadows dominated by Purple Moor-grass (*Molinia caerulea*) occur in seasonally flooded areas close to the lake shore. These support species such as Sharp-flowered Rush (*Juncus acutiflorus*), Jointed Rush (*J. articulatus*), Carnation Sedge (*Carex panicea*), Devil's-bit Scabious (*Succisa pratensis*), Creeping Bent (*Agrostis stolonifera*) and Tormentil (*Potentilla erecta*), amongst others.

This large site contains four discrete raised bog areas and is selected for active raised bog, degraded raised bog, Rhynchosporion and bog woodland. Active raised bog comprises areas of high bog that are wet and actively peat-forming, where the percentage cover of bog mosses (*Sphagnum* spp.) is high, and where some or all of the following features occur: hummocks, pools, wet flats, *Sphagnum* lawns, flushes and soaks. Degraded raised bog corresponds to those areas of high bog whose hydrology has been adversely affected by peat cutting, drainage and other land use activities, but which are capable of regeneration. The Rhynchosporion habitat occurs in wet depressions, pool edges and erosion channels where the vegetation includes White Beak-sedge (*Rhynchospora alba*) and/or Brown Beak-sedge (*R. fusca*), and at least some of the following associated species, Bog Asphodel (*Narthecium ossifragum*), Sundews (*Drosera* spp.), Deergrass (*Scirpus cespitosus*) and Carnation Sedge (*Carex panicea*).

At Addergoole, on the eastern shores of Lough Corrib, there is an important area of western raised bog. This bog area is one of the most westerly, relatively intact raised bogs in the country. There are also other substantial areas of raised bog along various tributaries of the Corrib in east Co. Galway, namely Slieve Bog, Lough Tee Bog and Killaclogher bog. The active parts of these bogs mostly correspond to the wettest areas, where there are well developed surface features with hummocks, lawns and pools. It is in such areas that Rhynchosporion vegetation is best represented. The dominant species is the aquatic bog moss *Sphagnum cuspidatum*, which is usually accompanied by Bogbean (*Menyanthes trifoliata*), White Beak-sedge, Bog Asphodel, Bog Cotton (*Eriophorum angustifolium*), Bog Sedge (*Carex limosa*) and Great Sundew (*Drosera anglica*). Brown Beak-sedge, a locally rare plant of wet bog pools, has been recorded from a number of the bog areas within the site. At Addergoole a substantial bog lake or soak occurs and this is infilling with large rafts of Rhynchosporion vegetation at present. This area is associated with an important area of wet bog woodland dominated by Downy Birch (*Betula pubescens*).

The largest part of the uncut high bog comprises degraded raised bog. Degraded bog is dominated by a raised bog flora which tends to be rather species-poor because of disturbance and/or drying-out. The most conspicuous vascular plant species are usually Carnation Sedge (*Carex panicea*), Heather (*Calluna vulgaris*), Bog Cotton, Cross-leaved Heath (*Erica tetralix*), Bog Asphodel and Deergrass. Bog Rosemary (*Andromeda polifolia*) and Cranberry (*Vaccinium oxycoccos*), two species indicative of raised bog habitat, are frequent on both degraded and active areas of raised bog. *Sphagnum* cover is generally low within degraded areas due to a combination of drying-out and frequent burning.

Limestone pavement occurs along much of the shoreline in the lower Corrib basin and supports a rich and diverse flora, including Herb-robert (*Geranium robertianum*), Bloody Crane's-bill (*G. sanguineum*), Carlina Thistle (*Carlina vulgaris*), Spring Gentian (*Gentiana verna*), Wild Thyme (*Thymus praecox*), Rustyback (*Ceterach officinarum*), Wood Sage (*Teucrium scorodonia*), Slender St. John's-wort (*Hypericum pulchrum*), Quaking-grass (*Briza media*) and Blue Moor-grass (*Sesleria albicans*). Areas of Hazel (*Corylus avellana*) scrub occur in association with exposed limestone pavement and these include species such as Hawthorn (*Crataegus monogyna*), Buckthorn (*Rhamnus catharticus*), Spindle (*Euonymus europaeus*) with occasional Juniper (*Juniperus communis*). Three Red Data Book species are also found in association with limestone scrub - Alder Buckthorn (*Frangula alnus*), Shrubby Cinquefoil (*Potentilla fruticosa*) and Wood Bitter-vetch (*Vicia orobus*), the latter is also protected under the Flora (Protection) Order, 1999.

Open areas of orchid-rich calcareous grassland are also found in association with the limestone exposures. These can support a typically rich vegetation, including many orchids such as Pyramidal Orchid (*Anacamptis pyramidalis*), Common Spotted-orchid (*Dactylorhiza fuchsii*), Early-purple Orchid (*Orchis mascula*), Frog Orchid (*Coeloglossum viride*), Fragrant Orchid (*Gymnadenia conopsea*), Marsh Helleborine (*Epipactis palustris*), Greater Butterfly-orchid (*Platanthera chlorantha*) and Irish Lady's-tresses (*Spiranthes romanzoffiana*). The latter is protected under the Flora (Protection) Order, 1999.

The Hill of Doon, located in the north-western corner of the lake, is a fine example of a Sessile Oak (*Quercus petraea*) woodland. The understorey is dominated by Sessile Oak, Holly (*Ilex aquifolium*) and occasional Juniper. There are occasional Yew (*Taxus baccata*) and Ash (*Fraxinus excelsior*) and a well developed ground layer dominated by Bilberry (*Vaccinium myrtillus*), Hard Fern (*Blechnum spicant*) and Wood Rush (*Luzula sylvatica*). Woodland also occurs on some of the islands in the lake.

The lake is rated as an internationally important site for waterfowl. Counts from 1984 to 1987 revealed a mean annual peak total of 19,994 birds. In the past a maximum peak of 38,281 birds was recorded. The lake supports internationally important numbers of Pochard (average peak 8,600) and nationally important numbers of the following species: Coot (average peak 6,756), Mute Swan (average peak 176), Tufted Duck (average peak 1,317), Cormorant (average peak 110) and Greenland White-fronted Goose (average peak 83). The latter species is listed on Annex I of Birds Directive. The Coot population is the largest in the country and populations of Tufted Duck and Pochard are second only to Lough Neagh. 30-41 breeding pairs of Common Scoter occur on the lake (1995 data) as well as breeding populations of Arctic Tern and Common Tern. Other bird species of note recorded from or

close to the lake recently include Hen Harrier, Whooper Swan, Golden Plover and Kingfisher. All of these species are listed on Annex I of the E.U. Birds Directive.

Otter and Irish Hare have been recorded regularly within this site. Both of these species are listed in the Red Data Book and are legally protected by the Wildlife Act 1976. Otter is also listed on Annex II of the E.U. Habitats Directive. Lough Corrib is considered one of the best sites in the country for otter, due to the sheer size of the lake and associated rivers and streams and also the generally high quality of the habitats. Atlantic Salmon (*Salmo salar*) use the lake and rivers as spawning grounds. Although this species is still fished commercially in Ireland, it is considered to be endangered or locally threatened elsewhere in Europe and is listed on Annex II of the E.U. Habitats Directive. Lough Corrib is also a well known fishing lake with a very good Trout (*Salmo trutta*) fishery. The lake has a population of Sea Lamprey (*Petromyzon marinus*), a scarce, though probably under-recorded species listed on Annex II of the E.U. Habitats Directive.

A population of Freshwater Pearl-mussel (*Margaritifera margaritifera*), a species listed on Annex II of the E.U. Habitats Directive, occurs within the site. White clawed Crayfish (*Austropotamobius pallipes*), also listed on Annex II, is well distributed throughout Lough Corrib and its in-flowing rivers over limestone. A summer roost of Lesser Horseshoe Bat (*Rhinolophus hipposideros*), another Annex II species, occurs within the site - approximately 100 animals were recorded here in 1999.

The main threats to the quality of this site are from water polluting activities resulting from intensification of agricultural activities on the eastern side of the lake, uncontrolled discharge of sewage which is causing localised eutrophication of the lake, and housing and boating development, which is causing the loss of native lakeshore vegetation. The raised bog habitats are susceptible to further degradation and drying out due to drainage and peat cutting and, on occasions, burning. Peat cutting threatens Addergoole Bog and already a substantial area of it has been cut away. Fishing and shooting occur in and around the lake. Introduction of exotic crayfish species or the crayfish fungal plague (*Aphanomyces astaci*) could have a serious impact on the native crayfish population. The bat roost is susceptible to disturbance or development.

Despite this ongoing interference however, Lough Corrib is one the best examples of a large lacustrine catchment system in Ireland, with a range of habitats and species still well represented. The lake itself is internationally important for birds and is designated as a Special Protection Area.

9.12.2005

SITE NAME: LOUGH CORRIB SPA

SITE CODE: 004042

Lough Corrib is situated to the north of Galway City and is the largest lake in the country. The lake can be divided into two parts: a relatively shallow basin, underlain by Carboniferous limestone, in the south and a larger, deeper basin, underlain by more acidic granite, schists, shales and sandstones, to the north. The main inflowing rivers are the Black, Clare, Dooghta, Cregg, Owenriff and the channel from Lough Mask. The main outflowing river is the Corrib, which reaches the sea at Galway City. Over the 1994-97 period Lough Corrib was classified as a mesotrophic system, a change from its oligo/mesotrophic status in the 1991-94 period. It retained its mesotrophic status for the 1998-2000 period, with a reduction in phosphorous and planktonic algal growth noted. Overall, the water quality of the Corrib is considered to be satisfactory.

The shallow, lime-rich waters of the southern basin of the lake support one of the most extensive beds of Stoneworts (Charophytes) in Ireland, with species such as *Chara aspera*, *C. hispida*, *C. delicatula*, *C. contraria* and *C. desmacantha* mixed with submerged Pondweeds (*Potamogeton perfoliatus*, *P. gramineus* and *P. lucens*), Shoreweed (*Littorella uniflora*) and Water Lobelia (*Lobelia dortmanna*). These *Chara* beds are a very important source of food for waterfowl. In contrast, the northern basin contains more oligotrophic and acidic waters, largely lacking Charophyte species, but with such

species as Shoreweed, Water Lobelia, Pipewort (*Eriocaulon aquaticum*) and Quillwort (*Isoetes lacustris*). Large areas of reedswamp vegetation, dominated by varying mixtures of Common Reed (*Phragmites australis*) and Common Club-rush (*Scirpus lacustris*), occur around the margins of the lake. Reedswamp usually grades into species-rich marsh vegetation. Of particular note are the extensive beds of Great Fen-sedge (*Cladium mariscus*) that have developed over the marly peat deposits in sheltered bays. Limestone pavement occurs along much of the shoreline in the lower Corrib basin and supports a rich and diverse flora. The lake has numerous islands, from rocky islets to larger islands with grassland or woodland. The surrounding lands are mostly pastoral farmland, to the south and east, and bog and heath, to the west and north.

Lough Corrib is of international importance for wintering Pochard (10,182) - all figures are average peaks for the 5 seasons 1995/96-1999/00. It is one of the top five sites in the country for wintering waterfowl and also qualifies for international importance because it regularly supports well in excess of 20,000 waterfowl. It is the most important site in the country for Pochard, Tufted Duck (5,521) and Coot (14,473), supporting 21%, 46% and 13% of the respective national totals. It also has nationally important populations of wintering Mute Swan (182), Gadwall (48), Shoveler (90), Golden Plover (1,727) and Lapwing (2,424). The lake is a traditional site for Greenland White-fronted Goose (62). Relatively small numbers of Whooper Swan (35) occur, along with Wigeon (528), Teal (77), Mallard (155), Goldeneye (74), Curlew (114) and Cormorant (36).

Lough Corrib is a traditional breeding site for gulls and terns, with various islands being used for nesting each year. There are important colonies of Common Tern (37 pairs in 1995) and Arctic Terns (60 pairs in 1995), both populations being of national importance. The site supports substantial colonies of Black-headed Gull (856 individuals in 1999) and Common Gull (181 pairs in 1999), these representing 11% and 17% of the respective national totals. Lesser Black-backed Gull (51 individuals in 1999) and Great Black-backed Gull (16 individuals in 1999) also breed, with a few pairs of Herring Gull. Considerably higher numbers of breeding gulls occurred in the recent past, as shown by surveys in 1977 and 1993; the reasons for the continued declines are, however, not fully known.

Whilst only colonised in the 1970/80s by nesting Common Scoter, Lough Corrib now supports approximately half of the national population of this rare duck, a Red Data Book species. The population has been stable since the mid-1990s, with 36 pairs recorded in the most recent survey in 1999.

Lough Corrib supports a range of species listed on Annex II of the E.U. Habitats Directive, including Otter, Salmon and Slender Naiad (*Najas flexilis*). The lake is an internationally renowned salmonid fishery.

Any deterioration in water quality of the lake would be of concern for the wintering birds and perhaps the breeding Common Scoter, though the condition of the lake has been satisfactory in recent years. The reasons for the long-term declines in the breeding gull populations since the 1970s are not known and require investigation. Fishing and shooting occur in and around the lake though it is not considered that these are significant threats to the birds.

Lough Corrib is one of the top ornithological sites in the country, and easily qualifies for international importance on the basis of numbers of wintering birds using it. It is also of international importance for its population of Pochard. There are a further seven species of wintering waterfowl that have populations of national importance. Its populations of breeding gulls and terns are also notable, with nationally important numbers of Common Tern, Arctic Tern, Common Gull and Black-headed Gull. The site is now the most important in the country for nesting Common Scoter. It is of note that several of the species which occur regularly are listed on Annex I of the E.U. Birds Directive, i.e. Whooper Swan, Greenland White-fronted Goose, Golden Plover, Common Tern and Arctic Tern. The site has been relatively well monitored for birds in recent years. Research is required into the reasons for the decline of the breeding gull populations.

APPENDIX E

Aquatic Ecology and Fisheries Assessment

(Aquatic Services Unit, September 2012)

Clare River (Claregalway) Flood Relief Scheme

Volume II: Main Report Environmental Impact Statement: Chapter 11 Aquatic Ecology & Water Quality

DOCUMENT CONTROL SHEET

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11 AQUATIC ECOLOGY AND WATER QUALITY

11.1 INTRODUCTION

This section assesses the potential impact of the Claregalway (Clare River) Flood Relief Scheme on aquatic ecology and fisheries.

The main objectives of aquatic ecological studies were:

- To undertake desk top study and consultation to assist the determination of existing water quality, aquatic ecological, fisheries (including amenity) values of the affected areas;
- To carry out walkover surveys of potentially affected watercourses to assess aquatic habitats and produce broad habitat maps;
- 1. To describe the main habitat types along the affected reaches with a focus on fisheries and protected aquatic habitat and species;
- 2. To undertake baseline biological water quality surveys at two sites on the Clare River (Q-value assessment);
- 3. To carry out presence/absence crayfish survey within tributaries/drains and on the main channel of the Clare River;
- 4. To predict the potential direct, indirect and cumulative impacts of the scheme on aquatic ecology and fisheries, and
- 5. To recommend mitigation measures in relation to the design and construction of the scheme and predict residual impacts.

The study area encompassed a reach of the Clare River from 1.3km upstream of Crusheen Bridge to the confluence of the Clare River with Lough Corrib. A number of tributaries and arterial drainage networks that are conduits to the Clare within that reach were also included. The Clare River and some of the lower reaches of the relevant tributaries and drains are located within the Lough Corrib cSAC (000297).

Surveys were carried out at each of the watercourses for which measures were proposed under the Scheme. Field studies were undertaken on the 11th and 12th July, 2011 and on 3rd September, 2012. Water levels were quite high, but receding, in the main channel of the Clare River following heavy rainfall in the previous week on each occasion.

This assessment included consultation, either in person, by written request or through public online resources with:

- Inland Fisheries Ireland (IFI) – on site meeting, 20th July 2011;
- National Parks and Wildlife (NPWS);
- National Biodiversity Data Centre (NBDC), and
- Environmental Protection Agency (EPA).

11.2 METHODOLOGY

11.2.1 Desktop study

As part of the assessment the following data was accessed:

- Design descriptions and drawings of proposed measures;
- Maps and aerial photography of the study area and relevant associated watercourses;
- Site synopses and qualifying interests for all of the protected areas within or adjoining the proposed development;
- Scoping comments by Inland Fisheries Ireland;
- A wide range of guidelines and best practice published by the OPW regarding the potential environmental impacts of drainage on the aquatic environment, and
- A range of peer-reviewed literature and reports of scientific research carried out in Ireland and internationally in relation to potential impacts of such measures on aquatic ecology and resources.

Various online resources were used to assist the desktop study including:

- i) National Biodiversity Data Centre Live Maps: <http://www.biodiversityireland.ie/biodiversity-data/access-biodiversity-data/>
- ii) EPA ENVision Mapping: <http://maps.epa.ie/InternetMapView/mapviewer.aspx>
- iii) NPWS Maps and Data: <http://www.npws.ie/mapsanddata/>
- iv) WFD and River Basin Management site: <http://www.wfdireland.ie/>
- v) OSI Mapviewer: <http://maps.osi.ie/publicviewer/#V1,591271,743300,0,10>
- vi) Geological Survey of Ireland online mapping: <http://www.gsi.ie/mapping.htm>

11.2.2 Aquatic Surveys and Habitat Assessment

11.2.2.1 Study Site Selection

All watercourses that were highlighted as being subject to measures under the scheme were investigated. Walkover surveys of as much of each watercourse as possible were conducted for the purpose of habitat characterisations. Detailed notes and photographs for fisheries assessments and targeted searches for crayfish were made within representative habitat units within each watercourse along the stretches examined. Detailed maps showing locations of **target notes** are available in **Figures 11.1 to 11.5**. These show the extent of ground covered with points of interest that correspond to habitat notes. In the following sections, these are referred to as **Points** followed by the relevant number i.e. Point 10.

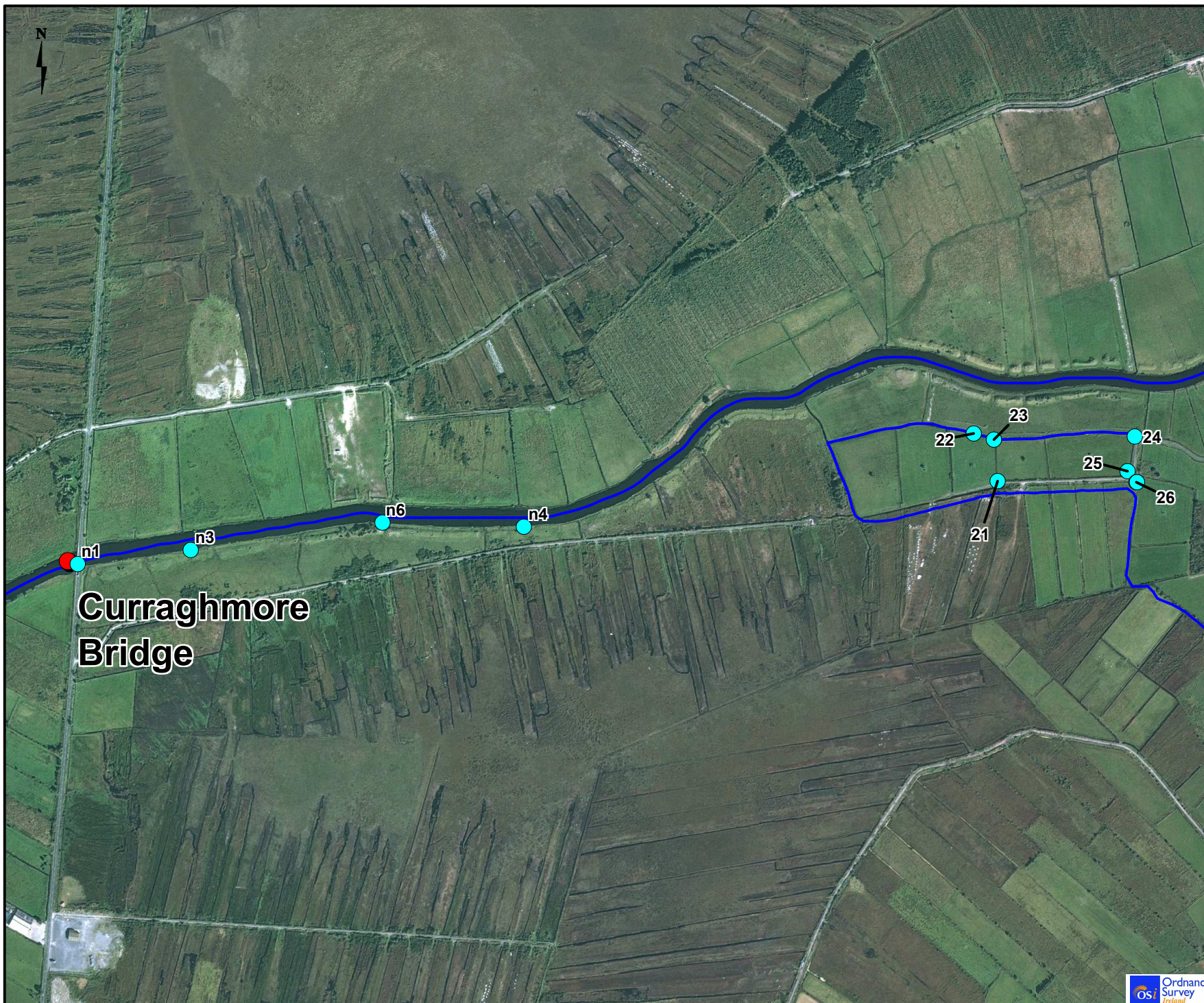
11.2.2.2 Habitat Assessments

General physical characteristics and hydromorphological features were recorded including substrate and flow types and aquatic vegetation (based on River Hydromorphology Assessment Technique (RHAT) (Anon., 2009). In particular, river, tributary and drainage channels were assessed with respect to fisheries and white clawed crayfish habitat. Crayfish habitat was assessed with respect to criteria shown in **Table 11.1**. Fisheries habitat assessment involved looking at flow characteristics and geomorphology of the site and combining this with desk top studies and IFI consultation. River levels were moderately high at the time of surveying which made assessment of deeper waters somewhat difficult.

11.2.2.3 Benthic Macroinvertebrate Sampling

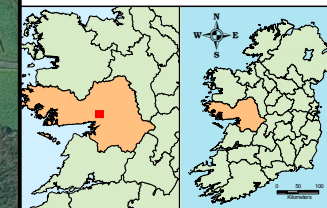
Two sites on the Clare River were assessed using the Quality Rating System (Q-value) scheme, developed by the EPA. Site 1 was 650m downstream of Crusheeny Bridge and Site 2 was located about 40m downstream of Claregalway Bridge. Benthic macroinvertebrate communities were collected using standard 2-minute kick-samples in the fast flowing (riffle) areas of the rivers using a

long-handled pond net (250 mm width, mesh size 1 mm; adhering to the ISO Standard for kick sampling and utilising the EPA/Western River Basin District (WRBD) protocols). Stonewashing was also employed to detach clinging species. One sample was taken at each site. Samples were preserved with 70% IMS alcohol and were analysed in the laboratory. All collected specimens were identified to the lowest taxonomic level possible. The biological indices calculated were Q value, Biological Monitoring Working Party (BMWP) score, Average Score Per Taxon (ASPT) and Ecological Quality Ratio (EQR).



Legend

- Clare River
- Aquatic Points



Client



Project
**Clare River (Claregalway)
Flood Relief Scheme**

Title

Aquatic points

Figure **11.1**

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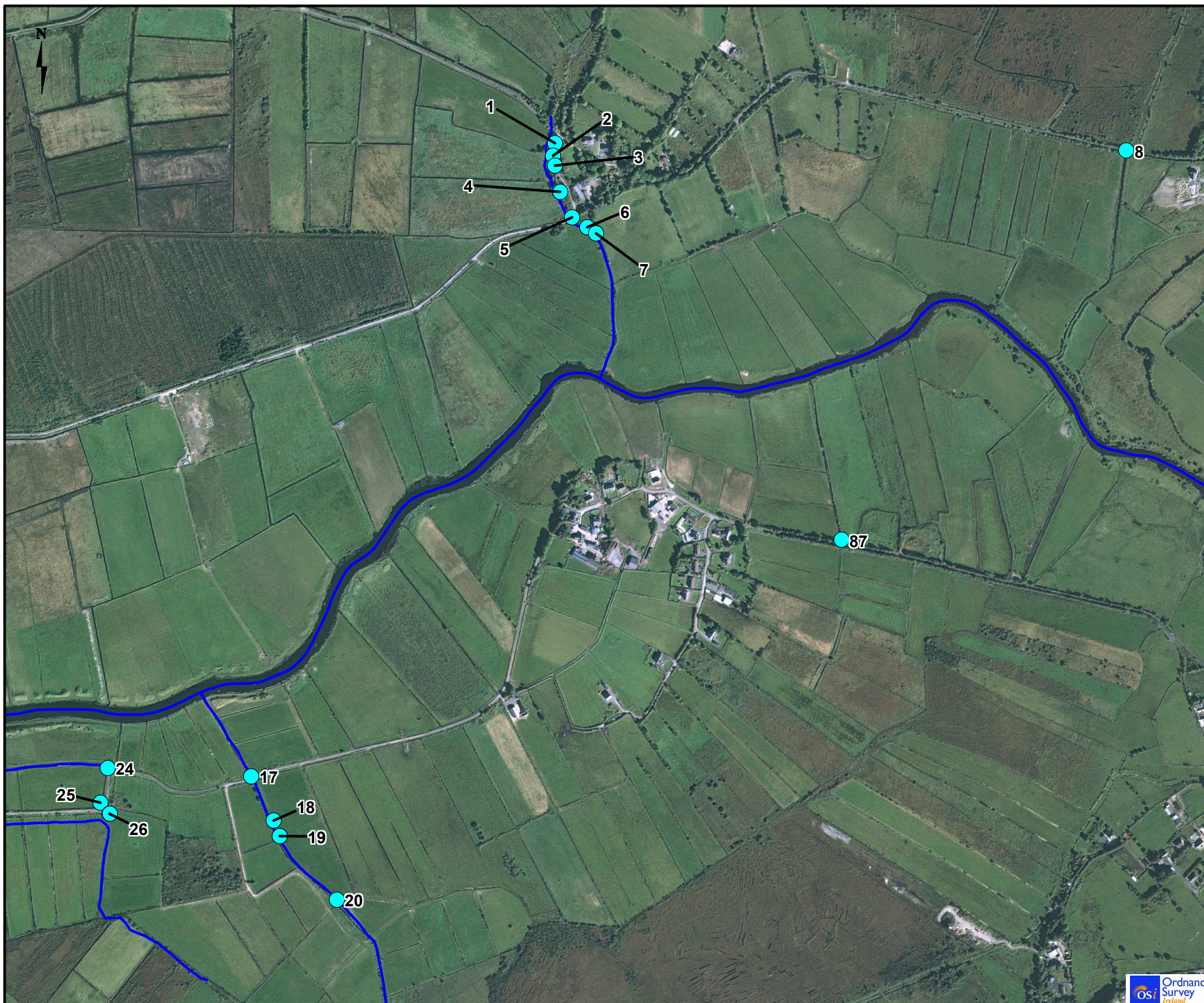
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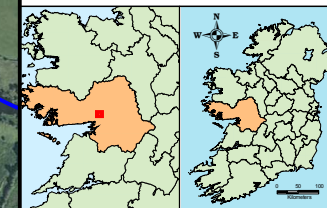
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Legend

- Clare River
- Aquatic Points



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Figure **11.2**

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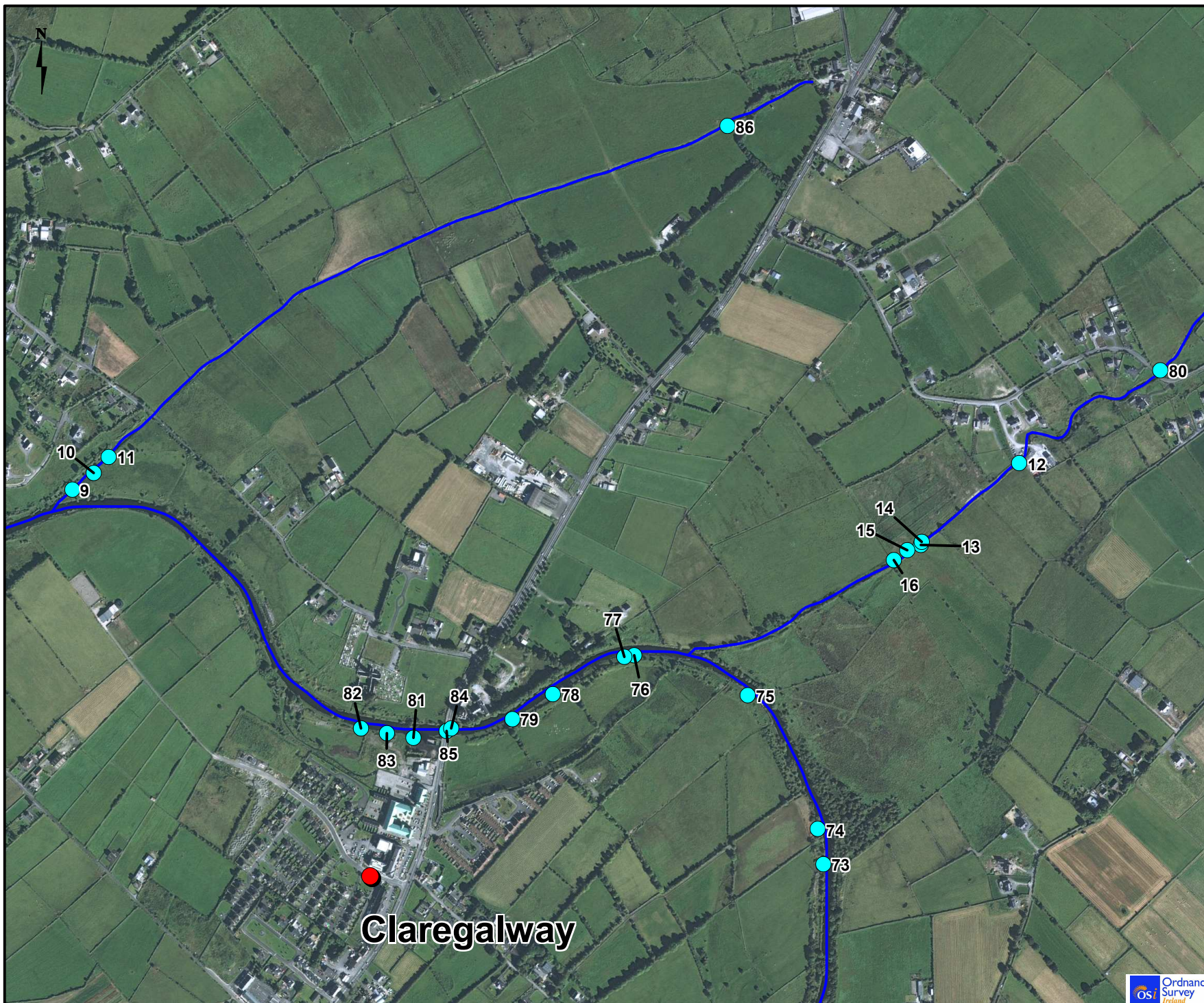
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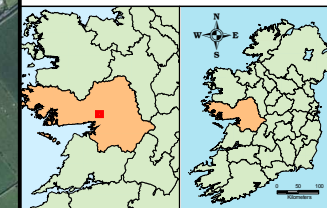
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Legend

- Clare River
- Aquatic Points



Client



Project
**Clare River (Claregalway)
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Title
Aquatic points

Figure **11.3**

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