

Foynes to Limerick Road (including Adare Bypass)

Natura Impact Statement

Volume 1 - Main Text | December 2019



Rialtas
na hÉireann
Government
of Ireland

Tionscadal Éireann
Project Ireland
2040



An Roinn Iompair
Turasoireachta agus Spóirt
Department of Transport,
Tourism and Sport



TIIV
Bord na gCeannaircigh
Transport Infrastructure Ireland



Comhairle Cathrach
& Contae Lúthmáigh
Limerick City
& County Council



FROD
AECOM

Foynes to Limerick Road (including Adare Bypass)

Natura Impact Statement

TABLE OF CONTENTS

VOLUME 1 MAIN TEXT

1. INTRODUCTION	1
1.1. Background.....	1
1.2. Legislative Context.....	2
1.3. Methodology	3
1.4. Ecological Assessment.....	4
2. DESCRIPTION OF THE PROPOSED ROAD DEVELOPMENT	8
2.1 Detailed Description	8
2.2 Construction	10
3. EUROPEAN SITES LIKELY TO BE AFFECTED	15
3.1 Establishing the Likely Zone of Impact	15
3.2 European Sites Screened In.....	20
3.3 European Site Descriptions	24
3.4 Effects on Conservation Objectives	29
3.5 Summary of Potential Significant Effects	51
4. ASSESSMENT OF POTENTIAL SIGNIFICANT EFFECTS	52
4.1 Lower River Shannon SAC.....	52
4.2 River Shannon and River Fergus Estuaries SPA.....	68
4.3 Curraghchase Woods SAC	72
4.4 Askeaton Fen Complex SAC.....	75
5. MITIGATION.....	79
5.1 Principles and Approach.....	79
5.2 Lower River Shannon SAC.....	79
5.3 River Shannon and River Fergus Estuaries SPA.....	82
5.4 Curraghchase Woods SAC	83
5.5 Askeaton Fen Complex SAC.....	83
5.6 Implementation of Mitigation	84
6. RESIDUAL EFFECTS	87
6.1 Annex I Habitats.....	87
6.2 Annex II Species	87
6.3 Wintering Bird Species.....	88
7. IN-COMBINATION EFFECTS	89
7.1 Introduction.....	89
7.2 Methodology	89

7.3	Assessment of In-combination Effects	89
7.4	Additional Mitigation Measures	96
7.5	Residual In-Combination Effects	96
8.	CONCLUSION.....	97
9.	REFERENCES	98
APPENDIX A	Appropriate Assessment Screening Report	
APPENDIX B	EIAR Biodiversity Chapter	
APPENDIX C	Environmental Operating Plan	
APPENDIX D	Four-Season Bat Survey Report	
APPENDIX E	EIAR Hydrogeology Chapter	
APPENDIX F	EIAR Hydrology Chapter	
APPENDIX G	Relevé Data from The Lower River Shannon SAC at the River Maigue Crossing Point	
VOLUME 2	FIGURES	
APPENDIX H	EIAR Proposed Road Development Figures	
APPENDIX I	EIAR Biodiversity Figures	
APPENDIX J	EIAR Hydrogeology Figures	
APPENDIX K	EIAR Hydrology Drawings	
APPENDIX L	Field Notes	

1. INTRODUCTION

1.1. Background

Roughan & O'Donovan (ROD) and AECOM were appointed by Limerick City and County Council (LCCC) to provide engineering and environmental consultancy services in relation to the proposed Foynes to Limerick Road (including Adare Bypass) hereafter referred to as "the proposed road development". The proposed road development comprises a new road between the towns of Foynes, Askeaton, Rathkeale and Adare to link to Limerick City via the existing M20 Motorway. The proposed road development is located mostly in a rural area in West County Limerick and in proximity to a number of European Sites.

In accordance with Article 6(3) of Council Directive 92/43/EEC of 21 August 1992 on the conservation of natural habitats and of wild fauna and flora ("the Habitats Directive"), as transposed into Irish law by Part 5 of the European Communities (Birds and Natural Habitats) Regulations, 2011 (as amended) ("the Habitats Regulations") and Part XAB of the Planning and Development Act, 2000 (as amended) ("the Planning and Development Act"), an Appropriate Assessment (AA) Screening Report (Appendix A) was prepared to assess whether or not the proposed road development, either individually or in combination with other plans or projects, was likely to have a significant effect on one or more sites of Community importance ("European Sites") for nature conservation.

The AA Screening Report, which was prepared by EirEco in conjunction with ROD - AECOM Alliance on behalf of LCCC, concluded, in view of best scientific knowledge and the Conservation Objectives of the sites concerned that, in the absence of appropriate mitigation, the proposed road development was likely to have a significant effect on four European Sites, namely:

- Lower River Shannon SAC;
- River Shannon and River Fergus Estuaries SPA;
- Curraghchase Woods SAC; and,
- Askeaton Fen Complex SAC.

On the basis of that conclusion, LCCC considered that AA was required in respect of the proposed road development and, in order to assist the Competent Authority, namely An Bord Pleanála ("the Board"), in undertaking its own AA Screening (pursuant to Section 177U of the Planning and Development Act) and AA (pursuant to Section 177V of the Planning and Development Act), decided to prepare a Natura Impact Statement (NIS) to accompany the application for consent for the proposed road development.

This document comprises the NIS in respect of the proposed road development and has been prepared by EirEco in conjunction with ROD-AECOM Alliance on behalf of LCCC. The NIS is intended to provide the Board with all of the scientific information necessary for it to make a valid AA in respect of the implications of the proposed road development for the European Sites concerned. To that end, it contains an examination, analysis and evaluation of the implications of the proposed road development, both individually and in combination with other plans and projects, for European Sites, in view of their Conservation Objectives, and is based on best scientific knowledge. It also identifies appropriate mitigation measures to ensure that the proposed road development will not adversely affect the integrity of those sites and

provides complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt in respect of the absence of such effects.

1.2. Legislative Context

The Habitats Directive and Directive 2009/147/EC of the European Parliament and of the Council of 30th November 2009 on the conservation of wild birds ("the Birds Directive") list habitats and species which are, in a European context, important for conservation and in need of protection. This protection is afforded in part through the designation of sites which support significant examples of habitats or populations of species (referred to collectively in the domestic context as "European Sites"). Sites designated for birds are termed "Special Protection Areas" (SPAs) and sites designated for natural habitat types or other species are termed "Special Areas of Conservation" (SACs). The complete network of European Sites is referred to as "the Natura 2000 Network".

In order to ensure the conservation of natural habitats and of wild fauna and flora in the context of land use planning and development, Article 6(3) of the Habitats Directive provides for the assessment of the implications of plans and projects for European Sites, as follows:

"Any plan or project not directly connected with or necessary to the management of the site [or sites] but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site [...], the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned [...]."

The requirements arising out of Article 6(3) are transposed into Irish law by Part 5 of the Habitats Regulations and Part XAB of the Planning and Development Act, and the assessment is referred to as "Appropriate Assessment" (AA).

The first stage of the process under the Habitats Directive is a screening process, generally referred to as "Stage 1 Screening" which assesses whether a plan or project, which is not directly connected with or necessary to the management of the site as a European Site, in view of best scientific knowledge and in view of the Conservation Objectives of the site¹, either alone or in combination with other plans and projects, is likely to have significant effects on the European Site. The outcome of the Stage 1 Screening Assessment dictates whether the assessment of the project proceeds to the next stage of the process, which is an Appropriate Assessment, generally referred to as "Stage 2 Appropriate Assessment". If the result of the Stage 1 Screening Assessment is negative, i.e. it concludes that the plan or project in view of best scientific knowledge and in view of the Conservation Objectives of the site, either alone or in combination with other plans and projects, is not likely to have significant effects on the European Site, then there is no requirement to proceed to Stage 2 Appropriate Assessment. It is only if the Stage 1 Screening concludes that there is likely to be a significant effect on the environment or there is uncertainty, that a Stage 2 Appropriate Assessment is required.

¹ Conservation Objectives are referred to, but not defined, in the Habitats Directive. In Ireland, Conservation Objectives are set for Qualifying Interests (the birds, habitats or other species for which a given European site is designated) and represent the overall target that must be met for that Qualifying Interest to reach or maintain favourable conservation condition in that site and contribute to its favourable conservation status nationally.

1.3. Methodology

On the basis of the objective information provided in the AA Screening Report and in view of the Conservation Objectives of the relevant European Sites, LCCC, as the Competent Authority at Stage 1, determined that the proposed road development, either individually or in combination with other plans and projects, has the potential to significantly affect four European Sites, namely the Lower River Shannon SAC, the River Shannon and River Fergus Estuaries SPA, the Curraghchase Woods SAC and the Askeaton Fen Complex SAC. The AA Screening Report concluded that, in view of best scientific knowledge and in view of the Conservation Objectives of the site, the proposed road development, either alone or in combination with other plans and projects, is not likely to have significant effects on any other European site.

Having reached that determination, this NIS assesses the implications of the proposed road development, either individually or in combination with other plans or projects, for those European Sites in view of their Conservation Objectives and having regard to best scientific knowledge.

This assessment is undertaken in five steps, as follows:

1. Step 1 involves gathering all of the information and data that will be necessary for a full and proper assessment. These include, but are not limited to, the details of the proposed road development, environmental data pertaining to the area in which the proposed road development is located, e.g. rare or protected habitats and species or invasive species present or likely to be present, and the details of the European Sites within the likely zone of impact (as undertaken in the Screening Report prepared for the proposed road development).
2. Step 2 involves examination of the information gathered in the first step and detailed scientific analysis of the effects or potential effects of the proposed road development on the European Sites in light of their Conservation Objectives in view of best scientific knowledge.
3. Having identified the effects or potential effects of the proposed road development on the European Sites, Step 3 involves the development of appropriate mitigation to avoid or minimise those effects.
4. Step 4 considers whether there are any additional effects or potential effects from the proposed road development in combination with other plans or projects and whether any additional mitigation measures are required.
5. Step 5 involves the identification of any residual (post-mitigation) effects and a determination of whether the proposed road development will, by itself or in combination with other plans or projects, have an adverse effect on the integrity of one or more European Sites.

The following guidance documents informed the assessment methodology:

- DEHLG (2010) *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities*. Department of the Environment, Heritage and Local Government, Dublin.
- EC (2001) *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*. Environment Directorate-General of the European Commission.
- EC (2018) *Managing Natura 2000 sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC*. Environment Directorate-General of the European Commission.

- NPWS (2010) *Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities*. Circular Letter NPWS 1/10 and PSSP 2/10. Department of the Environment, Heritage and Local Government, Dublin.
- NPWS (2012) *Marine Natura Impact Statements in Irish Special Areas of Conservation – a working document*. April 2012. National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.

1.4. Ecological Assessment

In order to fully inform this NIS in respect of the proposed road development, it was necessary to establish the baseline ecological conditions in the receiving environment, particularly with regard to European Sites. This was achieved by undertaking a comprehensive suite of desktop studies and field surveys, as well as engaging in consultations with the relevant statutory authorities, namely the National Parks & Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI), and stakeholders, including the Shannon-Foynes Port and LCCC.

Desk Studies

During the preparation of the AA Screening Report and NIS, the NPWS provided data on designations of sites, and habitats and species (including birds) of conservation interest. This included reports pursuant to Article 17 of the Habitats Directive² (NPWS, 2013a, b) and the Site Synopses, Natura 2000 Standard Data Forms and Conservation Objectives (including supporting documents) for the relevant European Sites.

The desk studies involved thorough reviews of existing information relating to ecology in the vicinity of the proposed road development. A number of web-based geographic information systems (GISs) were used to obtain information relating to the natural environment surrounding the proposed road development. These included the NPWS *Map Viewer* (NPWS, 2019), which provided information on the locations of protected sites, the National Biodiversity Data Centre's *Biodiversity Maps* (NBDC, 2019), which provided recent and historic records of rare and protected species in the area, and Ordnance Survey Ireland's *GeoHive* (OSI, 2019), which provided additional information on the wider environment.

Field Surveys

A walkover survey of the entire route corridor was carried out between June and September 2016, which is within the optimum time for botanical survey and habitat assessment. The field surveys were preceded by a review of aerial photography for the entire route and adjoining areas of ecological interest. Habitats were surveyed and mapped to a minimum distance of 50m on either side of the proposed road's centre line, with larger areas surveyed and mapped as necessary (especially where wetlands exist). Where potential Annex I listed habitats were encountered, species composition and relative abundance were recorded in sample relevés in order to determine conformity to the EU classification (provided in Appendix G). Habitats were classified based on their species composition in accordance with the Heritage Council classification (Fossitt, 2000). Conformity to Annex I habitats was determined using the Interpretation Manual of European Union Habitats (EC, 2013) in conjunction with the following key references:

- *National Survey of Native Woodlands* (Perrin *et al.*, 2008)
- *The Irish semi-natural grasslands survey 2007-2012*. *Irish Wildlife Manuals*, No. 78 (O'Neill *et al.*, 2013)

² Under Article 17, the NPWS is required to report to the European Commission every six years on their status and on the implementation of the measures taken under the Directive.

- *The Status of EU Protected Habitats and Species in Ireland* (NPWS, 2013)
- *Monitoring guidelines for the assessment of petrifying springs in Ireland. Irish Wildlife Manuals, No. 94* (Lyons & Kelly, 2016)
- *Irish Wetland Types* (Irish Ramsar Wetlands Committee, 2018)

Specific surveys were undertaken to determine the presence/absence of rare plant species, in particular those listed on the Flora (Protection) Order, 2015 where records of their occurrence were present within the vicinity of the proposed road development. Section 21 authorisation was received from the NPWS (Licence No: FL10/2016) to survey for Triangular Club-rush (*Schoenoplectus triquetus*) on the River Mague in the vicinity of a proposed bridge crossing as part of the proposed road development. The survey was undertaken on 29th September 2016 during a period of low water as the river is tidal in the vicinity of the proposed crossing point. Additional surveys were undertaken in potentially suitable habitat for Opposite-leaved Pondweed (*Groenlandia densa*) in the vicinity of the Mague crossing point (where it has previously been recorded) and for Hairy Violet (*Viola hirta*) in the vicinity of Craggs where there are scattered records in the vicinity of the proposed road development. These surveys were undertaken in May 2018 under Section 21 Licence no: FL02/2018. Further surveys of the River Mague at the proposed crossing point were undertaken for Triangular Club-rush and Opposite-leaved Pondweed in September 2019 (under Licence No: FL13/2019).

Throughout all surveys, evidence of invasive plant species listed on the Third Schedule to the Habitats Regulations and other non-native species with the potential to cause adverse effects on the integrity of a European Site, were checked for and recorded. Records of invasive plants within the vicinity of the proposed road development were also reviewed on the National Biodiversity Data Centre (NBDC) database.

A dedicated mammal survey was conducted in the period November 2016 to April 2017 to identify and determine the status of Otter (*Lutra lutra*) holts along the length of the proposed road development and within 500m of the proposed route, in addition to signs of other large mammals in accordance with the TII *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* (TII (formerly NRA)³, 2009) and *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes*. The surveys aimed to identify holts, couches (resting places), tracks, feeding signs, spraints (droppings) and any other evidence of activity.

A Four-Season Bat Survey was carried out for the purposes of the proposed road development. Bat Eco Services carried out the winter and spring surveys, while summer and autumn surveys were completed by Aardwolf Wildlife Surveys. The methodologies and results of the Four-Season Bat Survey are presented in Appendix D of this NIS.

Detailed breeding bird surveys were not necessary for the majority of the route which is situated on agricultural land of low conservation importance for birds. Targeted breeding bird surveys were undertaken at specific locations with potential for ground-nesting wader species of high conservation concern, including Curlew, Lapwing and Snipe. These areas are principally wetland habitats supporting wet grassland or fen vegetation.

³ Following the merger of the National Road Authority (NRA) into Transport Infrastructure Ireland in 2015, all guideline documents which were formerly published by the NRA previous to this date are referred to as TII documents throughout this NIS for consistency.

A review of existing data on wintering birds was undertaken to identify known foraging areas for waterfowl including Whooper Swan (*Cygnus cygnus*), and to identify potential flight paths intersected by the proposed road development. Additional sites of potential value for wintering birds were also identified during earlier walkover surveys and review of aerial imagery in the vicinity of the proposed road development. These sites were then subject to a series of winter counts using vantage points (at a total of 33 separate locations) undertaken by ornithologist Gerry Murphy (Chairperson of the Irish Whooper Swan Study Group) over the period December 2016 to March 2017, inclusive.

For all watercourse crossings, surveys were undertaken to determine potential nesting by riparian bird species (principally Kingfisher, Irish Dipper and Grey Wagtail) covering a stretch of river of up to 500m upstream and downstream of the crossing point. These surveys were undertaken during the dedicated watercourse surveys carried out in May and June 2016, though most watercourses were revisited during the habitat mapping undertaken between June and September 2016.

For White-clawed Crayfish the optimum survey period is identified as August to September. Although surveys are possible earlier and later in the year, absence of the species should not be inferred during this period. Surveys were undertaken during August and September in 2016, utilising sweep netting in marginal vegetation and active searching (turning stones, logs, etc.) to check for adults.

Surveys for Lamprey larva are optimally carried out between August and October. Surveys for adult Lamprey are most efficiently undertaken either by capturing adults as they return to the upstream spawning sites, or by direct observation at the spawning sites which vary according to the species between March and June. The surveys for Lamprey included an assessment of the site as potential spawning habitat and the presence of potentially suitable nursery beds for larvae. Suitable nursery habitat was assessed by a combination of coring and sweep netting.

Surveys for salmonid fish were carried out based on visual assessments of the suitability of habitat to support spawning and as habitat for juvenile fish in conjunction with water quality assessment.

Invertebrate samples for the assessment of Q-values were derived from two-minute kick samples in the nearest area of suitable riffle habitat to the proposed crossing point using a 2mm mesh net, as per the EPA Standard Methodology. Samples were subsequently analysed to identify macro-invertebrates, enumerated and assigned a sensitivity rating based on the overall diversity and abundance of the various sensitivity groupings to determine the Q-value.

Surveys of aquatic and riparian habitats were carried out during the period late March to mid-October 2016 to coincide with the growing season of most plants. Emphasis was placed on identifying habitats which conform to those listed on Annex I of the Habitats Directive such as 'Watercourses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation (3260)' and 'Hydrophilous tall herb fringe communities [6430]'.

Consultations

Throughout both the design and the environmental assessment processes, there were ongoing consultations both with the NPWS and with IFI. Consultations were also carried out with other relevant stakeholders, including BirdWatch Ireland, Bat

Conservation Ireland, the Vincent Wildlife Trust, the Irish Whooper Swan Study Group and the Botanical Society of Britain and Ireland.

Assessment

Once established, the ecological baseline in the receiving environment was used to inform the assessment of the ecological effects likely to arise from the proposed road development, particularly with regard to European Sites. Where there were any gaps in the ecological data available, the precautionary principle was applied.

2. DESCRIPTION OF THE PROPOSED ROAD DEVELOPMENT

2.1 Detailed Description

The location of the proposed road development is a predominantly rural area of central County Limerick and passes close to a number of settlements, including Foynes, Askeaton, Rathkeale, Croagh, Adare and Patrickswell, as shown in Plate 2.1.

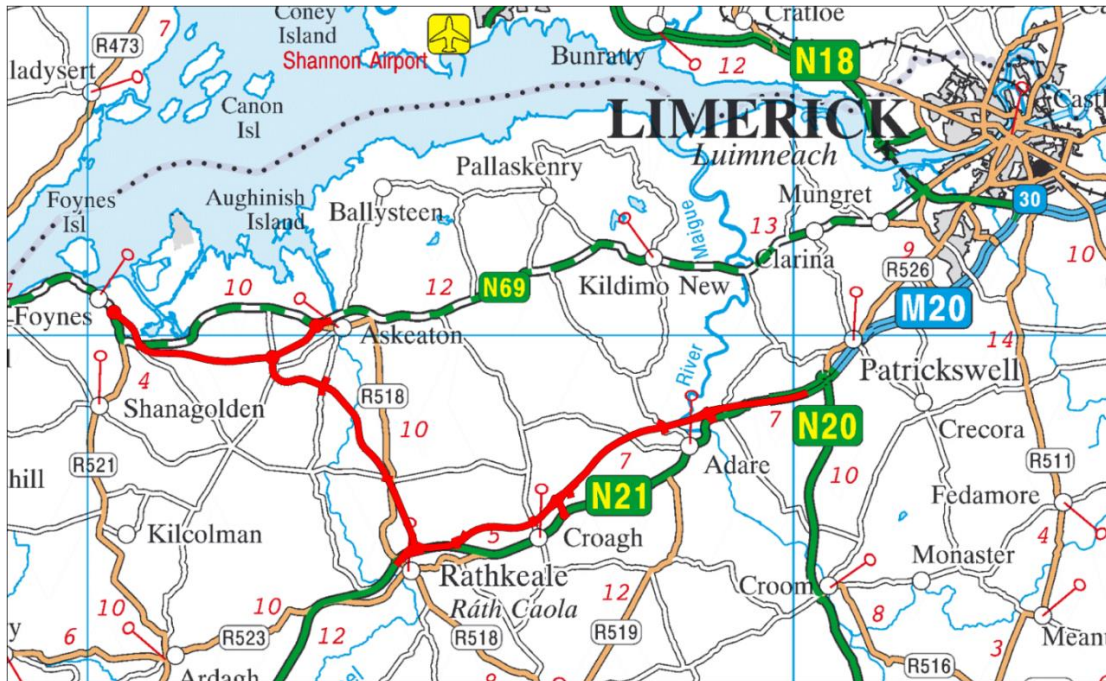


Plate 2.1 Location of the Proposed Road Development

Summary of the Proposed Road Development, as Relevant to Appropriate Assessment

The proposed Foynes to Limerick Road (including Adare Bypass) will be located in proximity to four sites designated for protection under the European Habitats Directive:

- (i) the Lower River Shannon SAC;
- (ii) the River Shannon and River Fergus Estuaries SPA;
- (iii) the Barrigone SAC;
- (iv) the Curraghchase Woods SAC, and
- (v) the Askeaton Fen Complex SAC.

The proposed road development will be located generally to the south of the River Shannon Estuary and will cross several rivers and streams that flow northwards to the estuary. At the western end of the route, the proposed road will skirt just to the south of the Churchtown estuary within the Lower River Shannon SAC, near Foynes. At the eastern end of the route, the proposed road will be located within the Lower River Shannon SAC, in the vicinity of Adare, where it will cross over the River Maigue via a bridge.

The proposed road development is located away from both the Curraghchase Woods SAC, and the Askeaton Fen Complex SAC.

The principal elements of the proposed road development are as follows:

Roads

- 15.6km of Type 2 Dual Carriageway Protected Road, extending from Foynes to Rathkeale, with an intermediate roundabout junction at Ballyclogh, 6.3km east of Foynes, and 9.3 km north of Rathkeale;
- 1.9km of Single Carriageway Road from Ballyclogh towards Askeaton;
- 17.5km of Dual Carriageway M21 Motorway, of which 15.5km is new construction or widening of the existing road, from Rathkeale to Attyflin; and
- 0.6km of Single Carriageway Road connecting the existing N21 to the proposed M21 and Foynes to Rathkeale Protected Road at a roundabout junction at Rathkeale.

Junctions

- 2 grade-separated junctions at Adare and Croagh, including structures, link roads and roundabouts (six in total);
- 5 at-grade roundabout type junctions, providing access points at Foynes, Ballyclogh, Askeaton, and two at Rathkeale.

Structures

- 3 railway bridges;
- In excess of 200m long clear-span bridge over the River Mague at Adare
- 4 other large river bridges (over Robertstown, Deel and Greanagh twice);
- 18 river / stream bridges (including Ahacronane and Clonshire);
- 16 overbridges / underbridges;
- 22 underpasses; and
- 1 retaining wall.

Other Works

- Drainage system in accordance with sustainable drainage design principles and guidance;
- The treatment of surface water run-off prior to outfall discharge, spill containment measures and attenuation treatment facilities;
- Alterations to high voltage 220kV and 110kV electricity lines;
- Diversion of existing services and utilities including overhead and underground electricity lines, transmission gas mains, water mains and communication cables;
- Earthworks including excavation of approximately 3 million m³ of soil and rock with processing into suitable construction material, and limited excavation and deposition of soft material within the site in landscaping works;
- Importation of a large volume of approximately 1 million m³ of earthworks materials will be required as due to the flat and low-lying topography with a high groundwater level - the proposed road development cannot achieve an earthworks balance within the lands to be acquired;
- Construction of farm access tracks with accommodation works ancillary to the proposed road development;
- Provision of landscape planting, signage, lighting and other works ancillary to the construction and operation of the proposed road development;
- A terminal service area for HGVs near Shannon-Foynes Port;

- Accommodation of the Great Southern Trail Greenway (GST) walking and cycling route on the former railway line, where crossed north of Rathkeale; and
- The acquisition of 9 dwelling houses (of which 2 are currently uninhabitable) and 1 ruin for the construction of the proposed road development.

2.2 Construction

2.2.1 Duration of Works

It is likely that the construction of the proposed road development will be progressed as a single construction contract with the construction phase potentially lasting between 30 - 36 months (2.5 – 3 years).

2.2.2 Main Construction Works

The main construction works consist predominantly of the earthworks and road pavement construction. The earthworks construction will involve the excavation and placement of materials, with blasting in rock cuttings, for the construction of cuttings and embankments, as well as the hauling of materials and importation of materials to complete the road formation and sub-formation. Materials for the road construction will include materials that will be brought to site, including gravels and bituminous pavement and surfacing materials. In addition to the earthworks and pavement construction, the main activities will involve the following:

- Drainage – the installation of pipes, culverts, surface water channels, filter drains, ditches and attenuation ponds;
- Structures – the construction of bridges, including their foundations, abutments and the installation of precast beams and other reinforced concrete works, the construction of retaining walls and piling works;
- The diversion and construction of utilities and services;
- Environmental mitigation including construction of noise bunds and barriers, landscaping and habitat creation;
- Ancillary roadworks including the installation of safety barriers, public lighting, signage and road marking; and
- Accommodation works for affected landowners, such as access roads, entrances, fences, gates, walls, ducting and reconnection of severed services.

Temporary works will be required at the major bridge crossing of the River Maigue and these will be confined to the riverbanks above the mean high-water level to avoid associated impacts on the habitats within the Lower River Shannon SAC.

2.2.3 Construction Compounds

The main construction compound will be immediately west of the proposed Rathkeale Junction, remote from the Natura 2000 sites. At the River Maigue Bridge there will be minor construction compounds on each side of the river.

The storage of fuels, other hydrocarbons and other chemicals within the construction compounds will comply with the mitigation measures set out in the EIAR, NIS and Environmental Operating Plan.

2.2.4 Environmental Operating Plan

During the construction phase of the proposed road development, the works will comply with all relevant legislation and guidelines that aim to reduce and minimise environmental impacts. Construction-related impacts are generally of short-term duration and localised in nature. These impacts will be reduced, as far as possible, by

complying with the mitigation measures outlined in the EIAR, this NIS, construction industry guidelines, TII Environmental Construction Guidelines (outlined below) and the Environmental Operation Plan, as described in this section.

An Environmental Operating Plan (EOP) has been developed for the proposed road development in accordance with the TII *Guidelines for the Creation and Maintenance of an Environmental Operating Plan*. It will be finalised by the successful Contractor in agreement with LCCC and implemented by the Contractor throughout the duration of the construction phase. The EOP for the proposed road development is to be regarded as a comprehensive set of minimum environmental requirements for the Contractor to adhere to during the construction phase, which address all pathways for potential environmental and human health impacts as a result of the proposed works. It also sets out the mitigation measures prescribed in the EIAR and / or NIS and the mandatory measures (if any) stipulated in the conditions of the planning permission.

The best practice measures set out in the EOP will be informed by the relevant TII guidelines, including but not limited to the following:

- *Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes;*
- *Guidelines for the Treatment of Bats during the Construction of National Road Schemes;*
- *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes;*
- *Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes;*
- *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes;*
- *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes;*
- *Guidelines on the Management of Noxious Weeds on National Roads;*
- *Guidelines for the Treatment of Noise and Vibration in National Road Schemes;*
- *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes;*
- *Guidelines for the Management of Waste from National Road Construction Projects; and*
- *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.*

This is a non-exhaustive list and relevant guidance current at the time of construction will be followed.

At a minimum, the EOP will include the following, as they relate to the proposed works:

- All environmental commitments / mitigation measures, as prescribed in the EIAR and / or NIS and conditioned by the Competent Authority (An Bord Pleanála) or any other statutory body (e.g. NPWS).
- Methodologies for the implementation of the above-stated environmental commitments / measures, where required.
- A list of all applicable environmental statutory requirements, the corresponding legislation, and a methodology for documenting compliance with same.

- Methodologies by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment.

The EOP has been appended to this NIS at Appendix C.

As can be seen, the EOP will include a number of sub sections which identify the approach in respect of the following for the construction stage of the proposed road development, as follows:

- Construction, Erosion and Sediment Control;
- Construction and Demolition Waste Management;
- Incident Response; and
- Invasive Species Management.

Construction, Erosion and Sediment Control

Measures in relation to construction, erosion and sediment control have been included within the EOP. This section includes details under the following headings, as relevant to the protection of watercourses:

- Details of chemical / fuel storage areas (including location and bunding to contain runoff of spillages and leakages);
- Details of construction plant storage, temporary offices and on-site chemical toilet areas;
- Traffic Management Plan (to be developed in conjunction with the LCCC Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements;
- Truck wheel wash details (including measures to reduce and treat run-off);
- Dust management to prevent nuisance (demolition and construction);
- Site run-off management;
- Noise and vibration management to prevent nuisance (demolition and construction);
- Landscape management;
- Management of demolition of all structures and assessment of risks for same;
- Lighting details (construction and operation);
- Signage;
- Stockpiles;
- Procedures and method statements for;
 - Demolition and removal of buildings, services, pipelines (including risk assessment and disposal);
 - Diversion of services;
 - Excavation and blasting (through soils and bedrock);
 - Piling;
 - Construction of pipelines;
 - Temporary hoarding and lighting;
 - Borrow Pits and location of crushing plant;

- Storage and Treatment of peat and soft soils;
- Deposition of surplus geological material (peat, soils, rock etc);
- Protection of watercourses from contamination and silting during construction; and
- Site Compounds, layouts and protective measures.

All of the mitigation measures, controls, requirements, procedures, etc., included in this plan will be implemented in full and will ensure that sediment laden run-off from the construction site does not enter watercourses or water bodies. The section sets out the minimum requirements that must be adhered to by the Contractor. Any alternative measures that may be incorporated at the construction stage will be required to provide at least the same, or, a better standard of protection. The contract documents for the proposed road development will also place an obligation on the construction Contractor to further develop this section to include any additional requirements stipulated by An Bord Pleanála.

Construction and Demolition Waste Management

Measures for dealing with the treatment, storage and recovery or disposal of waste is also included within the EOP. These measures, which will be further developed by the successful Contractor, shall be detailed, for the on-site management and treatment of waste materials, and will include (at a minimum) the following:

- Details of construction site waste storage (e.g. skips, bins, containers) to be provided for different waste streams and waste collection times;
- Details of where and how particular materials are to be disposed of (i.e. landfill or other appropriately licensed waste management facility);
- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of, where necessary; and
- Details of how and where hazardous wastes (hydrocarbons and other classes of hazardous waste substances) are to be stored and disposed of in a suitable manner.

Incident Response

A section on Incident Response will also be included in the EOP, which will describe the procedures, lines of authority and processes that will be followed in the event of an incident on site (e.g. spillage during construction stage), to ensure that incident response efforts are prompt, efficient, and appropriate to particular circumstances.

The primary objectives of this section are to:

- Minimise any impacts to the environment and to ensure protection of water quality and the aquatic species dependant on it;
- Ensure the health and safety of workers and visitors along the site;
- Protect property and operations at the proposed site and to minimise the impact on the continuity of business; and,
- Establish procedures that enable personnel to respond to incidents with an integrated multi-departmental effort and in a manner that minimises the possibility of loss and reduces the potential for affecting health, property and the environment.

Invasive Species Management

Measures to ensure that there is no potential for the introduction or spread of invasive species during construction are outlined in the EOP, to be implemented by the Contractor. These include biosecurity measures and guidance for the importation of materials.

Implementation of the EOP

It will be a condition of the Contract for the construction of the proposed road development that the successful Contractor fully implement the EOP throughout the works. To oversee the implementation of the EOP, the Contractor will be required to appoint a responsible Site Environmental Manager (SEM) to ensure that the environmental commitments (as described above) and the EOP are fully executed for the duration of works, and to monitor whether the mitigation measures employed are functioning properly (i.e. are effectively addressing the environmental impact(s) which they were prescribed for).

3. EUROPEAN SITES LIKELY TO BE AFFECTED

3.1 Establishing the Likely Zone of Impact

Section 3.2.3 of DEHLG (2010) outlines the procedure for selecting the European Sites to be considered in AA. It states that European Sites potentially affected should be identified and listed, bearing in mind the potential for direct, indirect and cumulative effects. It also states that the specific approach in each case is likely to differ depending on the scale and likely effects of the plan or project. However, it advises that the following sites should generally be included:

- All European Sites within or immediately adjacent to the plan or project area;
- All European Sites within the likely zone of impact of the plan or project; and,
- In accordance with the Precautionary Principle, all European Sites for which there is doubt as to whether or not they might be significantly affected.

The “likely zone of impact” of a project is the geographic extent over which significant ecological effects are likely to occur. In the case of plans, this zone should extend to a distance of 15 km in all directions from the boundary of the plan area. In the case of projects, however, the guidance recognises that the likely zone of impact must be established on a case-by-case basis, with reference to the following key variables:

- The nature, size and location of the project;
- The sensitivities of the ecological receptors; and,
- The potential for cumulative effects.

For example, in the case of a project that could affect a watercourse, it may be necessary to include the entire upstream and/or downstream catchment in order to capture all European Sites with water-dependent features of interest. However, within terrestrial habitats, the likely zone of impact may be confined to the study area. Particular attention was given to identifying any “stepping stone” sites which could potentially provide important links between European Sites or support a Qualifying Interest habitat or species from an adjacent European Site.

As part of the Screening process, a geographical representation of the likely zone of impact was produced in ArcGIS 10.5, using the proposed road development boundary and publicly available Ordnance Survey Ireland maps. This was used in combination with NPWS shapefiles to identify the boundaries of European Sites in relation to the likely zone of impact (Plate 3.1), with an indicative 15km buffer zone shown to illustrate the relative distances to each site from the proposed road development. Consideration was also given to the potential to affect other European Sites beyond this 15km zone through hydrological connectivity or the occurrence of critical ex-situ habitat. It was determined that seven European Sites occur within or adjacent to the likely zone of impact (Table 3.1).

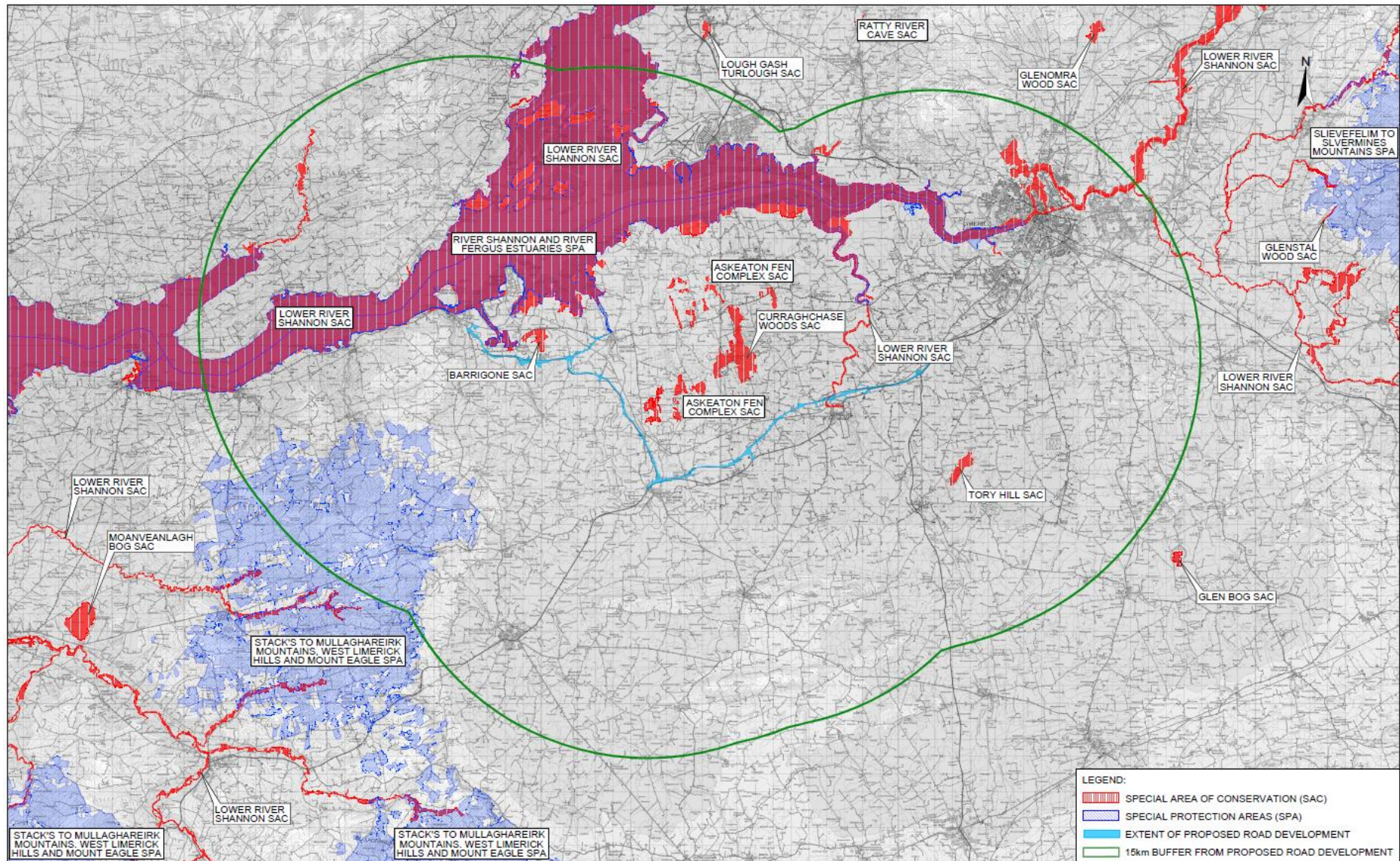


Plate 3.1 The boundaries of European Sites relative to the location of the proposed road development.

Table 3.1 Initial Assessment of Potential Pathways to European Sites located within the likely zone of impact.

European site	Distance from the proposed road development	Site summary	Are there potential pathways for impacts from the proposed road development to this site? Explain.
Lower River Shannon SAC [002165] Site area: 68,329.57 ha	The proposed road development intersects this European site.	This very large site stretches along the Shannon valley from Killaloe in County Clare to Loop Head / Kerry Head, a distance of some 120 km. The site thus encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the River Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II of the Habitats Directive, including the priority habitats Coastal Lagoon and Alluvial Woodland, the only known resident population of Bottlenose Dolphin (<i>Tursiops truncatus</i>) in Ireland and all three Irish Lamprey species. A number of Red Data Book species are also present, notably thriving populations of Triangular Club-rush. A number of species listed on Annex I of the Birds Directive are also present, either wintering or breeding. Habitats and species considered at risk in the vicinity of the proposed road development River Maigue crossing include Water courses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260], *Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0], Sea Lamprey (<i>Petromyzon marinus</i>) [1095], River Lamprey (<i>Lampetra fluviatilis</i>) [1099], Atlantic Salmon (<i>Salmo salar</i>) [1106] and European Otter (<i>Lutra lutra</i>) [1355]	Yes. The proposed road development intersects this European site (at the River Maigue) and all watercourses crossed by the proposed road development flow into the SAC. There is, therefore, potential for direct impacts on the estuarine environment (both its habitats and species) in the vicinity of the crossing point of this European Site at the River Maigue during both construction and operation, as well as indirect impacts through a reduction in water quality in other watercourses flowing into the SAC.

European site	Distance from the proposed road development	Site summary	Are there potential pathways for impacts from the proposed road development to this site? Explain.
River Shannon & River Fergus SPA [004077] Site area: 32,252.06 ha	150 m	The estuaries of the River Shannon and River Fergus form the largest estuarine complex in Ireland. The site comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in County Clare and Dooneen Point in County Kerry. Also included are several areas in the outer Shannon estuary, as well as the intertidal areas on the south shore of the Shannon between Tarbert and Beal Point. It is an internationally important site that supports an assemblage of over 20,000 wintering waterbirds and notable populations of Light-bellied Brent Goose (<i>Branta bernicla</i>), Dunlin (<i>Calidris alpina</i>), Black-tailed Godwit (<i>Limosa limosa</i>) and Redshank (<i>Tringa totanus</i>). The site has vast expanses of intertidal flats containing a diverse macroinvertebrate community which provides a rich food resource for the wintering birds while fringe salt marsh vegetation provides important high tide roost areas.	Yes. The proposed road development runs within close proximity (400m) to the Churchtown Estuary which is part of this European Site. There are also numerous pathways for impacts from the proposed road development during both construction and operation to the sensitivities of this European Site via various waterbodies crossed.
Curraghchase Woods SAC [000174] Site area: c. 358 ha	3 km	This site is situated c. 7km east of Askeaton in County Limerick. It consists largely of mixed woodland and a series of wetlands and contains two Annex I-listed woodland types; Yew woodlands, which is of very limited occurrence in Ireland, and Alluvial Forests. The site is of international importance for Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>).	Yes. The Lesser Horseshoe Bat population (a Qualifying Interest of this site) is mobile and there are potential impacts from the proposed road development on the movement of bats across the landscape.
Askeaton Fen Complex SAC [002279] Site area: 284.77 ha	500 m	Askeaton Fen Complex consists of a number of small and diverse fen areas to the east and south-east of Askeaton in County Limerick. One of the more important fen types, <i>Cladium</i> fen, occurs in various forms and is the most common fen type within the SAC. Also important are Alkaline fens which are found at the edge of almost all the sites. Both fens types exhibit many sub-types making this area ecological diverse and providing a valuable refuge for numerous faunal species.	Yes. The route of the proposed road development has been selected specifically to avoid direct impacts on this European Site, but due to the underlying karst geology, there remains nonetheless a potential for indirect impacts on the wetland sites during both construction and operation. Therefore, there is potential for pathways for impacts from the proposed road development to the sensitivities of this European Site.

European site	Distance from the proposed road development	Site summary	Are there potential pathways for impacts from the proposed road development to this site? Explain.
Barrigone SAC [000432] Site area: 66.36 ha	0.5 km	Barrigone is situated c. 5km west of Askeaton, County Limerick. The site comprises an area of dry, species-rich, calcareous grassland and patches of scrub. The presence of Annex I-listed Juniper Scrub and priority habitats of Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (*important orchid sites) and limestone pavements highlight the site's conservation value. The site also holds a large population of the Marsh Fritillary (<i>Euphydryas aurinia</i>), which is listed on Annex II to the Habitats Directive.	No. Despite the proximity of this site to the proposed road development, there are no potential pathways linking the site to the proposed road development. The Qualifying Interests of this site are not groundwater-dependant and there is no potential for direct or indirect impacts on this European Site.
Tory Hill SAC [000439] Site area: 76.9 ha	6 km	Tory Hill is an isolated, wooded limestone hill situated c. 2km northeast of Croom, County Limerick. It represents an important feature of the surrounding countryside and is a prime example of a limestone hill set amongst a region of volcanic intrusions of differing shape and geology. The Qualifying Interests for the site are Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (*important orchid sites), Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> * and Alkaline fens.	No. There are no pathways linking the site to the proposed road development. The proposed road development has been assessed as having no impact on the hydrology of groundwater-dependent habitats in the immediate vicinity of the development, so there is considered no risk to such habitats at a distance of 6km. There is considered to be no potential for direct or indirect impacts on this European Site.
Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA [004161] Site area: 56,673.39 ha	5 km	The Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle SPA is a very large site centred on the borders between the counties of Cork, Kerry and Limerick. The site consists of a variety of upland habitats, though almost half is afforested. The coniferous forests include first and second rotation plantations, with both pre-thicket and post-thicket stands present. Substantial areas of clear-fell are also present at any one time. This SPA is a stronghold for Hen Harrier (<i>Circus cyaneus</i>) and supports the largest concentration of the species in the country and provides excellent nesting and foraging habitat for breeding harriers. It is also an important site for Merlin (<i>Falco columbarius</i>) and Short-eared Owl (<i>Asio flammeus</i>).	No. There are no pathways linking the site to the proposed project. Hen Harrier, Merlin and Short-eared Owl will forage primarily within the SPA and its upland habitats during the breeding season. Following fledging of the young, the birds disperse widely over large areas. As a result, periodic occurrence in the vicinity of the proposed road development outside of the breeding season cannot be ruled out. Hunting occurs primarily over rough grassland, or semi-natural habitats and would not occur along the road embankments (as occurs with Barn Owl (<i>Tyto alba</i>)) and none of the species are considered at risk from traffic collision. There is considered to be no potential for direct or indirect impacts on this European Site or its conservation interests.

3.2 European Sites Screened In

The selection of the proposed road development has been heavily influenced by the dense concentration and distribution of European Sites within the central part of the overall study area identified during the Route Selection phase. The location of these areas is shown in Plate 3.2. There are five European Sites afforded protection under the Habitats Directive (SACs) and Birds Directive (SPAs), as transposed into Irish law, within the constraints study area, all of which are considered within the likely zone of impact of the proposed road development due to their proximity or connectivity to it, and one of which is intersected by the proposed road development (the Lower River Shannon SAC). Of these five sites, only four have been screened in as having the potential to be significantly affected by the proposed road development. Table 3.2 details these sites and outlines the corresponding Qualifying Interests / Special Conservation Interests, and their nearest point to the proposed road development. There are no European Sites outside of the original constraints study area that are, considered at risk of significant effects due to the distance from source to receptor, and the lack of pathways.

The entire Shannon Estuary to the north of the proposed road development is within the Lower River Shannon SAC [002165] and the River Shannon and River Fergus Estuaries SPA [004077]. The SAC boundary extends to include the River Maigue upstream as far as Adare, while the SPA boundary extends upstream as far as Ferry Bridge on the N69.

The Lower River Shannon SAC boundary also extends to include the estuary of the River Deel upstream as far as the N69 at Askeaton and the estuary of the River Ahacronane upstream as far as the N69 at Rincullia. The Qualifying Interests for the Lower River Shannon SAC comprise a large number of habitats and species including estuaries and mudflats, alluvial forests (a “priority” habitat in danger of disappearing from the EU), Atlantic Salmon (*Salmo salar*), Lamprey species and European Otter. Three plant species protected under the Flora (Protection) Order, 2015, namely Triangular Club-rush, Opposite-leaved Pondweed and Meadow Barley (*Hordeum secalinum*) are also recorded from the River Maigue estuary.

A number of other European Sites occur within the study area including the large woodland complex at the Curraghchase Woods SAC [000174], which supports a hibernation roost of the Lesser Horseshoe Bat, a species listed on Annex II to the Habitats Directive. The Askeaton Fen Complex SAC [002279] includes a number of individual sites scattered to the north and south of the N69 between Askeaton and Kildimo. The fens occur in basins between undulating hills of limestone in an otherwise intensive agricultural landscape.



Table 3.2: European Sites brought forward from Stage 1 Appropriate Assessment Screening

Site Code	Site Name	Status	Distance	Qualifying or Ecological Interests (*indicates "priority" habitat)
002165	Lower River Shannon	SAC	The proposed road development crosses this site	<p>[1110] Sandbanks which are slightly covered by sea water all the time</p> <p>[1130] Estuaries</p> <p>[1140] Mudflats and sandflats not covered by seawater at low tide</p> <p>[1150] *Coastal lagoons</p> <p>[1160] Large shallow inlets and bays</p> <p>[1170] Reefs</p> <p>[1220] Perennial vegetation of stony banks</p> <p>[1230] Vegetated sea cliffs of the Atlantic and Baltic coasts</p> <p>[1310] <i>Salicornia</i> and other annuals colonising mud and sand</p> <p>[1330] Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>)</p> <p>[1410] Mediterranean salt meadows (<i>Juncetalia maritimi</i>)</p> <p>[3260] Water courses of plain to montane levels with the <i>Ranunculon fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation</p> <p>[6410] <i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>)</p> <p>[91E0] *Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>)</p> <p>[1029] Freshwater Pearl Mussel (<i>Margaritifera margaritifera</i>)</p> <p>[1095] Sea Lamprey (<i>Petromyzon marinus</i>)</p> <p>[1096] Brook Lamprey (<i>Lampetra planeri</i>)</p> <p>[1099] River Lamprey (<i>Lampetra fluviatilis</i>)</p> <p>[1106] Atlantic Salmon (<i>Salmo salar</i>)</p> <p>[1349] Bottlenose Dolphin (<i>Tursiops truncatus</i>)</p> <p>[1355] European Otter (<i>Lutra lutra</i>)</p>

Site Code	Site Name	Status	Distance	Qualifying or Ecological Interests (*indicates "priority" habitat)
004077	River Shannon and River Fergus Estuaries	SPA	150 m	[A017] Cormorant (<i>Phalacrocorax carbo</i>) [A038] Whooper Swan (<i>Cygnus cygnus</i>) [A046] Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A048] Shelduck (<i>Tadorna tadorna</i>) [A050] Wigeon (<i>Anas penelope</i>) [A052] Teal (<i>Anas crecca</i>) [A054] Pintail (<i>Anas acuta</i>) [A056] Shoveler (<i>Anas clypeata</i>) [A062] Scaup (<i>Aythya marila</i>) [A137] Ringed Plover (<i>Charadrius hiaticula</i>) [A140] Golden Plover (<i>Pluvialis apricaria</i>) [A141] Grey Plover (<i>Pluvialis squatarola</i>) [A142] Lapwing (<i>Vanellus vanellus</i>) [A143] Knot (<i>Calidris canutus</i>) [A149] Dunlin (<i>Calidris alpina</i>) [A156] Black-tailed Godwit (<i>Limosa limosa</i>) [A157] Bar-tailed Godwit (<i>Limosa lapponica</i>) [A160] Curlew (<i>Numenius arquata</i>) [A162] Redshank (<i>Tringa totanus</i>) [A164] Greenshank (<i>Tringa nebularia</i>) [A179] Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A999] Wetlands and Waterbirds
000174	Curraghchase Woods	SAC	3 km	[91E0] *Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91J0] * <i>Taxus baccata</i> woods of the British Isles [1303] Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>)
002279	Askeaton Fen Complex	SAC	0.5 km	[7210] *Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7230] Alkaline fens

3.3 European Site Descriptions

3.3.1 Lower River Shannon SAC

This very large site stretches along the River Shannon from Killaloe to Loop Head / Kerry Head, a distance of c. 120km. It encompasses the Shannon, Feale, Mulkear and Fergus estuaries, the freshwater lower reaches of the Shannon (between Killaloe and Limerick), the freshwater stretches of much of the Feale and Mulkear catchments and the marine area between Loop Head and Kerry Head. The Shannon and Fergus Estuaries form the largest estuarine complex in Ireland. They form a unit stretching from the upper tidal limits of the Shannon and Fergus Rivers to the mouth of the Shannon Estuary. To the west of Foynes, a number of small estuaries form indentations in the predominantly hard coastline, namely Poulmasherry Bay, Ballylongford Bay, Clonderalaw Bay and the Feale or Cashen River estuary.

This site is of great ecological interest as it contains a high number of habitats and species listed on Annexes I and II to the Habitats Directive, including the priority habitats Coastal Lagoon and Alluvial Woodland, and it also contains vast expanses of intertidal mudflats, often fringed with saltmarsh vegetation. The smaller estuaries also feature mudflats but have their own unique characteristics, with stony habitats, and are unusually rich in species and biotopes.

Saltmarsh vegetation frequently fringes the mudflats. Over twenty areas of estuarine saltmarsh have been identified within the site, the most important of which are around the Fergus estuary and at Ringmoylan Quay. Areas of Mediterranean salt meadows characterised by clumps of Sea Rush (*Juncus maritimus*) occur occasionally. Two scarce species are found on saltmarshes in the vicinity of the Fergus estuary: a type of robust Saltmarsh-grass (*Puccinellia foucaudii*), sometimes placed within the species Common Saltmarsh-grass (*P. maritima*) and Hard-grass (*Parapholis strigosa*). Saltmarsh vegetation also occurs around a number of lagoons within the site, two of which have been surveyed as part of a National Inventory of Lagoons, (1) Cloonconeen Pool and (2) Shannon Airport Lagoon. The former is a natural sedimentary lagoon impounded by a low cobble barrier; seawater enters by percolation through the barrier and by over-wash. This lagoon represents a type which may be unique to Ireland since the substrate is composed almost entirely of peat. Shannon Airport Lagoon (2ha) is an artificial saline lake with an artificial barrier and sluiced outlet. However, it supports two Red Data Book species of stonewort (*Chara canescens* and *Chara connivens*).

The sea cliffs in the outer part of the site are sparsely vegetated with lichens, Red Fescue, Sea Beet (*Beta vulgaris* subsp. *maritima*), Sea Campion (*Silene uniflora*), Thrift (*Armeria maritima*) and plantains (*Plantago* spp.). A rare endemic subspecies of Irish Sea-lavender (*Limonium recurvum* subsp. *pseudotranswallianum*), occurs on sea cliffs.

One grassland type of particular conservation significance, *Molinia* meadows, occurs in semi-natural wet grassland, wet woodland and marsh found along the freshwater rivers in the site. Also present are distinct areas of floating river vegetation characterised by species of water-crowfoot (*Ranunculus* spp.), pondweeds (*Potamogeton* spp.) and Greater Water-moss (*Fontinalis antipyretica*).

Alluvial woodland occurs on the banks of the Shannon and on islands near Limerick City, where the most prominent woodland type is gallery woodland dominated by White Willow (*Salix alba*) and with occasional Alder (*Alnus glutinosa*).

A number of plant species that are listed in the Irish Red Data Book occur within the site, and several of these are protected under the Flora (Protection) Order (2015).

These include Triangular Club-rush, a species which is only found in Ireland in the Shannon Estuary, where it borders creeks in the inner estuary. Opposite-leaved Pondweed is found in the Shannon where it passes through Limerick City, while Meadow Barley is abundant in saltmarshes at Ringmoylan and Mantlehill. Hairy Violet occurs in the Askeaton / Foynes area. Golden Dock (*Rumex maritimus*) is noted as occurring in the River Fergus estuary.

This site is the most important coastal site in Ireland for a number of the waders including Lapwing, Dunlin, Snipe and Redshank. It also provides an important staging ground for species such as Black-tailed Godwit and Greenshank (*Tringa nebularia*) and other over-wintering wader and wildfowl including Greylag Goose (*Anser anser*), Shelduck (*Tadorna tadorna*), Wigeon (*Mareca penelope*), Teal (*Anas crecca*), Mallard (*Anas platyrhynchos*), Pintail (*Anas acuta*), Shoveler (*Anas clypeata*), Tufted Duck (*Aythya fuligula*), Scaup (*Aythya marila*), Ringed Plover (*Charadrius hiaticula*), Grey Plover, Lapwing, Knot (*Calidris canutus*), Dunlin, Snipe, Black-tailed Godwit, Curlew, Redshank, Greenshank and Turnstone (*Arenaria interpres*). A number of species listed on Annex I to the Birds Directive breed within the site including Peregrine (*Falco peregrinus*), Sandwich Tern (*Thalasseus sandvicensis*), Common Tern (*Sterna hirundo*), Red-billed Chough (*Pyrrhocorax pyrrhocorax*) and Kingfisher.

This SAC has the only known resident population of Bottlenose Dolphin in Ireland and all three Irish lamprey species. Two additional fish species of note, listed in the Irish Red Data Book, also occur, namely Smelt (*Osmerus eperlanus*) and Pollan (*Coregonus autumnalis pollan*). The Fergus is important in its lower reaches for spring salmon. Twaité Shad (*Alosa fallax*), while present, is not thought to spawn within the site.

Other Annex II-listed species include the Otter (*Lutra lutra*), which is commonly found throughout the SAC and the Freshwater Pearl Mussel (*Margaritifera margaritifera*) which occurs abundantly in parts of the Cloon River.

The site is an SAC selected for the following Qualifying Interests:

- [1110] Sandbanks which are slightly covered by sea water all the time
- [1130] Estuaries
- [1140] Mudflats and sandflats not covered by seawater at low tide
- [1150] *Coastal lagoons
- [1160] Large shallow inlets and bays
- [1170] Reefs
- [1220] Perennial vegetation of stony banks
- [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts
- [1310] *Salicornia* and other annuals colonising mud and sand
- [1330] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- [1410] Mediterranean salt meadows (*Juncetalia maritimi*)
- [3260] Water courses of plain to montane levels with the *Ranunculum fluitantis* and *Callitriche-Batrachion* vegetation
- [6410] *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)
- [91E0] *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)
- [1029] Freshwater Pearl Mussel (*Margaritifera margaritifera*)

- [1095] Sea Lamprey (*Petromyzon marinus*)
- [1096] Brook Lamprey (*Lampetra planeri*)
- [1099] River Lamprey (*Lampetra fluviatilis*)
- [1106] Atlantic Salmon (*Salmo salar*)
- [1349] Bottlenose Dolphin (*Tursiops truncatus*)
- [1355] European Otter (*Lutra lutra*)

3.3.2 River Shannon and River Fergus Estuaries SPA

This site comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in County Clare and Dooneen Point in County Kerry. The site has vast expanses of intertidal flats which contain a diverse macroinvertebrate community, e.g. *Macoma-Scrobicularia-Nereis*, which provides a rich food resource for the wintering birds. Saltmarsh vegetation frequently fringes the mudflats and this provides important high tide roost areas for the wintering birds. Elsewhere in the site, the shoreline comprises stony or shingle beaches.

The site is of special conservation interest due to the presence of the following Qualifying Interests:

- [A017] Cormorant (*Phalacrocorax carbo*)
- [A038] Whooper Swan (*Cygnus cygnus*)
- [A046] Light-bellied Brent Goose (*Branta bernicla hrota*)
- [A048] Shelduck (*Tadorna tadorna*)
- [A050] Wigeon (*Anas penelope*)
- [A052] Teal (*Anas crecca*)
- [A054] Pintail (*Anas acuta*)
- [A056] Shoveler (*Anas clypeata*)
- [A062] Scaup (*Aythya marila*)
- [A137] Ringed Plover (*Charadrius hiaticula*)
- [A140] Golden Plover (*Pluvialis apricaria*)
- [A141] Grey Plover (*Pluvialis squatarola*)
- [A142] Lapwing (*Vanellus vanellus*)
- [A143] Knot (*Calidris canutus*)
- [A149] Dunlin (*Calidris alpina*)
- [A156] Black-tailed Godwit (*Limosa limosa*)
- [A157] Bar-tailed Godwit (*Limosa lapponica*)
- [A160] Curlew (*Numenius arquata*)
- [A162] Redshank (*Tringa totanus*)
- [A164] Greenshank (*Tringa nebularia*)
- [A179] Black-headed Gull (*Chroicocephalus ridibundus*)
- [A999] Wetlands and Waterbirds

It is also of special conservation interest for holding an assemblage of over 20,000 wintering waterbirds. The site is the most important coastal wetland in the country and regularly supports in excess of 50,000 wintering waterfowl (a five-year mean of 57,133 for the period 1995/96 to 1999/2000), a concentration easily of international importance. The site has internationally important populations of Light-bellied Brent

Goose (494), Dunlin (15,131), Black-tailed Godwit (2,035) and Redshank (2,645). A further 17 species have populations of national importance, i.e. Cormorant (*Phalacrocorax carbo*; 245), Whooper Swan (118), Shelduck (1,025), Wigeon (3,761), Teal (2,260), Pintail (62), Shoveler (107), Scaup (102), Ringed Plover (223), Golden Plover (5,664), Grey Plover (558), Lapwing (15,126), Knot (2,015), Bar-tailed Godwit (460), Curlew (2,396), Greenshank (61) and Black-headed Gull (*Chroicocephalus ridibundus*; 2,681). These figures are five-year mean peak counts for the period 1995/96 to 1999/2000. Of particular note is that three of the species that occur regularly, i.e. Whooper Swan, Golden Plover and Bar-tailed Godwit, are listed on Annex I of the Birds Directive.

The site is among the most important in the country for several of these species, notably Dunlin (13 % of national total), Lapwing (6% of national total) and Redshank (9% of national total) and also supports a nationally important breeding population of Cormorant (93 pairs in 2010). Other species that occur include Mute Swan (*Cygnus olor*; 103), Mallard (441), Red-breasted Merganser (*Mergus serrator*; 20), Great Crested Grebe (*Podiceps cristatus*; 50), Grey Heron (*Ardea cinerea*; 38), Oystercatcher (*Haematopus ostralegus*; 551), Turnstone (124) and Common Gull (*Larus canus*; 445). These figures are also five-year mean peak counts for the period 1995/96 to 1999/2000. Apart from the wintering birds, large numbers of some species also pass through the site whilst on migration in spring and/or autumn. Parts of the River Shannon and River Fergus Estuaries SPA are Wildfowl Sanctuaries.

3.3.3 Curraghchase Woods SAC

This site is situated c. 7km east of Askeaton in County Limerick and 3 km from the proposed road development at the closest point. The area is characterised by glacial drift deposits over Carboniferous limestone. The site consists largely of mixed woodland and a series of wetlands.

The site is an SAC selected for the following Qualifying Interests:

- [91E0] *Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)
- [91J0] **Taxus baccata* woods of the British Isles
- [1303] Lesser Horseshoe Bat (*Rhinolophus hipposideros*)

One of the main interests at the site is the presence of a hibernation site of the Lesser Horseshoe Bat. The bats hibernate in the cellars of the former mansion, Curraghchase House, but are known to be present throughout the year. The entrance to the cellar is now grilled and all other access points blocked to prevent disturbance. In recent years, bats have remained within the cellar throughout the year. In the winter of 1995/1996, more than 60 bats were recorded in the hibernation site, resulting in the site being rated as of international importance. It is considered that the number of bats will increase now that the site is protected from disturbance. This is the largest known site for Lesser Horseshoe Bats in County Limerick. It is also one of only two known hibernation sites of the species in County.

The woodland consists of both deciduous species and stands of commercial conifers. Beech (*Fagus sylvatica*) is the most frequent deciduous species, but Pedunculate Oak (*Quercus robur*), Ash (*Fraxinus excelsior*), Sycamore (*Acer pseudoplatanus*) and Hornbeam (*Carpinus betulus*) are also present. Spruce (*Picea* sp.) and Scots Pine (*Pinus sylvestris*) are the commonest conifers. Scrub dominated by Hazel (*Corylus avellana*) and areas of wet woodland dominated by willows (*Salix* spp.) also occur.

The alluvial forest occurs in the southern part of the site and occupies low ground in a stream valley and some areas adjacent to a small lake. The dominant canopy species include Rusty Willow (*Salix cinerea* subsp. *oleifolia*), Alder, Downy Birch (*Betula pubescens*) and Ash. A rich herb layer is found where the conifers are less dense, characterised by such species as Bugle (*Ajuga reptans*), Hemlock Water-dropwort (*Oenanthe crocata*), Yellow Iris (*Iris pseudacorus*), Meadowsweet (*Filipendula ulmaria*), Water-cress (*Nasturtium officinale*), Common Nettle (*Urtica dioica*) and Sanicle (*Sanicula europaea*).

The Yew wood occurs as a stand on a limestone ridge above a stream valley. It is associated with an Oak-Ash wood, but also has a range of commercial planted species. Nevertheless, Yew is well represented and is readily regenerating. Other species present include Holly (*Ilex aquifolium*), Ash, Pedunculate Oak, Hazel and Hawthorn (*Crataegus monogyna*).

A series of small lakes and fens runs the length of the site. Some of these lakes are overgrown with vegetation. Black Bog-rush (*Schoenus nigricans*), Great Fen-sedge (*Cladium mariscus*), Greater Tussock-sedge (*Carex paniculata*), Carnation Sedge (*Carex panicea*) and Blunt-flowered Rush (*Juncus subnodulosus*) are some of the wetland species recorded. These wetlands, along with some wet grassland, add habitat diversity to the site.

The semi-natural habitats within the site provide ideal foraging habitat for the Lesser Horseshoe Bat. Further planting of conifer tree species at the expense of deciduous species should be avoided and attempts should be made to increase the area of deciduous woodland.

3.3.4 Askeaton Fen Complex SAC

The Askeaton fen complex consists of a number of small fen areas to the east and southeast of Askeaton in County Limerick, and 0.5 km from the proposed road development at the closest point. This area has a number of undulating hills, some of which are quite steep, and is underlain by Lower Carboniferous Limestone. At the base of the hills a series of fens, reedbeds and loughs can be found, often in association with marl or peat deposits. In south-eastern Askeaton, both Cappagh and Ballymorrisheen fens are surrounded by large cliff-like rocky limestone outcrops.

The site is an SAC selected for the following Qualifying Interests:

[7210] *Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*

[7230] Alkaline fens

One of the more important fen types, *Cladium* fen, which contains Great Fen-sedge, occurs in various forms and is the most common fen type within the SAC. It is associated with wet conditions generally not more than 25cm deep and can be found in mono-dominant stands growing on a marl base, such as at Feereagh and Mornane Loughs, and in the fen in the townland of Mornane. It can also be co-dominant with Common Reed in slightly drier conditions, such as in Deegerty, Blind Lough and Dromlohan. It is also found in association with alkaline fen species such as Black Bog-rush where it grows on a peaty substrate. *Cladium* fen is indicative of extremely base rich conditions. Typical species seen growing with the Great Fen-sedge include pondweeds (*Potamogeton* spp.), Marsh Horsetail (*Equisetum palustre*), Water Horsetail (*E. fluviatile*), Lesser Water-parsnip (*Berula erecta*), Lesser Marshwort (*Apium inundatum*), Bottle Sedge (*Carex rostrata*), particularly where marl is present, and Water Mint (*Mentha aquatica*). One such area of fen within the site is the only

known location in Ireland for the water beetle *Hygrotus decoratus* and is also known to contain *Hydroporus scalesianus*, a rare water beetle indicative of undisturbed fens. At the edge of some of the Great Fen-sedge fens, particularly where improved grassland is not present, there is typically found a gradation to wet marsh, which in turn grades into wet grassland. These transition habitats add to the ecological diversity of the site.

Alkaline fen is characterised by the presence of Black Bog-rush in association with brown mosses and a small sedge community. The soil is permanently waterlogged but generally not flooded, unless for a short period. Examples of this fen type are found at the edge of almost all the sites, but its extent is much less than the Great Fen-sedge fen type. The fen in the townlands of Moig West and Graigues is a good example of alkaline fen. Species seen growing with Black Bog-rush include Purple Moor-grass (*Molinia caeruleae*), Long-stalked Yellow-sedge (*Carex lepidocarpa*), Carnation Sedge, rushes (*Juncus* spp.) and an abundance of brown mosses, including *Campyllum stellatum*, *Ctenidium molluscum*, *Calliergon cuspidatum* and *Bryum pseudotriquetrum*. This fen type also grades into marsh and wet grassland. Scrub and woodland are present on high ground in some areas, such as Ballymorishen, Blind Lough, Ballyvogue, Dromlohan and Lough Feereagh. Species include Hawthorn, Blackthorn (*Prunus spinosa*), Gorse (*Ulex europaeus*), Ash, Willows, Downy Birch and Hazel. This is a useful faunal habitat particularly as it is adjacent to reedbeds and fens.

A small area of limestone species-rich grassland is found to the north of Balinvirick Fen. Species found which are typically associated with the habitat include the Early-purple Orchid (*Orchis mascula*), Carlina Thistle (*Carlina vulgaris*) and Mountain Everlasting (*Antennaria dioica*). Snipe use the tall marsh vegetation at the edge of the fens. Birds of prey such as Sparrowhawk (*Accipiter nisus*) feed over the reedbeds and scrubland areas of the site. Land-use in the area is quite intensive, with improved grassland extending down relatively steep slopes to the edge of the fens/loughs. New drainage or the deepening of existing drains poses a threat to the aquatic habitats at the site. In some instances, the fens appear to be drying out.

This site is of conservation value as it supports two fen types, each of which exhibit many sub-types. *Cladium* fen is listed as an Annex I priority habitat. These wetland habitats of fen, reedbeds, open water, marsh and wet grassland are also valuable in that they supply a refuge for fauna in an otherwise intensively managed countryside.

3.4 Effects on Conservation Objectives

Each Qualifying Interest in each European site is assigned a Conservation Objective of either restoration or maintenance of its "favourable conservation condition", as defined by a set of Attributes with corresponding Targets. The restoration and maintenance of the favourable conservation condition of habitats and species within European Sites contributes to the overall conservation status of those habitats and species at a national level.

Favourable conservation status of a habitat is achieved when:

- its natural range, and area it covers within that range, are stable or increasing;
- the specific structures and functions 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.

Favourable conservation status of a species is achieved when:

- population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats;

- the natural range of the species is neither being reduced nor is 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.

The potential for adverse effects on the Qualifying Interests of these European Sites is assessed in view of the relevant Conservation Objectives in the Screening Matrices in Tables 3.3 to 3.6 below. Where potential impacts exist as a result of the proposed road development, the adverse effects on the relevant Conservation Objectives are assessed on the basis of their specific Attributes and Targets.

Table 3.3 Assessment of Conservation Objectives for the Lower River Shannon SAC. Source: NPWS (2013a), unless otherwise referenced. * = a “priority habitat” in danger of disappearing from the EU.

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
Sandbanks which are slightly covered by sea water all the time [1110]	> 40km	Sandbanks in Irish waters comprise distinct banks (i.e. elongated, rounded or irregular mound shapes) that may arise from horizontal or sloping plains of sediment, ranging from gravel to fine sand. They are primarily composed of sandy sediments permanently covered by water, at depths of less than 20m below chart datum (though the banks may extend to water depths greater than 20m). The diversity and types of communities associated with this habitat are determined particularly by sediment type, together with a variety of other physical, chemical and hydrographical factors. Sandbank habitat is typically composed of superficial mobile sediment that forms into sand-waves or 'stippled bank crest facies'. There are currently 19 identified sandbank features in Ireland. These are predominantly composed of a fine sand to sand community, typified by the presence of the polychaete worm <i>Nephtys cirrosa</i> . The species found tend to be adapted to mobile substrates but all of the noted species recorded in Irish waters are frequently found in similar shallow coastal sediment habitats. There is some indication that mobile predators such as birds and marine mammals aggregate around sandbanks but it is not known if this is a function of the features themselves or the accessibility of shallow water. The overall conservation status of this habitat is considered to be 'Favourable', but threatened to a certain degree by offshore development, e.g. wind farms and harvesting of aquatic resources.	Water pollution and fishing/aquaculture-related activities. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Sandbanks which are slightly covered by sea water all the time in the Lower River Shannon SAC	Habitat distribution	The distribution of sandbanks is stable, subject to natural processes.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and the fact that potential pathways are not considered to exist, there will be no adverse effect on this habitat.
					Habitat area	The permanent habitat area is stable or increasing, subject to natural processes.	
					Community Distribution	Conserve the following community type in a natural condition: Subtidal sand to mixed sediment with <i>Nephtys</i> spp. Community complex.	
Estuaries [1130]	Within 200m	The estuary is the downstream part of a river valley, subject to the tide and extending from the limit of brackish waters. River estuaries are coastal inlets where there is generally a significant freshwater influence. Muddy to sandy substrates are the most common estuarine substrates, in an Irish context, and this is reflected in the communities occurring. The overall conservation status of this habitat is considered to be 'Inadequate' but 'improving'. The major pressures on Irish estuaries include pollution of surface waters, fishing, harvesting of other aquatic resources and bottom culture.	Water pollution and fishing/aquaculture-related activities. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Estuaries in the Lower River Shannon SAC	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and in view of the nature of the habitat, there will be no adverse effect on this habitat. The biota of estuarine environments is considered to be extremely robust being adapted to fluctuating environmental conditions including tidal exposure, salinity and temperature regime.
					Community Distribution	Conserve the following community types in a natural condition: Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex; Estuarine subtidal muddy sand to mixed sediment with gammarids community complex; Subtidal sand to mixed sediment with <i>Nucula nucleus</i> community complex; Subtidal sand to mixed sediment with <i>Nephtys</i> spp. community complex; Fucoid-dominated intertidal reef community complex; Faunal turf-dominated subtidal reef community; and Anemone-dominated subtidal reef community.	
Mudflats and sandflats not covered by seawater at low tide [1140]	Crossed by bridge	This habitat is found exclusively between the low water and mean high water marks. It is often a component of the Annex I habitats 'Large shallow inlets and bays' and 'Estuaries' but can occur independently. The fine sediment of intertidal mudflats is most often associated with rivers. Communities found in this habitat are very similar to those found in estuaries. The overall conservation status of this habitat is considered to be 'Inadequate' but 'improving'. The major pressures on this habitat include pollution of surface waters, fishing, harvesting of other aquatic resources and bottom culture.	Water pollution and fishing/aquaculture-related activities. Yes – Given the nature and proximity of the proposed road development, potential pathways of risk are considered to exist.	To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in the Lower River Shannon SAC	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes.	Yes – Owing to the close proximity and hydrological connectivity of this habitat type with regard to the proposed road development and the crossing of the River Maigue, adverse effects on this Qualifying Interest cannot be ruled out at this stage.
					Community Distribution	Conserve the following community types in a natural condition: Intertidal sand with <i>Scolecopsis squamata</i> and <i>Pontocrates</i> spp. community; and Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex.	
Coastal lagoons [1150] *	c. 15km	Irish lagoons are defined on the basis of biological communities rather than morphology. Any permanent water body, natural or artificial, with salinity of >1 psu (practical salinity units) and a very restricted tidal prism is considered to be a lagoon. The great majority have <i>Ruppia</i> sp. present. Water bodies separated from the sea by barrier islands are classified as lagoons in some countries but not in Ireland due to large tidal range and marine biota. Five main morphological types of	Water pollution and fishing/aquaculture-related activities. None – Given the nature of the proposed road development, potential	To restore the favourable conservation condition of Coastal lagoons in the Lower River Shannon SAC	Habitat area	Area stable or increasing, subject to natural processes.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and that potential pathways are not considered to exist, there
					Habitat distribution	No decline, subject to natural processes.	
					Salinity regime	Median annual salinity and temporal variation within natural ranges	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
		lagoon are recognised in Ireland: (i) sedimentary lagoons; (ii) artificial lagoons; (iii) rock / peat lagoons on the west coast(similar to lagoons in Scotland, but otherwise rare in Europe); (iv) karst lagoons (found in parts of Clare and Galway and possibly unique to Ireland); and (v) saltmarsh lagoons. The overall conservation status of this habitat is considered to be 'Bad' but 'stable'. The major pressures on this habitat in Ireland include pollution (eutrophication) of surface waters, erosion, land reclamation and modification of hydrographic functioning.	pathways of risk are not considered to exist.		Hydrological regime	Annual water level fluctuations and minima within natural ranges	will be no adverse effect on this habitat.
					Barrier: Connectivity between lagoon and sea	Appropriate hydrological connections between lagoons and sea, including where necessary, appropriate management.	
					Water quality: chlorophyll <i>a</i>	Annual median chlorophyll <i>a</i> within natural ranges and less than 5µg/L	
					Water quality: Molybdate Reactive Phosphorus (MRP)	Annual median MRP within natural ranges and less than 0.1mg/L	
					Water quality: Dissolved Inorganic Nitrogen (DIN)	Annual median DIN within natural ranges and less than 0.15mg/L	
					Depth of macrophyte colonisation	Macrophyte colonisation to maximum depth of lagoons	
					Typical plant species	Maintain number and extent of listed lagoonal specialists, subject to natural variation	
					Typical animal species	Maintain listed lagoon specialists, subject to natural variation	
					Negative indicator Species	Negative indicator species absent or under control	
Large shallow inlets and bays [1160]	> 30km	Large shallow inlets and bays are described as indentations of the coast where there is limited freshwater influence. These habitats are typically shallower and more sheltered than open coasts and can show a variety of habitat forms, being composed of fine sediments to bedrock, intertidally and sub-tidally. The shallow and sheltered nature of these habitats results in highly productive and frequently diverse areas, in terms of both species and communities. These habitats frequently incorporate a number of constituent Annex I habitats, including sandbank at the mouth of the Lower River Shannon, where <i>Nephtys cirrosa</i> and <i>Bathyporeia elegans</i> characterise the habitat. These habitats also form an important resource for various bird and mammal species (notably Annex II marine mammals) for feeding, breeding and resting. The overall conservation status of this habitat is considered to be 'Inadequate' but 'improving'. The major pressures on this habitat include fishing, harvesting of other aquatic resources, bottom culture, suspension culture and outdoor sports / leisure activities.	Water pollution and fishing/aquaculture-related activities. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Large shallow inlets and bays in the Lower River Shannon SAC	Habitat area	The permanent habitat area is stable or increasing, subject to natural processes	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and that potential pathways are not considered to exist, there will be no adverse effect on this habitat.
					Community distribution	Conserve the following community types in a natural condition: Intertidal sand with <i>Scolecopsis squamata</i> and <i>Pontocrates</i> spp. community; Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex; Subtidal sand to mixed sediment with <i>Nucula nucleus</i> community complex; Subtidal sand to mixed sediment with <i>Nephtys</i> spp. community complex; <i>Fucoid</i> -dominated intertidal reef community complex; Mixed subtidal reef community complex; Faunal Turf-dominated subtidal reef community; Anemone dominated subtidal reef community; and <i>Laminaria</i> dominated community complex.	
Reefs [1170]	c. 10km	Reefs are marine features with immobile hard substrate available for colonisation by epifauna. Reefs in Irish waters range from the intertidal zone to 4.5km depth and >400km from the coast. Intertidal reefs are widespread and characterised by hard rock washed by the tide. Tidal	Water pollution and fishing/aquaculture-related activities.	To maintain the favourable conservation condition of Reefs in	Habitat distribution	The distribution of Reefs is stable, subject to natural processes.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road
					Habitat area	The permanent habitat area is stable, subject to natural processes.	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
		immersion, influence of freshwater, variation in temperature, desiccation, exposure to waves and stability of substrate all influence this habitat type but all become less influential with increasing distance from the intertidal zone. Intertidal and subtidal reefs are often dominated by algae. Subtidal reef is most often found in exposed areas with little freshwater influence. In depths below 30m (and shallower in some coastal areas) insufficient light penetrates to facilitate photosynthesis by algae and the habitat usually becomes dominated by fauna. The overall conservation status of this habitat is considered to be 'Bad' and 'declining'. The major pressures on this habitat include fishing, harvesting of other aquatic resources, bottom culture, suspension culture and pollution to surface waters.	None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	the Lower River Shannon SAC	Community distribution	Conserve the following community types in a natural condition: <i>Furoid</i> -dominated intertidal reef community complex; Mixed subtidal reef community complex; Faunal turf-dominated subtidal reef community; Anemone dominated subtidal reef community; and <i>Laminaria</i> dominated community complex.	development and that potential pathways are not considered to exist, there will be no adverse effect on this habitat.
Perennial vegetation of stony banks [1220]	>40km	This habitat occurs along the coast where shingle (cobbles and pebbles) and gravel have accumulated to form elevated ridges or banks above the high tide mark. Most of the rocky material should be less than 25cm in diameter to be considered in this category. The vegetation tends to be dominated by perennial species, typically including <i>Honckenya peploides</i> , <i>Rumex crispus</i> , <i>Beta vulgaris</i> subsp. <i>maritima</i> , <i>Crithmum maritimum</i> and <i>Tripleurospermum maritimum</i> . The rare plants <i>Crambe maritima</i> and <i>Mertensia maritima</i> are also associated with this community (Fossitt, 2000). Species diversity is determined by the degree of exposure and by substrate stability, coarseness and size. The presence of lichens indicates long-term stability. The overall conservation status of this habitat is considered to be 'Inadequate' but 'stable'. Major pressures on this habitat include fishing, harvesting of other aquatic resources, bottom and suspension culture and pollution to surface waters.	Water pollution and fishing/aquaculture-related activities. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Perennial vegetation of stony banks in the Lower River Shannon SAC	Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and that potential pathways are not considered to exist, there will be no adverse effect on this habitat or its attributes and targets.
					Habitat distribution	No decline, or change in habitat distribution, subject to natural processes.	
					Physical structure: functionality and sediment supply	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	
					Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	
					Vegetation composition: typical species and sub-communities	Maintain the typical vegetated shingle flora including the range of sub-communities within the different zones	
					Vegetation composition: negative indicator species	Negative indicator species (including non-natives) to represent less than 5% cover	
Vegetated sea cliffs of the Atlantic and Baltic Coasts [1230]	>40km	Barron <i>et al.</i> (2011) defined a sea cliff as a steep or vertical slope located on the coast, the base of which is in either the intertidal or subtidal zone. The cliff may be composed of hard rock or of softer substrate such as shale or boulder clay. Hard cliffs are at least 5m high, while soft cliffs are at least 3m high. The cliff top is generally defined by a change to an obvious less steep gradient. In some cases, the cliff may grade into the slopes of a hillside located close to the coast. In these cases, the cliff is defined as that part of the slope which was formed by processes of coastal erosion, while the 'cliff top' is where there is the distinct break in slope. Both the cliff and the cliff top may be subject to maritime influence in the form of salt spray and exposure to coastal winds. A cliff can ascend in steps with ledges, and the top of the cliff is starts at the point at which erosion from wave action is no longer considered to have been a factor in the development of the landform. The cliff base may be marked by a change in gradient at the bottom of the cliff. Where the base is exposed, it can be characterised by scree, boulders, a wave-cut platform or sand, among other substrates. Sea cliffs may support a range of plant communities such as grassland, heath, scrub and bare rock communities, among others. The overall conservation status of this habitat is considered to be 'Inadequate' but 'stable'. The major pressures on this habitat include invasive alien species, sand / gravel extraction and construction of coastal defences and paths.	Invasive alien species, sand/gravel extraction and construction of coastal defences and paths. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Vegetated sea cliffs in the Lower River Shannon SAC	Habitat length	Area stable or increasing, subject to natural processes, including erosion.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and that potential pathways are not considered to exist, there will be no adverse effect on this habitat or its attributes and targets.
					Habitat distribution	No decline, subject to natural processes	
					Physical structure: functionality and hydrological regime	No alteration to natural functioning of geomorphological and hydrological processes due to artificial structures	
					Vegetation structure: zonation	Maintain range of sea cliff habitat zonations including transitional zones, subject to natural processes including erosion and succession	
					Vegetation structure: vegetation height	Maintain structural variation within sward	
					Vegetation composition: typical species and sub-communities	Maintain range of sub-communities with typical species listed in the Irish Sea cliff survey (Barron <i>et al.</i> ,2011)	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
					Vegetation composition: negative indicator species	Negative indicator species (including non-natives) to represent less than 5% cover	
					Vegetation composition: bracken and woody species	Cover of bracken (<i>Pteridium aquilinum</i>) on grassland and/or heath to be less than 10%. Cover of woody species on grassland and/or heath to be less than 20%	
Salicornia and other annuals colonizing mud and sand [1310]	c. 4.5km	<i>Salicornia</i> mud is a pioneer saltmarsh community that may occur on muddy sediment seaward of established saltmarsh, or form patches within other saltmarsh communities where the elevation is suitable and there is regular tidal inundation. In Ireland, three sub-types are recognised: (i) <i>Salicornia</i> type, (ii) <i>Suaeda</i> type and (iii) the much rarer <i>Sagina</i> type. Mono-specific swards of <i>Salicornia</i> sp. growing on muddy sediments are the most common plant community belonging to this Annex I habitat type found in Ireland. As this habitat is dominated by annuals, it can be ephemeral or transient in nature and is highly susceptible to erosion. Its distribution can vary considerably from year to year and it can move in response to changing conditions, e.g. in estuaries with shifting river channels. The overall conservation status of this habitat is considered to be 'Inadequate' and 'declining', owing to pressures and threats such as invasive species, intensive grazing, pollution and changes in abiotic conditions.	Invasive species, intensive grazing, pollution and changes in abiotic conditions. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of <i>Salicornia</i> and other annuals colonizing mud and sand in the Lower River Shannon SAC	Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and that potential pathways are not considered to exist, there will be no adverse effect on this habitat.
					Habitat distribution	No decline, or change in habitat distribution, subject to natural processes.	
					Physical structure: sediment supply	Maintain natural circulation of sediments and organic matter, without any physical obstructions	
					Physical structure: creeks and pans	Maintain/restore creek and pan structure, subject to natural processes, including erosion and succession	
					Physical structure: flooding regime	Maintain natural tidal regime	
					Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	
					Vegetation structure: vegetation height	Maintain structural variation within sward	
					Vegetation structure: vegetation cover	Maintain more than 90% of area outside creeks vegetated	
					Vegetation composition: typical species and sub-communities	Maintain the presence of species-poor communities with typical species listed in Saltmarsh Monitoring Project (McCorry and Ryle, 2009)	
					Vegetation composition: negative indicator species – <i>Spartina anglica</i>	No significant expansion of common cordgrass (<i>Spartina anglica</i>), with an annual spread of less than 1%	
Atlantic salt meadows (Glaucopuccinellietalia maritimae) [1330]	c. 200m	Atlantic salt meadows generally occupy the widest part of the saltmarsh gradient. They exhibit a distinctive topography with an intricate network of creeks and salt pans occurring on the larger marshes. This habitat contains several distinctive zones that are related to elevation and frequency of submergence. The lowest part along the tidal zone is generally dominated by common saltmarsh-grass (<i>Puccinellia maritima</i>). This habitat is important for wildlife, including wintering waders and wildfowl. Atlantic salt meadows are distributed around most of the coastline of Ireland. The overall conservation status of this habitat is considered to be 'Inadequate' but 'stable', owing to pressures and threats such as intensive grazing and pedestrian / cyclist trails.	Intensive grazing and paths/tracks and cycling tracks. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To restore the favourable conservation condition of Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) in the Lower River Shannon SAC	Habitat area	Area stable or increasing, subject to natural processes, including erosion and succession.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and in view of the nature of the habitat, there will be no adverse effect on this habitat. There will be no interference with sediment supply, flooding or salinity regimes.
					Habitat distribution	No decline or change in habitat distribution, subject to natural processes.	
					Physical structure: sediment supply	Maintain natural circulation of sediments and organic matter, without any physical obstructions	
					Physical structure: creeks and pans	Maintain creek and pan structure, subject to natural processes, including erosion and succession	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
					Physical structure: flooding regime	Maintain natural tidal regime	
					Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	
					Vegetation structure: vegetation height	Maintain structural variation within sward	
					Vegetation structure: vegetation cover	Maintain more than 90% of area outside creeks vegetated	
					Vegetation composition: typical species and sub-communities	Maintain the presence of species-poor communities with typical species listed in Saltmarsh Monitoring Project (McCorry and Ryle, 2009)	
					Vegetation composition: negative indicator species – <i>Spartina anglica</i>	No significant expansion of common cordgrass (<i>Spartina anglica</i>), with an annual spread of less than 1%	
Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [1410]	>1km	Mediterranean salt meadows occupy the upper zone of saltmarshes and usually occur adjacent to the boundary with terrestrial habitats. They are widespread on the Irish coastline but are not as extensive as Atlantic salt meadows. The habitat is distinguished from Atlantic salt meadows by the presence of rushes, e.g. Sea Rush (<i>Juncus maritimus</i>) and/or Sharp Rush (<i>J. acutus</i>), along with a range of species typically found in Atlantic salt meadows, including Sea Aster (<i>Aster tripolium</i>), Sea Purslane (<i>Atriplex portulacoides</i>), Sea-milkwort (<i>Glaux maritima</i>), Saltmarsh Rush (<i>J. gerardii</i>), Parsley Water-dropwort (<i>Oenanthe lachenalii</i>), Sea Plantain (<i>Plantago maritima</i>) and Common Saltmarsh-grass (<i>Puccinellia maritima</i>). The overall conservation status of this habitat is considered to be 'Inadequate' but 'stable', owing to pressures and threats such as intensive cattle grazing and pedestrian / cyclist trails.	Intensive cattle grazing and walking/cycling tracks. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To restore the favourable conservation condition of Mediterranean salt meadows (<i>Juncetalia maritimi</i>) in the Lower River Shannon SAC	Habitat area	Area increasing, subject to natural processes, including erosion and succession.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and in view of the nature of the habitat, there will be no adverse effect on this habitat.
					Habitat distribution	No decline or change in habitat distribution, subject to natural processes.	
					Physical structure: sediment supply	Maintain natural circulation of sediments and organic matter, without any physical obstructions	
					Physical structure: creeks and pans	Maintain creek and pan structure, subject to natural processes, including erosion and succession	
					Physical structure: flooding regime	Maintain natural tidal regime	
					Vegetation structure: zonation	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	
					Vegetation structure: vegetation height	Maintain structural variation within sward	
					Vegetation structure: vegetation cover	Maintain more than 90% of area outside creeks vegetated	
					Vegetation composition: typical species and sub-communities	Maintain the presence of species-poor communities with typical species listed in Saltmarsh Monitoring Project (McCorry and Ryle, 2009)	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
					Vegetation composition: negative indicator species – <i>Spartina anglica</i>	No significant expansion of Common Cord-grass (<i>Spartina anglica</i>), with an annual spread of less than 1%	
Water courses of plain to montane levels with the <i>Ranunculon fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation [3260]	Crossed by bridge	The description of this habitat type is broad, covering rivers from upland bryophyte and macroalgal-dominated stretches, to lowland depositing rivers with pondweeds and starworts. Selection of SACs for this habitat in Ireland has used this broad interpretation. The overall conservation status of this habitat is considered to be 'Inadequate' and 'declining' due to numerous pressures, including pollution from agriculture, forestry and industry, as well as modification of hydrological regimes.	Pollution from agricultural, forestry and industrial sources, as well as modification of hydrological regimes. Yes – Given the nature of the proposed road development, potential pathways of risk are considered to exist.	Water courses of plain to montane levels with the <i>Ranunculon fluitantis</i> and <i>Callitricho-Batrachion</i> vegetation	Habitat area	Area stable or increasing, subject to natural processes	Yes – Owing to the close proximity and hydrological connectivity of this habitat type with regard to the proposed road development and the crossing of the River Maigue, adverse effects on this Qualifying Interest cannot be ruled out at this stage.
					Habitat distribution	No decline, subject to natural processes.	
					Hydrological regime: river flow	Maintain appropriate hydrological regimes	
					Hydrological regime: tidal influence	Maintain natural tidal regime	
					Hydrological regime: freshwater seepages	Maintain appropriate freshwater seepage regimes	
					Substratum composition: particle size range	The substratum should be dominated by the particle size ranges, appropriate to the habitat sub-type (frequently sands, gravels and cobbles)	
					Water quality: nutrients	The concentration of nutrients in the water column should be sufficiently low to prevent changes in species composition or habitat condition	
					Vegetation composition: typical species	Typical species of the relevant habitat sub-type should be present and in good condition	
					Floodplain connectivity	The area of active floodplain at and upstream of the habitat should be maintained	
<i>Molinia</i> meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [6410]	>10km	<i>Molinia</i> meadows are represented in Ireland by fen and grassland communities on nutrient poor soils. This habitat type is either managed as traditional hay meadows (i.e. cut only once a year in late summer or autumn with the hay crop removed) or, more usually, as extensive pasture. Within Ireland, <i>Molinia</i> meadows occur in lowland plains on neutral to calcareous gleys, sometimes with a Marl layer beneath the surface, or on peaty soils both in lowland and upland contexts. <i>Molinia</i> meadows generally have a central to north-western distribution in Ireland that follows the distribution of <i>Cirsium dissectum</i> , one of the key indicator species for the habitat. The Annex I habitat is very rare in the east of the country with only one site recorded within the five eastern counties on the Irish Sea. The habitat is comprised of a few distinct communities belonging to the <i>Junco-Molinion</i> alliance. These communities have been classified: (i) <i>Cirsium dissectum-Potentilla erecta</i> (O'Neill <i>et al.</i> , in prep.), (ii) the <i>Carex panicea-Festuca rubra</i> community (Heery, 1991) and (iii) M24: <i>Molinia caerulea-Cirsium dissectum</i> fen meadow (Rodwell, 1991). The overall conservation status of this habitat is considered to be 'Bad' and 'declining', owing to pressures and threats such as land abandonment, land use change	Abandonment or lack of mowing, pastoral systems and grazing, water abstraction from groundwater and changes in species composition. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of <i>Molinia</i> meadows on calcareous, peaty or clayey-silt laden soils (<i>Molinion caeruleae</i>) in the Lower River Shannon SAC	Habitat area	Area stable or increasing, subject to natural processes	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and given that potential pathways do not exist, there will be no adverse effect on this habitat.
					Habitat distribution	No decline, subject to natural processes	
					Vegetation structure: broadleaf herb: grass ratio	Broadleaf herb component of vegetation between 40 and 90%	
					Vegetation structure: sward height	30-70% of sward between 10 and 80cm high	
					Vegetation composition: typical species	At least 7 positive indicator species present, including 1 "high quality" species	
					Vegetation composition: notable species	No decline, subject to natural processes	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
		(i.e. change of grazing / mowing regime), groundwater abstraction and changes in species composition.			Vegetation composition: negative indicator species	Negative indicator species collectively not more than 20% cover, with cover by an individual species less than 10%. Non-native invasive species, absent or under control	
					Vegetation composition: negative indicator moss species	Bog mosses (<i>Sphagnum</i> spp.) not more than 10% cover; hair mosses (<i>Polytrichum</i> spp.) not more than 25% cover	
					Vegetation Structure: woody species and bracken (<i>Pteridium aquilinum</i>)	Cover of woody species and bracken not more than 5% cover	
					Physical structure: bare ground	Not more than 10% bare ground	
*Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0]	c. 100m	Residual alluvial forests occur on heavy soils that are periodically inundated by the annual rise of river levels, but which are otherwise well drained and aerated during low water. In addition, there are gallery forests of tall willows (<i>Salicion albae</i>) alongside river channels and occasionally on river islands, where the tree roots are almost continuously submerged. The overall conservation status of this habitat is considered to be 'Bad' but 'improving'.	Inappropriate grazing, invasive species, clearance; changes to hydrological regime. Yes – Given the nature of the proposed road development, potential pathways of risk are considered to exist.	To restore the favourable conservation condition of Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) in the Lower River Shannon SAC	Habitat area	Area stable or increasing, subject to natural processes, at least c.8.5ha for sites surveyed.	Yes – Owing to the close proximity and hydrological connectivity of this habitat type with regard to the proposed road development and the crossing point on the River Maigue, potentially significant impacts on this Qualifying Interest cannot be ruled out at this stage.
					Habitat distribution	No decline.	
					Woodland size	Area stable or increasing. Where topographically possible, "large" woods at least 25ha in size and "small" woods at least 3ha in size	
					Woodland structure: cover and height	Diverse structure with a relatively closed canopy containing mature trees; sub-canopy layer with semi- mature trees and shrubs; and well-developed herb layer	
					Woodland structure: community diversity and extent	Maintain diversity and extent of community types	
					Woodland structure: natural regeneration	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	
					Hydrological regime: flooding depth/height of water table	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	
					Woodland structure: dead wood	At least 30m³/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems > 40cm diameter (> than 20cm diameter in the case of alder)	
					Woodland structure: veteran trees	No decline	
					Woodland structure: indicators of local distinctiveness	No decline	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
					Vegetation composition: native tree cover	No decline. Native tree cover not less than 95%	
					Vegetation composition: typical species	A variety of typical native species present, depending on woodland type, including alder (<i>Alnus glutinosa</i>), willows (<i>Salix</i> spp.) and, locally, oak (<i>Quercus robur</i>) and ash (<i>Fraxinus excelsior</i>)	
					Vegetation composition: negative indicator species	Negative indicator species, particularly non-native invasive species, absent or under control	
Freshwater Pearl Mussel (<i>Margaritifera margaritifera</i>) [1029]	c. 11km NW in the Cloon River	Freshwater pearl mussel grows to 140 mm in length, and burrows into sandy substrates, often between boulders and pebbles, in fast-flowing rivers and streams. It requires cool, well-oxygenated soft water, free of pollution or turbidity. The mussel spends its larval (or glochidial) stage attached to the gills of salmonid fishes. The species does not reach reproductive maturity until at least 12 years old and may live for over 120 years, therefore population-age structure is a vitally important consideration when assessing viability. This species has undergone severe population decline and, in many cases, individuals are unable to reproduce because of poor water quality. The overall conservation status of this species is considered to be 'Unfavourable'.	Nutrient enrichment, organic pollution, siltation, afforestation, inappropriate development, channel modification, loss of vector species (salmonids). None – Given that there is no suitable habitat for this species downstream of the proposed road development, potential pathways of risk are not considered to exist.	To restore the favourable conservation condition of Freshwater Pearl Mussel in the Lower River Shannon SAC	Distribution	Applies to the Cloon River, County Clare only where there is the desire to maintain distribution at 7km.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development (on the north side of the Shannon Estuary) and given that no potential pathways exist, there will be no adverse effect on this habitat.
					Population size	Restore to 10,000 adult mussels	
					Population structure: recruitment	Restore to least 20% of population no more than 65mm in length; and at least 5% of population no more than 30mm in length	
					Population structure: adult mortality	No more than 5% decline from previous number of live adults counted; dead shells less than 1% of the adult population and scattered in distribution	
					Habitat extent	Restore suitable habitat in more than 3.3km and any additional stretches necessary for salmonid spawning	
					Water quality: macroinvertebrate and phytobenthos (diatoms)	Restore water quality- macroinvertebrates: EQR (Environmental Quality Rating) greater than 0.90; phytobenthos: EQR greater than 0.93	
					Substratum quality: filamentous algae (macroalgae), macrophytes (rooted higher plants)	Restore substratum quality- filamentous algae: absent or trace (<5%)	
					Substratum quality: sediment	Restore substratum quality- stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	
					Substratum quality: oxygen availability	Restore to no more than 20% decline from water column to 5cm depth in substrate	
					Hydrological regime: flow variability	Restore appropriate hydrological regimes	
					Host fish	Maintain sufficient juvenile salmonids to host glochidial larvae	
Sea Lamprey (<i>Petromyzon marinus</i>) [1095]	Indeterminate but not recorded from	Sea Lamprey is an anadromous fish species. Adults live at sea as external parasites on host fish. Migration to freshwater occurs in spring, with spawning in June / July. Hatching of ammocoetes takes	Drainage maintenance works, barriers to migration, and pollution.	To restore the favourable conservation condition of Sea	Distribution: extent of anadromy	Greater than 75% of main stem length of rivers accessible from estuary	No Adverse Effect: There are no published records or evidence of Sea

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
	the watercourses crossed by the proposed road development.	place within days and the immature lamprey swims or drifts downstream until it encounters an area of fine sediment into which it can burrow. Transformation to the adult stage occurs in late summer and young adults migrate downriver in late autumn / winter. Barriers to migration are seen as major negative impacts on this species. The overall conservation status of the species is considered 'Bad' but 'stable', with major pressures / threats including canalisation and barriers to migration.	None – Given the distance from the preferred habitat of this Qualifying Interest and the nature of the proposed road development, potential pathways of risk are not considered to exist.	Lamprey in the Lower River Shannon SAC	Population structure of juveniles	At least three age/size groups present	Lamprey from the River Maigue or tributaries (Harrington, 2017). In the event that sea lamprey would occur, there would be no interference with their movement within the River Maigue. Spawning by Sea lamprey occurs in freshwater habitats only.
					Juvenile density in fine sediment	Juvenile density at least 1/m ²	
					Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds	
					Availability of juvenile habitat	More than 50% of sample sites positive	
Brook Lamprey (<i>Lampetra planeri</i>) [1096]	Indeterminate but not recorded from the watercourses crossed by the proposed road development.	Brook Lamprey is the smallest of the three lampreys recorded in Ireland. It is non-parasitic and non-migratory as an adult, living its entire life in freshwater habitats. Adults spawn in spring and, after hatching, the ammocoetes drift or swim downstream before encountering areas of riverbed with a fine silt composition. They burrow into this bed material and live as filter feeders over a period of years before transforming into young adult fish. The young adults overwinter before migrating short distances upstream to gravelled areas where they spawn and die. The overall conservation status of the species is considered 'Favourable', with main pressures / threats including dredging and removal of sediments.	Drainage maintenance works, barriers to migration, and pollution. None – Given the estuarine nature of the River Maigue in the vicinity of the proposed bridge location, potential pathways of risk are considered not to exist.	To maintain the favourable conservation condition of Brook Lamprey in the Lower River Shannon SAC	Distribution	Access to all water courses down to first order streams	No Adverse Effect: As this species is confined to freshwater habitats, it will not occur in the vicinity of the River Maigue bridge and there is considered to be no potential for adverse effects on this Qualifying Interest.
					Population structure of juveniles	At least three age/size groups of brook lamprey present	
					Juvenile density in fine sediment	Mean catchment juvenile density of brook lamprey at least 2/m ²	
					Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds	
					Availability of juvenile habitat	More than 50% of sample sites positive	
River Lamprey (<i>Lampetra fluviatilis</i>) [1099]	Movement of fish within the footprint of the proposed road development.	River and Brook Lamprey are indistinguishable as larvae, living as filter feeders in sediment. The mature adult forms are clearly distinguishable on the basis of body size. Major pressures / threats to River Lamprey include both diffuse and point-source pollution, invasive species, dredging and barriers to migration. The overall conservation status of the species is considered to be 'Favourable'.	Drainage maintenance works, barriers to migration, and pollution. Yes – Given the nature of the proposed road development, potential pathways of risk are considered to exist.	To maintain the favourable conservation condition of River Lamprey in the Lower River Shannon SAC	Distribution	Access to all water courses down to first order streams	Yes – Owing to the use of this habitat by this species in the vicinity of the proposed road development and the crossing point on the River Maigue, adverse effects on this Qualifying Interest cannot be ruled out at this stage. While there are no records of this species near the proposed crossing point of the River Maigue, the species is likely to occur in the area.
					Population structure of juveniles	At least three age/size groups of river lamprey present	
					Juvenile density in fine sediment	Mean catchment juvenile density of river lamprey at least 2/m ²	
					Extent and distribution of spawning habitat	No decline in extent and distribution of spawning beds	
					Availability of juvenile habitat	More than 50% of sample sites positive	
Atlantic Salmon (<i>Salmo salar</i>) [1106]	Movement of fish within the footprint of the proposed road development.	Atlantic Salmon is an anadromous species indigenous to the North Atlantic. Salmon use rivers to reproduce and as nursery areas during their juvenile phase. Adults spend 1 – 3 years at sea, where growth rates are much greater. The Irish population is generally comprised of fish that spend two winters in freshwater before going to sea in April – June. The majority of Irish fish spend one winter at sea before returning to their natal rivers, mainly during the summer. Smaller numbers spend two winters at sea, returning mainly in spring. A small proportion of the adult population returns to sea post-spawning and can spawn again. The overall conservation status of the species is considered 'Inadequate' but 'stable', with major pressures / threats including agricultural intensification, disposal of household / recreational facility waste, poaching and pollution due to agriculture, forestry and domestic wastewater.	Agricultural intensification; waste disposal; poaching; afforestation and pollution. Yes – Given the nature of the proposed road development, potential pathways of risk are considered to exist.	To restore the favourable conservation condition of Salmon in the Lower River Shannon SAC	Distribution: extent of anadromy	100% of river channels down to second order accessible from estuary	Yes – Owing to the use of this habitat by salmon in the vicinity of the proposed road development and the crossing point on the River Maigue, adverse effects on this Qualifying Interest cannot be ruled out at this stage.
					Adult spawning fish	Conservation Limit (CL) for each system consistently exceeded	
					Salmon fry abundance	Maintain or exceed 0+ fry mean catchment-wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	
					Out-migrating smolt abundance	No significant decline	
					Number and distribution of redds	No decline in number and distribution of spawning redds due to anthropogenic causes	
					Water quality	At least Q4 at all sites sampled by EPA	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
Bottlenose Dolphin (<i>Tursiops truncatus</i>) [1349]	c. 15km	Bottlenose Dolphin is one of the most familiar cetaceans occurring in Irish waters. Its conservation status has been classified as 'Least Concern' since its widespread global distribution and abundance indicate that it is well above the thresholds for a threatened category. The species is regularly recorded in Irish coastal and offshore waters (Ó Cadhla <i>et al.</i> , 2004; Berrow <i>et al.</i> , 2010) and show a level of residency in certain coastal areas (DEH LG, 2009). The population in the Shannon Estuary has been shown to be genetically distinct from other populations (Mirimin <i>et al.</i> , 2011). The pressures / threats identified for the species include fishing, harvesting of other aquatic resources, wildlife watching and seismic exploration / explosions.	By-catch in fishing gear, pollution, acoustic disturbance; habitat degradation, increasing disturbance from dolphin watching boat trips. None – given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Bottlenose Dolphin in the Lower River Shannon SAC	Access to suitable habitat	Species range within the site should not be restricted by artificial barriers to site use.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development and that potential pathways are not considered to exist, there will be no adverse effect on this species.
					Habitat use: critical areas	Critical areas, representing habitat used preferentially by bottlenose dolphin, should be maintained in a natural condition.	
					Disturbance	Human activities should occur at levels that do not adversely affect the bottlenose dolphin population at the site	
European Otter (<i>Lutra lutra</i>) [1355]	Present throughout the River Shannon catchment and on most watercourses crossed by the proposed road development.	European Otter is a large carnivore with a long, slim body, short legs with webbed feet and a tapered tail. Adult males can reach 1 m in length and 10 kg in weight. Dramatic declines occurred in many European populations during the latter half of the 20 th Century. As a result, otters became extinct in several countries. However, Ireland has remained a stronghold for the species. The overall conservation status of the species is considered 'Favourable', with road mortalities constituting the major pressure at present.	Pollution, riparian vegetation removal, over-fishing, hunting, poisoning, coastal protection works, watercourse modifications. Yes – Given the nature of the proposed road development, potential risks to this species are considered to exist. The crossing of the River Maigue may impact habitat for this Qualifying Interest during construction. Ex-situ occurrence of otters on other watercourses is also likely to affect the habitat and movement of this species.	To restore the favourable conservation condition of Otter in the Lower River Shannon SAC	Distribution	No significant decline	Yes – Owing to the use of this habitat by otters in the vicinity of the proposed road development and the crossing point on the River Maigue, potential impacts on this Qualifying Interest cannot be ruled out at this stage. Construction of the bridge over the River Maigue may temporarily impact otters' use of the riparian habitat during the construction process.
					Extent of terrestrial habitat	No significant decline. Area mapped and calculated as 596.8ha above high water mark (HWM); 958.9ha along river banks/ around ponds	
					Extent of marine habitat	No significant decline. Area mapped and calculated as 4,461.6ha	
					Extent of freshwater (river) habitat	No significant decline. Length mapped and calculated as 500.1km	
					Extent of freshwater (lake/lagoon) habitat	No significant decline. Area mapped and calculated as 125.6ha	
					Couching sites and holts	No significant decline	
					Fish biomass available	No significant decline	
					Barriers to connectivity	No significant increase.	

Table 3.4 Assessment of Conservation Objectives for the River Shannon and River Fergus Estuaries SPA. Source: NPWS (2013a), unless otherwise referenced. * = a “priority habitat” in danger of disappearing from the EU.

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
Cormorant (<i>Phalacrocorax carbo</i>) [A017]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Cormorant is a large, mainly all dark seabird, often seen standing with wings outstretched drying. The bird has a long body and neck, long strong hooked bill and dark webbed feet. The adult breeding bird is black with a green, bronze and blue gloss to its plumage, yellow and white bare flesh at the base of its lower mandible and a white thigh patch. Outside the breeding season (August to February), some Cormorants remain in the vicinity of their colonies, while others move to sheltered, coastal or inland locations – mostly south and east of their breeding sites. Ringing analyses (Wernham <i>et al.</i> , in press) show that Cormorants from Ireland move to continental Europe. There is significant movement of coastal breeding birds inland in winter. Overall, its European population is classed as secure with a long-term increasing trend in Ireland. Current national population estimates are 5,211 individuals. The number of breeding pairs in the River Shannon and River Fergus Estuaries SPA is 93. The main pressures acting on this species are fishing and harvesting of other aquatic resources.	Fishing and harvesting aquatic resources. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Cormorant in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Breeding population abundance: apparently occupied nests (AONs)	No significant decline	No Adverse Effect: There is limited potential for cormorant activity in the vicinity of the proposed Maigue crossing location though occasional foraging cannot be ruled out. There is no nesting habitat within the Maigue Estuary. There is considered to be no potential to adversely affect this species.
					Productivity rate	No significant decline	
					Distribution: breeding colonies	No significant decline	
					Prey biomass available	No significant decline	
					Barriers to connectivity	No significant increase	
					Disturbance at the breeding site	Human activities should occur at levels that do not adversely affect the breeding cormorant population	
					Population trend	Long term population trend stable or increasing	
Whooper Swan (<i>Cygnus cygnus</i>) [A038]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Whooper Swan is a large white waterbird. The yellow patch on its beak is wedge-shaped and reaches its nostrils, helping to distinguish it from the slightly smaller Bewick's Swan. Its tail is short and rounded, not like the wedge-shaped tail of the Mute Swan. The population occurring in Ireland breeds in Iceland, wintering on lakes, marshes, lagoons and sheltered inlets. Birds are also increasingly found in agricultural fields. There has been a 6% increase in non-breeding population in Ireland between 2005 and 2010. The current national population is 15,158 and the baseline population size in the River Shannon and River Fergus Estuaries SPA is 118 individuals.	Change in agricultural practices. Yes – Given the nature of the proposed road development, potential pathways of risk are considered to exist.	To maintain the favourable conservation condition of Whooper Swan in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	Yes – Owing to the use of ex-situ habitat outside of the SPA by Whooper Swans for foraging, adverse effects on this Conservation Interest cannot be ruled out at this stage.
					Distribution	No significant decrease in the range, timing or intensity of use of areas by Whooper Swan, other than that occurring from natural patterns of variation	
Light-bellied Brent Goose (<i>Branta bernicla hrota</i>) [A046]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The Light-bellied Brent Goose is a small dark goose, with a black head, neck and breast, and dark-brown upperparts and pale underparts. It has almost whitish flanks, and small white crescent on the upperparts of the neck visible at close range. Current national wintering population estimates are 25,100 wintering individuals. Twenty-four SPAs have been designated for this species in the Country. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 494 individuals. The main pressures acting on this species are outdoor sports / recreational activities, utility service lines and modification of cultivation practices.	Loss of habitat for foraging and roosting, and outdoor sports and leisure activities, recreational activities, hunting, utility service lines and modification of cultivation practices. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Light-bellied Brent Goose in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: There are no records of Brent goose foraging in the Maigue estuary and no flyways intercepted by the proposed road development. There is considered to be no potential to adversely affect this species.
					Distribution	No significant decrease in the range, timing or intensity of use of areas by Light-bellied Brent Goose, other than that occurring from natural patterns of variation	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
Shelduck (<i>Tadorna tadorna</i>) [A048]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The Shelduck is a large-sized goose-like duck, mostly white with dark-green head with a red bill, a chestnut belt across the breast and black scapulars. Adult males have a prominent knob at the base of the bill. It is a resident and winter migrant. Ireland receives additional birds during the winter months (October to March) from Scandinavia and the Baltic region. The species is amber-listed in Ireland, as the majority of the wintering population occurs at less than ten sites. Current national wintering population estimates are 11,760 individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 1,025 individuals. The main pressures acting on this species are outdoor sports / recreational activities, marine and freshwater aquaculture and changes in abiotic conditions.	Loss of habitat for foraging and roosting, and outdoor sports and leisure activities, recreational activities and hunting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Shelduck in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: Shelduck are mainly associated with expansive mudflats and the limited intertidal zone in the vicinity of the Mague crossing point does not provide suitable habitat for the species. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Shelduck, other than that occurring from natural patterns of variation	
Wigeon (<i>Anas penelope</i>) [A050]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Wigeon is a medium-sized duck with a round head and small bill. The head and neck of the male are chestnut, with a yellow forehead, pink breast and grey body. In flight, birds show white bellies and males have a large white wing patch. The species is red-listed in Ireland. Current national wintering population estimates are 62,980 wintering individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 3,761 individuals. The main pressures acting on this species are outdoor sports / recreational activities.	Loss of habitat for foraging and roosting, and outdoor sports and leisure activities, recreational activities and hunting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Wigeon in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Wigeon, other than that occurring from natural patterns of variation	
Teal (<i>Anas crecca</i>) [A052]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The Teal is a small duck with short neck. Males have a brown head with striking green patch which extends from the eye towards the back of the neck and is thinly bordered with yellow. They are grey-bodied with horizontal white stripe along the body, green speculum and creamy-yellow patch bordered by black on either side of the rump. The females are brown, streaked and mottled dark, with green speculum. The species is Amber-listed in Ireland due to a decline in the breeding population. Current national wintering population estimates are 29,050 individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 2,260 individuals.	Loss of habitat for foraging, breeding and roosting, and outdoor sports and leisure activities, recreational activities and hunting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Teal in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Teal, other than that occurring from natural patterns of variation	
Pintail (<i>Anas acuta</i>) [A054]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Pintail has a widespread global distribution across North America and northern Eurasia. Most birds occurring in winter migrate from more northern and eastern breeding areas in Fennoscandia and Russia. The European distribution in winter is predominantly coastal. Pintail form large flocks on brackish coastal lagoons, in estuaries and deltas, and on large inland lakes. Current national wintering population estimates are 1,280 wintering individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 62 individuals. The main pressures acting on this species are outdoor sports / recreational activities and hunting.	Loss of habitat for foraging and roosting, and outdoor sports and leisure activities, recreational activities and hunting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Pintail in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Pintail, other than that occurring from natural patterns of variation	
Shoveler (<i>Anas clypeata</i>) [A056]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The Shoveler is medium to large-sized waterfowl with a long and broad bill. Males have a green head, white breast, chestnut belly and flanks and blue upper forewing. Females are similar to Mallard but distinguished by the bill and darker brown belly. The species is Red-listed in Ireland. It is a resident and winter migrant. Most occur between October and March. Current national wintering population estimates are 2,770 wintering individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 107 individuals. The main pressures acting on this species are outdoor sports / recreational activities and hunting.	Loss of habitat for foraging and roosting, and outdoor sports and leisure activities, recreational activities and hunting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Shoveler in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Shoveler, other than that occurring from natural patterns of variation	
Scaup (<i>Aythya marila</i>) [A062]	Within 150m of the	Scaup is a medium-sized duck. The males have a black head and neck, with white wing bar, but lack a crest, have an elongated shape, and a	Loss of habitat for foraging, roosting and breeding.	To maintain the favourable conservation condition of	Population trend	Long term population trend stable or increasing	No Adverse Effect:

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
	boundary of the SPA containing this Qualifying Interest	pale grey bill. The females are dull brown with pale grey-brown flanks and slightly darker back. A broad white band surrounds the base of grey bill. In Ireland it is a winter visitor from Iceland, northern Europe and western Siberia, mostly occurring between November and April. Scaups are found mainly along the coast in shallow bays, although Lough Neagh is the single most important site in Ireland. There has been a 30% decline in the non-breeding population in Ireland between 1994/95 and 2003/04 with a current national population estimate of c. 4,430. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 102 individuals. The main pressures acting on this species are pollution of surface waters, outdoor sports / recreational activities and hunting.	None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	Scaup in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Scaup, other than that occurring from natural patterns of variation	The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species..
Ringed Plover (<i>Charadrius hiaticula</i>) [A137]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Ringed Plover are found across the northern hemisphere. The species generally winters as far south as Africa but many are resident in Ireland all year round. The species generally breeds on the coasts of Eurasia and Arctic Canada, but also breed at inland sites in western Europe. Current national population estimates are c. 9,060 individuals. The baseline wintering population size in the River Shannon and River Fergus Estuaries SPA is 223 individuals.	Loss of habitat for foraging and roosting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Ringed Plover in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Ringed Plover, other than that occurring from natural patterns of variation	
Golden Plover (<i>Pluvialis apricaria</i>) [A140]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The global distribution of Golden Plovers is very much restricted to boreal regions of the western Palearctic, with only a small extension further east. Golden Plovers generally breed between 60° – 70° N, although nesting occurs significantly further south in Britain and Ireland (being the southernmost extent of the global range). Generally, within southern parts of the range the distribution is discontinuous. In winter, birds migrate south and westwards, with localised wintering occurring from North Africa and Iberia, east through the Mediterranean Basin to the Middle East and the shores of the Caspian Sea. Large numbers winter in Britain and Ireland, France and the Low Countries. Current national population estimates are between 134 and 156 breeding pairs. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 5,664 individuals. The main pressures acting on this species are mining and quarrying, afforestation on open ground, grazing, interspecific faunal relations and slash-and-burn practices.	Loss of habitat for foraging and roosting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Golden Plover in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Golden Plover, other than that occurring from natural patterns of variation	
Grey Plover (<i>Pluvialis squatarola</i>) [A141]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Grey Plovers have a very restricted global distribution. They have an almost circumpolar breeding range, occurring in the high Arctic from the Kanin Peninsula east to the Bering Sea. In North America, they occur from Alaska to the western side of Baffin Island. Globally, there are five recognised biogeographic populations. Of these, birds occurring in Europe belong to the East Atlantic Flyway population, which comprises those breeding in the western Russian high Arctic. These birds winter from the Wadden Sea along the Atlantic coasts of Europe south to West Africa. Current national population estimates are 2,850 wintering individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 299 individuals.	Loss of habitat for foraging and roosting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Grey Plover in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Grey Plover, other than that occurring from natural patterns of variation	
Lapwing (<i>Vanellus vanellus</i>) [A142]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Lapwings have a wide global distribution throughout the temperate regions of Eurasia, from Britain, Ireland and Iberia in the west, to the Pacific coast of Russia and the Sea of Japan in the east. In Scandinavia, breeding extends northward but, through most of the range, Lapwings breed further south. Lapwings breed in all European countries, although within the Mediterranean Basin their distribution is highly localized. Across most of the range, Lapwings are highly migratory, moving south at the end of the breeding season to winter. Recent declines in the breeding population have been reported in many parts of north-western Europe. Current national population estimates are 2,000 breeding pairs. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 15,126 individuals.	Loss of habitat for foraging, roosting and breeding. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Lapwing in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Lapwing, other than that occurring from natural patterns of variation	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
Knot (<i>Calidris canutus</i>) [A143]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Knots are found in many regions of the world, although they are highly localised within each region. The breeding distribution is circumpolar, with the species nesting in the high Arctic. After the breeding season, they migrate through temperate coastal regions in the northern hemisphere to wintering grounds in the southern hemisphere. They undertake some of the longest migrations of any bird species. Current national wintering population estimates are 28,030 individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 2,015 wintering individuals.	Loss of habitat for foraging, roosting and breeding. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Knot in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Knot, other than that occurring from natural patterns of variation	
Dunlin (<i>Calidris alpina</i>) [A149]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Dunlin have a wide global distribution around the Arctic, and are found in nearly all Arctic regions. In Europe, they also extend south to temperate regions where they are found in wetland habitats. Breeding Dunlin are characteristic of moorland and upland habitats and this is reflected in the species' breeding distribution. Current national wintering population estimates are 150 breeding pairs. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 15,131 individuals. The main pressures acting on this species are modification of cultivation practices, mowing, fertilisation, grazing and interspecific faunal relations.	Loss of habitat for foraging, roosting and breeding. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Dunlin in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Dunlin, other than that occurring from natural patterns of variation	
Black-tailed Godwit (<i>Limosa limosa</i>) [A156]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The Black-tailed Godwit is very similar in size and shape to Bar-tailed Godwit, but the slightly longer, straighter bill, neck and legs give it a more elegant appearance. Its winter plumage is a similar greyish brown to Bar-tailed, but generally plainer, with less dark-centred feathers, especially on the wings. In flight, the similarities between the godwits disappears. Black-tailed shows a striking contrasting upperwing – mostly black with bold white wingbars, a square white rump and a black tail. The species typically wades in shallow water on tidal mudflats and favours the inner more silty parts of estuaries and inlets. It can occur in large flocks of several hundred birds. It is an amber-listed bird in Ireland, as the majority of Black-tailed Godwits winter at less than ten sites. Current national population estimates are 18,080 wintering individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 2,035 individuals. The main pressures acting on this species are marine and freshwater aquaculture.	Loss of habitat for foraging and roosting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Black-tailed Godwit in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Black-tailed Godwit other than that occurring from natural patterns of variation	
Bar-tailed Godwit (<i>Limosa lapponica</i>) [A157]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The Bar-tailed Godwit breeds in Arctic regions of Eurasia, from Northern Scandinavia, through high latitudes of Russia to the west coast of Alaska. It winters in north-western Europe and south to southern Spain and Portugal. Bar-tailed Godwits are almost entirely coastal in their winter habits, feeding mainly on worms, both on sandy and muddy shores. As a mid- to high-Arctic nesting species, significant between-year population changes might be expected as a consequence of variation in weather and predation pressures on breeding areas. Current national wintering population estimates are 11,890 individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 460 individuals. The main pressures acting on this species are marine / freshwater aquaculture and changes in abiotic conditions.	Loss of habitat for foraging and roosting. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Bar-tailed Godwit in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Bar-tailed Godwit other than that occurring from natural patterns of variation	
Curlew (<i>Numenius arquata</i>) [A160]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The breeding distribution of Curlew is globally restricted to the temperate and boreal regions of Europe and Asia. The species breeds from Ireland and Britain in the west, across continental Europe to the Russian far east. In winter, Curlews migrate south from their breeding areas and occur widely, though sparsely on southern hemisphere coasts in the Northern winter. Despite its recent expansion into lowland agricultural habitats, the species is still more abundant in uplands and northern regions where there are extensive areas of moorland and rough grazing. Current national wintering population estimates are 98 breeding pairs. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 2,396 individuals.	Loss of habitat for foraging, roosting and breeding. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Curlew in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Curlew other than that occurring from natural patterns of variation	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
Redshank (<i>Tringa totanus</i>) [A162]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The Eastern Atlantic Flyway population of the nominate race of Redshank winters from the North Sea countries through the western part of the Mediterranean to West Africa. Both <i>T. totanus</i> and <i>T. robusta</i> Redshank populations are declining. At least some of this decline is attributable to changes in agricultural practices and loss of important wetland sites. Current national wintering population estimates are c. 29,520 individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 2,645 wintering individuals.	Loss of habitat for foraging, roosting and breeding. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Redshank in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Redshank other than that occurring from natural patterns of variation	
Greenshank (<i>Tringa nebularia</i>) [A164]	Within 150m of the boundary of the SPA containing this Qualifying Interest	Greenshank is a distinctive long-legged, long-billed wader. It is quite large, and very white looking at long range, with dark wings. Its bill is straight with a very slight upturn. Its legs are a washed-out greyish-green colour. In flight, the species is quite long-winged, showing no wing bar, just plain, blackish wings, contrasting with a long white rump and back. Species is not very common, typically seen singly or in very small groups. Current national wintering population estimate is 890 wintering individuals. The baseline population size in River Shannon and River Fergus Estuaries SPA is 61 individuals. The main pressure acting on this species is changes in abiotic conditions.	Loss of habitat for foraging, roosting and breeding. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Greenshank in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Greenshank other than that occurring from natural patterns of variation	
Black-headed Gull (<i>Chroicocephalus ridibundus</i>) [A179]	Within 150m of the boundary of the SPA containing this Qualifying Interest	The Black-headed Gull is the most widely distributed seabird breeding in Ireland, with similar numbers breeding inland as on the coast. The majority of the breeding population is resident throughout the year. Black-headed gulls breed throughout the middle latitudes of the Palaearctic and have recently formed a breeding outpost in north-eastern North America. Habitats such as wetlands, bogs, marshes and artificial ponds are favoured breeding sites, but dry areas adjacent to water are also used. Current national population estimate is 50,181 individuals. The baseline population size in the River Shannon and River Fergus Estuaries SPA is 2,681 wintering individuals.	Loss of habitat for foraging, roosting and breeding. None – Given the nature of the proposed road development, potential pathways of risk are not considered to exist.	To maintain the favourable conservation condition of Black-headed Gull in River Shannon and River Fergus Estuaries SPA (NPWS, 2013c)	Population trend	Long term population trend stable or increasing	No Adverse Effect: The habitats in the vicinity of the Mague crossing point do not provide optimal habitat for this species though occasional occurrence of small numbers of birds cannot be ruled out. There is considered to be no potential to adversely affect this species.
					Distribution	There should be no significant decrease in the range, timing or intensity of use of areas by Black-headed Gull other than that occurring from natural patterns of variation	
Wetland and Waterbirds [A999]	Within 150m of the boundary of the SPA containing this Qualifying Interest	This site is designated for wetland and waterbirds because it contains wetland habitat of high ornithological importance for wintering waterfowl, with one species occurring in internationally important numbers and a further seven species having populations of national importance. High tide roosting sites, however, are limited.	Loss of habitat for foraging, roosting and breeding, changing agricultural practices, water pollution. Yes – Given the proximity of the proposed road development to the SPA at Churchtown Estuary, there is considered a potential risk of disturbance during the construction phase.	To maintain the favourable conservation condition of wetland habitat in River Shannon and River Fergus Estuaries SPA as a resource for the regularly occurring migratory waterbirds that utilise it (NPWS, 2013c)	Habitat Area	The permanent area occupied by the wetland habitat should be stable and not significantly less than the area of 32,261 hectares, other than that occurring from natural patterns of variation.	Yes – Owing to the proximity of the proposed road development to the SPA at Churchtown Estuary, the potential risk of disturbance during the construction phase cannot be ruled out at this stage.

Table 3.5 Assessment of Conservation Objectives for the Curraghchase Woods SAC. Source: NPWS (2013a), unless otherwise referenced. * = a “priority habitat” in danger of disappearing from the EU.

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
*Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0]	3km north	Residual alluvial forests occur on heavy soils that are periodically inundated by the annual rise of river levels, but which are otherwise well drained and aerated during low water. In addition, there are gallery forests of tall willows (<i>Salicion albae</i>) alongside river channels and occasionally on river islands, where the tree roots are almost continuously submerged. The overall conservation status of this habitat is considered to be ‘Bad’ but ‘improving’.	Inappropriate grazing, invasive species, clearance; changes to hydrological regime. None – Given the nature of the proposed road development, potential pathways of risk do not exist.	To restore the favourable conservation condition of Alluvial Forests in the Curraghchase Woods SAC	Habitat area	Area stable or increasing, subject to natural processes, at least c.8.5ha for sites surveyed.	No Adverse Effect: Due to the distance of this Qualifying Interest from the proposed road development with no potential pathways, there will be no adverse effect on this habitat or its attributes and targets.
					Habitat distribution	No decline.	
					Woodland size	Area stable or increasing. Where topographically possible, “large” woods at least 25ha in size and “small” woods at least 3ha in size	
					Woodland structure: cover and height	Diverse structure with a relatively closed canopy containing mature trees; sub-canopy layer with semi-mature trees and shrubs; and well-developed herb layer	
					Woodland structure: community diversity and extent	Maintain diversity and extent of community types	
					Woodland structure: natural regeneration	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	
					Hydrological regime: flooding depth/height of water table	Appropriate hydrological regime necessary for maintenance of alluvial vegetation	
					Woodland structure: dead wood	At least 30m³/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems > 40cm diameter (> than 20cm diameter in the case of alder)	
					Woodland structure: veteran trees	No decline	
					Woodland structure: indicators of local distinctiveness	No decline	
					Vegetation composition: native tree cover	No decline. Native tree cover not less than 95%	
					Vegetation composition: typical species	A variety of typical native species present, depending on woodland type, including alder (<i>Alnus glutinosa</i>), willows (<i>Salix</i> spp.) and, locally, oak (<i>Quercus robur</i>) and ash (<i>Fraxinus excelsior</i>)	
					Vegetation composition: negative indicator species	Negative indicator species, particularly non-native invasive species, absent or under control	
* <i>Taxus baccata</i> woods of the	3km north	Yew woodland is a highly restricted habitat type in Ireland. It occurs at a handful of sites in the south-west, mostly on skeletal soils over limestone outcrops or pavement. The canopy in these stands is typically dominated	Over-grazing, lack of regeneration and invasive species.	To restore the favourable conservation condition of <i>Taxus baccata</i> woods in	Habitat area	Area stable or increasing, subject to natural processes, with a minimum area of 73.46ha	No Adverse Effect: Due to the distance of this Qualifying Interest from the

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
British Isles [91J0]		by <i>Taxus baccata</i> with <i>Fraxinus excelsior</i> and frequently the introduced <i>Fagus sylvatica</i> . <i>Corylus avellana</i> and <i>Ilex aquifolium</i> are frequent components of the shrub layer but typically in small quantities. The dense evergreen canopy is inimical to the strong development of the field layer and regeneration is very limited or absent. The herb layer is characteristically species-poor and poorly developed with the most frequent and abundant species being <i>Hedera helix</i> , which is locally dominant, <i>Brachypodium sylvaticum</i> , <i>Viola riviniana</i> and ferns, especially <i>Phyllitis scolopendrium</i> . A striking feature is the rocky forest floor which is typically covered by an extensive carpet of bryophytes dominated by a few robust pleurocarpous species. The overall conservation status of this habitat is considered to be 'Bad' but 'improving'.	None – Given the nature of the proposed road development, potential pathways of risk do not exist.	the Curraghchase Woods SAC	Habitat distribution	No decline	proposed road development with no potential pathways, there will be no adverse effect on this habitat or its attributes and targets.
					Woodland size	Area stable or increasing	
					Woodland structure: cover and height	Diverse structure with a relatively closed canopy containing mature trees; sub-canopy layer with semi-mature trees and shrubs; and herb and bryophyte layer	
					Woodland structure: community diversity and extent	Maintain diversity and extent of community types	
					Woodland structure: natural regeneration	Seedlings, saplings and pole age-classes occur in adequate proportions to ensure survival of woodland canopy	
					Woodland structure: dead wood	At least 30m³/ha of fallen timber greater than 10cm diameter; 30 snags/ha; both categories should include stems greater than 40cm diameter	
					Woodland structure: veteran trees	No decline	
					Woodland structure: indicators of local distinctiveness	No decline	
					Vegetation composition: native tree cover	No decline. Native tree cover not less than 95%	
					Vegetation composition: typical species	A variety of typical native species present, including yew (<i>Taxus baccata</i>) and ash (<i>Fraxinus excelsior</i>)	
					Vegetation composition: negative indicator species	Negative indicator species, particularly non-native invasive species, absent or under control	
Lesser Horseshoe Bat <i>Rhinolophus hipposideros</i> [1303]	3km north	Lesser Horseshoe Bat is widely distributed in western, central and southern Europe, as far east as Kashmir and through northern Africa to Arabia, Ethiopia and Sudan (Mitchell-Jones <i>et al.</i> , 1999). Ireland represents the most northerly and westerly limits of the species' distribution (Roche, 2001) and here it is confined to six west coast Counties: Mayo, Galway, Clare, Limerick, Cork and Kerry (McAney, 1994). Although this bat has declined in many European countries, Ireland is considered a stronghold for the species (Marnell <i>et al.</i> , 2009). The Lesser Horseshoe Bat is the only member of the <i>Rhinolophidae</i> family occurring in Ireland. Summer roosting sites are often in the attics of old or derelict buildings. Lesser Horseshoe bats are faithful to a roost site and will return to the same site each year. Hibernation sites are typically caves, souterrains, cellars and icehouses (O'Sullivan, 1994). Lesser Horseshoe Bat rely on linear landscape features (e.g. treelines, stonewalls and hedgerows) to navigate and commute from roosts to feeding sites, and are reluctant to fly out in the open (Schofield, 2008). Individuals forage on flying insects in deciduous woodland and riparian vegetation normally within a few kilometres of their roosts (Bontadina <i>et al.</i> , 2002; Motte & Libois, 2002). They are sensitive to disturbance and	Loss of roosting sites due to deterioration or renovation of old buildings, loss of commuting routes and unsympathetic management of foraging sites. Yes – Given the nature of the proposed road development, potential pathways of risk are considered to exist.	To restore the favourable conservation condition of Lesser Horseshoe Bat <i>Rhinolophus hipposideros</i> in the Curraghchase Woods SAC	Population per roost	Minimum number of 182 bats in winter for Roost ID 623; minimum number of 127 in winter and 358 in summer for Roost ID 505; minimum number of 176 in winter and 315 in summer for Roost ID 296; minimum number of 218 in summer for Roost ID 615	Yes – Owing to the movement of Lesser Horseshoe Bat across the landscape and the potential for the proposed road development to intersect flight paths and thus result in habitat fragmentation, potential impacts on this Qualifying Interest cannot be ruled out at this stage.
					Winter roosts	No decline	
					Summer roosts	No decline	
					Number of auxiliary roosts	No decline	
					Extent of potential foraging habitat	No significant decline	
					Linear features	No significant loss, within 2.5km of qualifying roosts.	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
		normally do not occupy the same buildings as humans. Loss of roosting sites due to deterioration or renovation of old buildings, loss of commuting routes and unsympathetic management of foraging sites are the major threats to this species (McAney, 1994; McGuire, 1998; Roche, 2001). There is a hibernation roost for c. 60 Lesser Horseshoe Bats in Curraghchase House. The overall conservation status of the species is considered 'Favourable'.			Light pollution	No significant increase in artificial light intensity adjacent to named roosts or along commuting routes within 2.5km of those roosts.	

Table 3.6 Assessment of Conservation Objectives for the Askeaton Fen Complex SAC. Source: NPWS (2013a), unless otherwise referenced. * = a “priority habitat” in danger of disappearing from the EU.

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210]	0.5 m	This fen type is often dominated by Saw Sedge (<i>Cladium mariscus</i>). <i>Cladium</i> fens occur in a variety of situations including fens found in valleys or depressions, floodplains, over-grown-ditches, extensive wet meadows, within tall reed beds, on the landward side of lakeshore communities, calcium rich flush areas in blanket bogs, dune slack areas, fens adjacent to raised and blanket bogs, in turloughs, wet hollows in machair and often in association with alkaline fen. The key ecological requirements are a high water table, a calcareous, low-nutrient water supply and minimal water level fluctuation. The main pressures on this habitat type were identified as peat extraction, wetland reclamation and infilling. Wetland habitats are afforded additional protection under the recent Environmental Impact Assessment (Agriculture) Regulations (S.I. No. 407/2011), however the overall conservation status is considered to be 'Bad' due to the pressures outlined above.	Peat extraction, wetland reclamation and infilling. Yes – Given the nature of the proposed road development, potential pathways of risk are considered to exist.	To maintain the favourable conservation condition of Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> in the Askeaton Fen Complex SAC	Habitat area	Area stable or increasing, subject to natural processes	Yes – Owing to the proximity and hydrological connectivity of this habitat type with regard to the proposed road development including areas of fen habitat which are not designated as part of the SAC but which conform to the Annex habitat classification and form part of the overall complex of site, in tandem with the underlying karstified limestone geology along the proposed road alignment, potential impacts on this Qualifying Interest cannot be ruled out at this stage.
					Habitat distribution	No decline, subject to natural processes	
					Ecosystem function: hydrology	Maintain appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	
					Ecosystem function: peat formation	Maintain active peat formation, where appropriate	
					Ecosystem function: water quality	Maintain appropriate water quality, particularly nutrient levels, to support the natural structure and functioning of the habitat	
					Vegetation structure: typical species	Maintain vegetation cover of typical species including brown mosses and vascular plants	
					Vegetation composition: non-native species	Cover of non-native species less than 1%	
					Vegetation composition: trees and shrubs	Cover of scattered native trees and shrubs less than 10%	
					Physical structure: disturbed bare ground	Cover of disturbed bare ground not more than 10%. Where tufa is present, disturbed bare ground not more than 1%	
					Physical structure: drainage	Areas showing signs of drainage as a result of drainage ditches or heavy trampling not more than 10%	
Alkaline fens [7230]	0.5 m	Alkaline fens are typically calcareous basin or flush fen systems with extensive areas of species-rich small sedge communities. These fen systems are often a complex mosaic of habitats, with co-occurring tall sedge beds, reedbeds, wet grasslands, springs and open water. The habitat is characterised by a broad range of small to medium <i>Carex</i> sp., carpets of brown mosses and high species diversity including Black Bog-rush (<i>Schoenus nigricans</i>), Blunt-flowered Rush (<i>Juncus subnodulosus</i>), Devil's-bit Scabious (<i>Succisa pratensis</i>), Hemp Agrimony (<i>Eupatorium cannabinum</i>) and Purple Moor-grass (<i>Molinia caerulea</i>). This habitat requires a high water table, a calcareous, low-nutrient water supply and minimal water level fluctuation. Low intensity mowing and / or grazing are also very important for maintaining species richness. The main pressures affecting the habitat type have been identified as peat extraction, wetland reclamation and infilling. Wetland habitats are afforded additional protection under the recent Environmental Impact Assessment (Agriculture) Regulations (S.I. No. 407/2011), however the	Peat extraction, wetland reclamation and infilling. Yes – Given the nature of the proposed road development, potential pathways of risk are considered to exist.	To maintain the favourable conservation condition of Alkaline fens in the Askeaton Fen Complex SAC	Habitat area	Area stable, subject to natural processes	Yes – Owing to the proximity and hydrological connectivity of this habitat type with regard to the proposed road development including areas of fen habitat which are not designated as part of the SAC but which conform to the Annex habitat classification and form part of the overall complex of site, in tandem with the underlying karstified limestone geology along
					Habitat distribution	No decline.	
					Vegetation composition: typical species	At least seven positive indicator species present	
					Vegetation composition: bryophyte layer	Bryophyte cover at least 50% on wooded pavement	
					Vegetation composition: negative indicator species	Collective cover of negative indicator species on exposed pavement not more than 1%	

Qualifying Interest	Closest proximity	Extent and character	Risk to this Qualifying Interest	Conservation Objective	Attribute	Target	Potential Adverse Effect
		conservation status of the habitat type is considered to be 'Bad' due to the pressures outlined above.			Vegetation composition: non-native species	Cover of non-native species not more than 1% on exposed pavement; on wooded pavement not more than 10% with no regeneration	the proposed road alignment, potential impacts on this Qualifying Interest cannot be ruled out at this stage.
					Vegetation composition: scrub	Scrub cover no more than 25% of exposed pavement	
					Vegetation composition: bracken cover	Bracken (<i>Pteridium aquilinum</i>) cover no more than 10% on exposed pavement	
					Vegetation structure: woodland canopy	Canopy cover on wooded pavement at least 30%	
					Vegetation structure: dead wood	Sufficient quantity of dead wood on wooded pavement to provide habitat for saproxylic organisms	
					Physical structure: disturbance	No evidence of grazing pressure on wooded pavement	
					Indicators of local distinctiveness	Indicators of local distinctiveness are maintained	

3.5 Summary of Potential Significant Effects

Having considered the nature, scale and location of the proposed road development and the Conservation Objectives of the European Sites within the likely zone of impact in light of the best available scientific knowledge, and having applied the Precautionary Principle, it was determined that the proposed road development has the potential to result in adverse effects on certain Qualifying Interests in four European Sites, as summarised in Table 3.7 below.

Table 3.7 European Sites and their respective Qualifying Interests which have the potential to be significantly affected by the proposed road development (summarised from Tables 3.3 to 3.6 above).

European site	Qualifying Interest(s)
Lower River Shannon SAC [002165]	Mudflats and sandflats not covered by seawater at low tide [1140] Water courses of plain to montane levels with the <i>Ranunculus fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation [3260] *Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i> , <i>Alnion incanae</i> , <i>Salicion albae</i>) [91E0] River Lamprey (<i>Lampetra fluviatilis</i>) [1099] Atlantic Salmon (<i>Salmo salar</i>) [1106] European Otter (<i>Lutra lutra</i>) [1355]
River Shannon and River Fergus Estuaries SPA [004077]	Whooper Swan (<i>Cygnus cygnus</i>) [A038] Wetlands and Waterbirds [A999]
Curraghchase Woods SAC [000174]	Lesser Horseshoe Bat (<i>Rhinolophus hipposideros</i>) [1303]
Askeaton Fen Complex SAC [002279]	*Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> [7210] Alkaline fens [7230]

The potential significant effects on the Qualifying Interests listed in Table 3.7, above, are assessed in detail in the following sections of this NIS.

4. ASSESSMENT OF POTENTIAL SIGNIFICANT EFFECTS

In Section 3.0 of this NIS, potential significant effects on the integrity of the Lower River Shannon SAC, the River Shannon and River Fergus SPA, Askeaton Fen Complex SAC and Curraghchase SAC were identified. In accordance with European Commission guidance (EC, 2001), the identification of these effects was focussed on and limited to the Conservation Objectives of the sites concerned.

In order to fully assess the implications of the proposed road development for the European Sites concerned, each of the potential significant effects is now evaluated with reference to the Attributes and Targets which define the Conservation Objectives for the Qualifying Interest or Special Conservation Interest of those sites in the absence of mitigation measures. Where mitigation measures are required, they are detailed in Section 6.0 Mitigation Measures.

4.1 Lower River Shannon SAC

4.1.1 Mudflats and sandflats not covered by seawater at low tide [1140] and Water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation [3260]

These two habitat types occur in a mosaic in the vicinity of the proposed crossing point of the River Maigue, which is in the tidal reaches of the river downstream of Adare. The mudflats and sandflats not covered by seawater at low tide forms a narrow fringe at the lower end of the typically steep, sloping river banks, with pockets of vegetation conforming to Water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* in the mid to upper tide level.

The Conservation Objectives supporting document (NPWS, 2012) for Mudflats and sandflats not covered by seawater at low tide identifies two community types:

1. Intertidal sand with *Scolecopsis squamata* and *Pontocrates* spp. community
2. Intertidal sand to mixed sediment with polychaetes, molluscs and crustaceans community complex

The Conservation Objectives supporting document (NPWS, 2012) for Water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation identifies three sub-types of this vegetation community:

1. *Groenlandia densa* (Opposite-leaved Pondweed)
2. *Schoenoplectus triquetus* (Triangular Club-rush)
3. Bryophyte-rich streams and rivers

The Opposite-leaved Pondweed and Triangular Club-rush sub-types are associated with tidal reaches of rivers, while the latter sub-type is found in fast-flowing stretches of unmodified streams and rivers. Both sub-type 1 and sub-type 2 are present in the vicinity of the proposed crossing of the River Maigue. Opposite-leaved Pondweed has been recorded from a large drainage ditch to the west of the flood embankments along the Maigue downstream of Adare in the vicinity of the proposed crossing point on a number of occasions following the initial record Roger Goodwillie in 2000 (Reynolds, 2013). However, during the survey undertaken by EirEco in May 2018 no evidence of Opposite-leaved Pondweed was recorded in the drainage ditch which may be because of recent maintenance dredging undertaken in the area. On account of the regular maintenance of these drains, the plant appears to undergo some movement in distribution locally, with the result that its absence on one occasion does not preclude it appearing there at a later stage.

Triangular Club-rush is only found in Ireland in and around the upper Shannon Estuary in Counties Limerick and Clare where it is locally common by tidal creeks and stony-muddy shores and channels (Reynolds, 2013). The distribution of the plant in the estuary appears to be associated with sheltered sites where there is likely to be sediment accumulation and it is primarily found on creek banks, the outer zone of mud banks and within lagoons (B. Deegan, 2000). The plant was recorded in small quantities (less than 10 stems) on the lower intertidal muds on the west bank of the River Maigue in the immediate vicinity of the proposed crossing point in September 2017 as part of the walkover surveys for the proposed road development. However, a follow-up survey undertaken in September 2019 found no evidence of Triangular Club-rush at this location. A stand of several hundred stems was recorded in a small inlet also on the western riverbank c. 350m upstream of the proposed crossing point during both surveys. This stand was listed on the NPWS database from both 2008 and 2009. At this location it occurs in association with Water Pepper (*Polygonum hydropiper*), Fool's-water-cress (*Apium nodiflorum*), Water-cress, Water Forget-me-not (*Myosotis scorpioides*), Water-plantain (*Alisma plantago-aquatica*), Pink Water-speedwell (*Veronica catenata*) and occasional Curled Dock subspecies (*Rumex crispus* subsp. *uliginosus*). It extends from the bare mud at the lower tidal limit into the edge of reed-swamp dominated by Reed Canary-grass (*Phalaris arundinacea*) and Branched Bur-reed (*Sparganium erectum*) approximately 1.5m above the low water mark. There was no evidence of Triangular Club-rush from the eastern river bank in the vicinity of the proposed crossing point.

The Conservation Objective for these Qualifying Interests is to maintain the favourable conservation condition of the habitats in the Lower River Shannon SAC. The potential impacts of the proposed road development on these habitats is now assessed in view of the following key parameters reflected in the attributes and targets of the Conservation Objectives:

- Habitat area and distribution;
- Hydrological regime;
- Water quality; and
- Vegetation structure and composition (non-native species and negative indicator species).

Habitat Area and Distribution

As the River Maigue in the vicinity of the proposed crossing point is tidal, it undergoes a flood range of several meters under normal tidal conditions, though is prone to episodic extreme floods during combined low pressure events with strong westerly winds and spring tidal flows. It has large flood embankments on both banks which are set back approximately 20m from the river edge to prevent over-topping on such occasions. The vegetation between the embankments and the river is a gradation from dry meadows and grassy verges (GS2) on the embankments, through a fringe of freshwater marsh (GM1) / reed swamp (FS2) at the upper tidal limit to a sparse tidal river community (CW2) in the intertidal zone with bare mud on the lowest levels exposed during low tide. The muds are comprised of very fine silt with a small fraction of gravel. The instream substrate is comprised of a cobble and gravel matrix with silt, which supports scattered beds of Spiked Water-milfoil (*Myriophyllum spicatum*). Relevé data from the various plant communities in the vicinity of the bridge location are provided in Appendix G.

The lower section of the banks exposed at low tide are primarily bare mud with small amounts of water-starworts (*Callitriche* sp.) and occasional Curled Dock (*Rumex*

crispus subsp. *uliginosus*). Above this in the mid-section of the banks, where the vegetation cover is almost complete and dominated by Water Forget-me-not, Water Pepper, Fool's-water-cress, and Water-cress. Other components include Sea Beat, English Scurvy-grass (*Cochlearia anglica*) and occasional stands of Reed Canary-grass. A small amount of Triangular Club-rush was recorded in this zone on the western riverbank during surveys in 2016 but was not evident in 2019. In view of this, the community is considered to conform to the Triangular Club-rush sub-type of the Annex I habitat water courses of plain to montane levels with the *Ranunculon fluitantis* and *Callitricho-Batrachion* vegetation.

Towards the top of the bank which is covered by the mean tidal flood level, a fringe of freshwater marsh (GM1) / reed swamp (FS2) occurs with Reed Canary-grass, Water Mint, Water Forget-me-not and Creeping Buttercup (*Ranunculus repens*) dominating. Above this level the ground is gently sloping towards the flood embankment and grades from a wet grassland (GS4) community to a dry meadows and grassy verges (GS2) community with Creeping Bent (*Agrostis stolonifera*), Creeping Buttercup, Marsh Ragwort (*Senecio aquaticus*), Sharp-flowered Rush (*Juncus acutiflorus*). The flood embankments are comprised of a range of common species associated with agricultural grasslands including Perennial Rye-grass (*Lolium perenne*), Cock's-foot (*Dactylis glomerata*), Spear Thistle (*Cirsium vulgare*), Creeping Thistle (*Cirsium arvense*), Broad-leaved Dock (*Rumex obtusifolius*), Common Ragwort (*Senecio jacobaea*) and Common Nettle.

The proposed bridge design will entail a structure with piers set into the flood embankments providing a clear-span between the eastern and western flood embankment, thereby retaining the riverbanks intact. The construction will however require temporary supports inside the flood embankment along with platforms to support the cranes required to lift the pre-cast beams into place. These elements will be contained within a temporary sheet-pile wall erected above the river banks which is set back to avoid any de-stabilising effects on the banks. The sheet piling, which will be installed at the outset of the works and removed post-construction, will define the works zone on the river side, while the minimum amount of land required for construction will be used on the landward site. The proposed bridge design and construction works areas are shown in Plates 4.1 to 4.4. Refer also to Appendix H, EIAR Proposed Road Development Figures for the construction sequence drawings for the River Mague Bridge. The piles will not impact on the tidal river community (CW2) in the intertidal zone which is the habitat for the Triangular Club-rush and there is considered to be no effect on the habitat distribution or area for the species.

Within the works zone between the sheet pile wall and the flood embankments, all topsoil will be stripped and stored separately for subsequent reinstatement post-works. This plant community, which is comprised of mainly rhizomatous species, will regenerate rapidly post-construction though the reduced light levels as a result of the bridge deck may affect plant growth under the central part of the bridge. While reduced light may also affect the vegetation growing on the river banks immediately under the bridge, the plants will not be subject to any change in hydrology and more shade-tolerant species are likely to dominate over time. There was no evidence of the Triangular Club-rush at the bridge location in 2019 and the proposed bridge will not affect the plant's distribution or abundance.

No evidence was found of the occurrence of Opposite-leaved Pondweed at the drainage ditch to the west of the flood embankments (which can be seen in Plate 4.1) or outside of the SAC during the surveys undertaken in 2016 or 2019. It was recorded from the drain approximately 100m to the south of the proposed bridge location in 2008 (Reynolds, 2013). The proposed bridge over the River Mague will have long back-

spans on each side that will carry the proposed road over the existing drains behind the flood bunds along the riverbanks. This drain is subject to periodic maintenance dredging, which the plant appears to tolerate and may also contribute to the disturbance necessary for the species' persistence, and so is likely to reappear in the future. The drain will be retained intact, though the reduced light levels associated with the bridge deck will render the conditions under the section covered by the bridge deck unsuitable for the species. As with Triangular Club-rush, the bridge construction will not lead to any changes in the habitat distribution or area for the species.

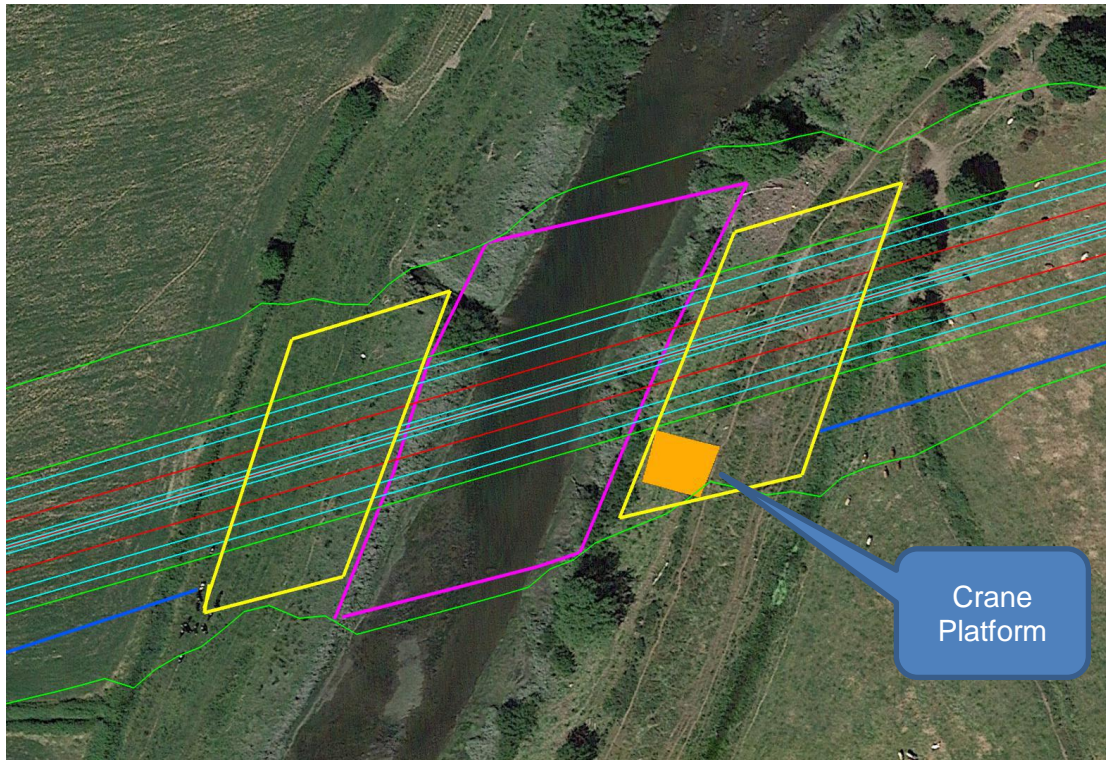


Plate 4.1: River Maigue Bridge Construction Zones (shown in yellow) and Habitat Protection Zone (shown in pink)

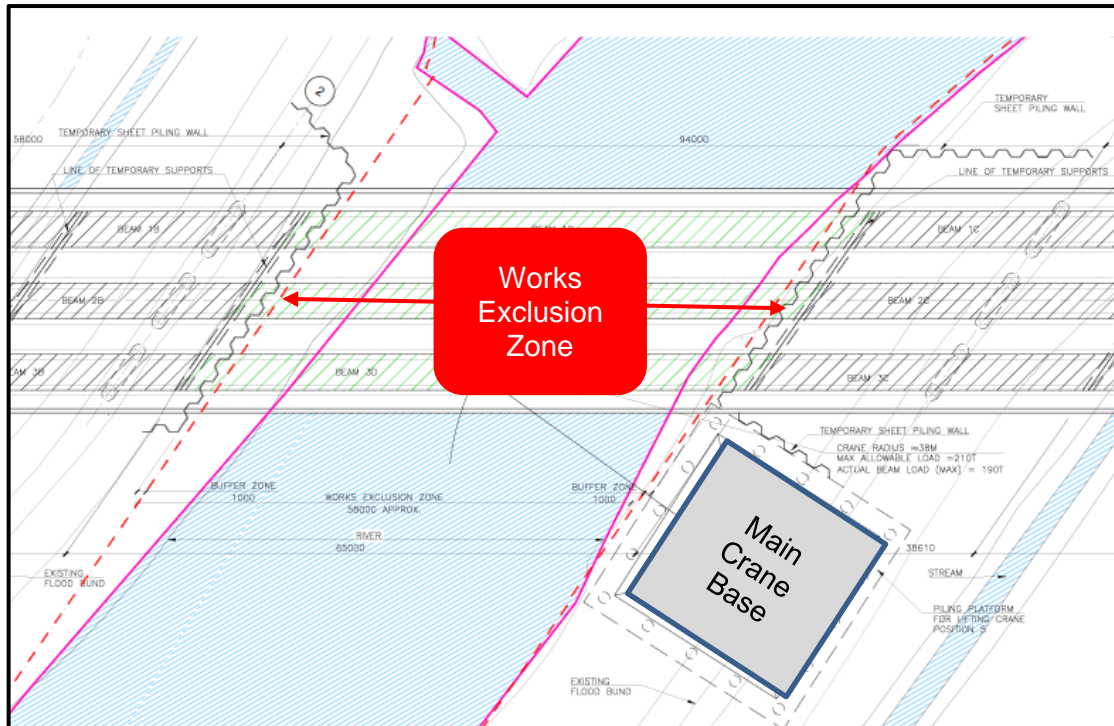


Plate 4.2: River Maigue Bridge – Erection Sequence Plan Drawing showing Works Exclusion Zone (Red Dashed Line) with Main Crane Position on the Eastern Riverbank

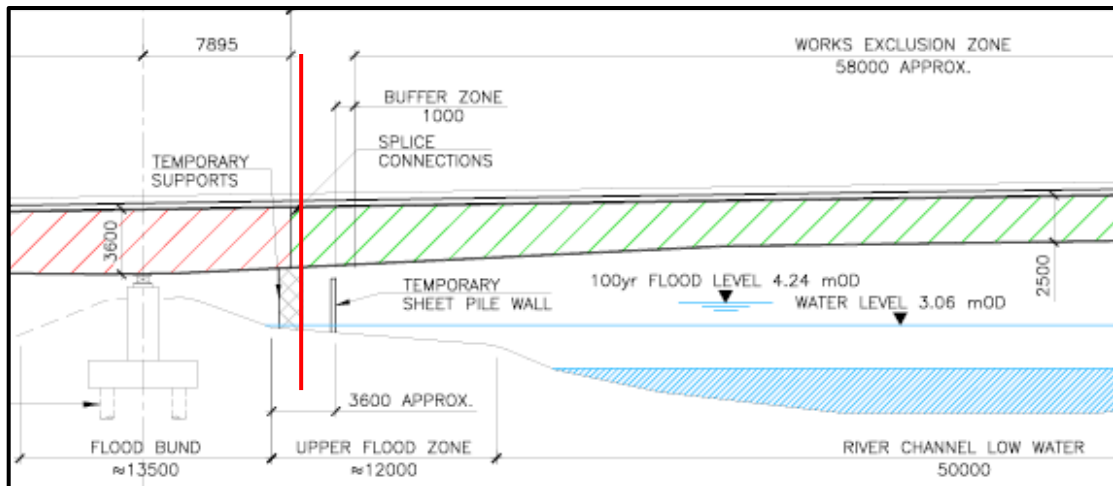


Plate 4.3: River Maigue Bridge – Erection Sequence Drawing showing Construction Zone for Habitat Protection on the Western River Bank (to the red line)

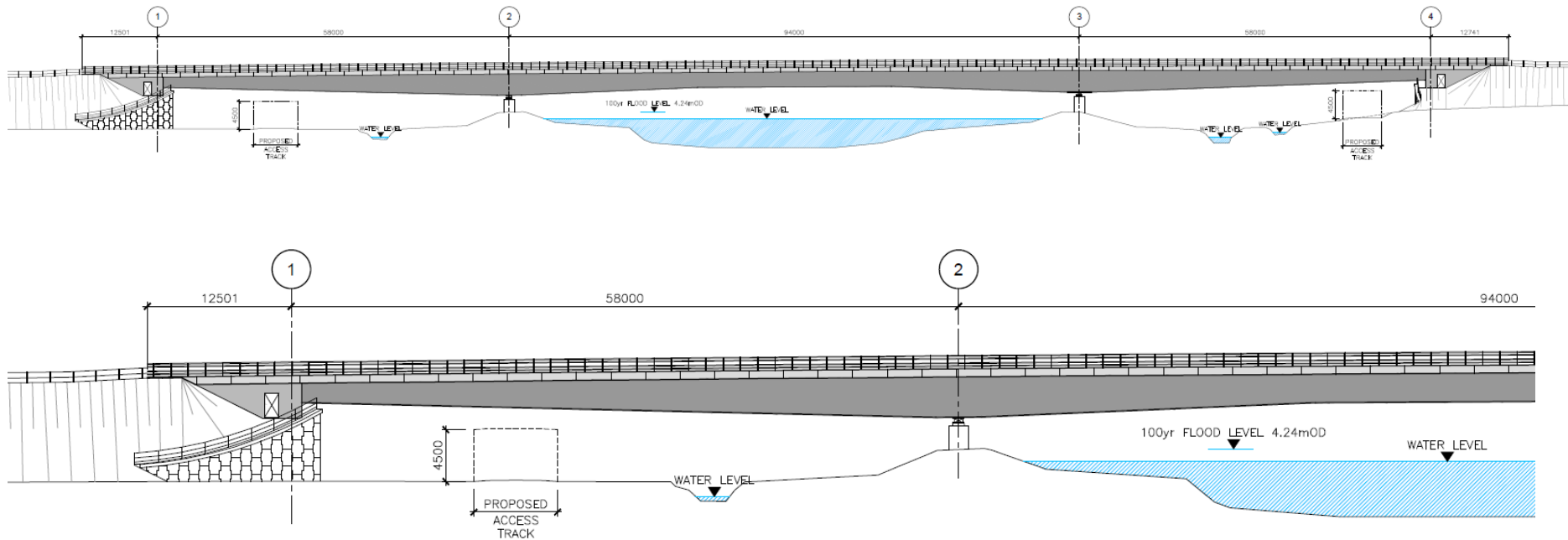


Plate 4.4: Proposed River Mague Bridge (RVB04) – Full bridge at top and enlargement of Half Span below

Hydrological Regime

The construction of the River Maigue Bridge would not lead to any changes in the hydrological regime, sediment composition or nutrient status in the estuary which would affect the distribution of the habitats or species at this location. The permanent bridge piers will be keyed into the existing flood embankments while the temporary sheet piles required for construction will be set at the high water mark and will have no effect on flow regimes within the river channel.

Elsewhere on the proposed road development, there will be no changes to the hydrological regime within any of the watercourses or within the SAC, as all crossings are appropriately sized to the existing channels and road run-off is attenuated.

Water Quality

During the construction works and, in particular, the erection and removal of the temporary sheet pile wall along the top of the river bank at the River Maigue crossing, there is a risk of silt-laden surface water entering the river, causing sediment to become suspended in the water column. Standard protective measures which have proven effectiveness will be provided to trap surface run-off from the construction zone and allow for settlement prior to discharge, as detailed in Section 5.2. However, given the naturally high sediment load in the estuarine reaches of the River Maigue in the vicinity of the proposed road development, elevated levels of suspended solids would not lead to significant impacts on habitats or species. The risk of negatively affecting water quality during both the construction and operational phase as a result of hydrocarbons or other pollutants is explored further below:

Construction Phase

Construction activities within and adjacent to the River Maigue and at all watercourses along the length of the proposed road development which ultimately drain to the SAC, if not properly managed, has the potential to impact on water quality as follows:

- Sedimentation – In the absence of appropriate mitigation, construction activities can result in sedimentation impacts as follows:
 - Surface water run-off from construction areas adjacent to the river may contain high levels of suspended sediments (and contaminants). Such run-off, if not attenuated and treated prior to discharge to the River Maigue, has the potential to cause significant ecological impacts. High deposition can lead to smothering of the habitat, which may alter the vegetation composition. Deposition of fine sediments can also increase the amounts and persistence of chemical contaminants in the receiving habitat, leading to further changes in the vegetation structure and composition.
 - Suspended sediments can also exacerbate other water quality impacts by providing chemical contaminants with a surface on which to bind, thereby increasing the bioavailability of these contaminants, eventually leading to ecological effects.
- Spillage of cementitious materials – During bridge construction concrete or other cementitious materials may be washed into the river in construction site run-off. Cementitious materials are highly alkaline and, consequently, can drastically alter the pH of the receiving watercourse. This can lead to profound ecological impacts on the affected watercourse and any habitats connected to it. Changes in the alkalinity of surface waters can affect the pH of connected ground waters and soils. This can affect the vegetation composition by causing damage to pH-sensitive species. As the pH impact is greater near the affected watercourse, vegetation here is disproportionately affected, leading to changes in zonation.

- Spillage of hydrocarbons – Vehicles, plant and equipment which will be used during the construction of the bridge rely on hydrocarbons such as diesel, petrol and lubricating oils. Leaks from poorly maintained vehicles, plant, equipment or storage tanks provide for a risk of input of hydrocarbons into the environment. In the absence of appropriate mitigation, hydrocarbons from the construction site may be washed into the river in construction site run-off. This has the potential to cause negative ecological impacts on the River Maigue and any habitats connected to it. Hydrocarbons can have direct phytotoxic effects, including reducing the ability of plants to absorb water and nutrients from their environment. These compounds can also alter the nutrient balance and microbiota in soil and water, which can benefit some plant species while detrimentally affecting others. Such changes have the potential to alter the vegetation structure and composition of the habitat.
- Faecal contamination – Inadequate treatment of wastewater from on-site toilets and washing facilities also provides for potential water quality impacts which could lead to ecological effects in the River Maigue and any habitats connected to it. Faecal contamination can alter the nutrient balance in soils and water, causing significant changes in microbial communities and reductions in oxygen levels. This can have significant effects on vegetation structure and composition in receiving habitats.

Operational Phase

The principal risks to the aquatic environment during operation relates to the potential for pollutants from road run-off entering watercourses leading to deterioration in water quality. However, the drainage design for the proposed road development includes the direction of all surface water run-off through a controlled drainage system which includes attenuation ponds to allow for the settlement of run-off and capture of suspended solids and pollutants. These facilities will also operate as spill containment facilities and hydrocarbon interceptors will also be incorporated where the drainage from the ponds will discharge directly to a large or sensitive watercourse, including the River Maigue, the River Deel, and both the Ahacronane River and Robertstown Stream which discharge into the Churchfield Estuary within the Lower River Shannon SAC. On the basis of the design and mitigation measures proposed, the operation of the proposed road development will present no significant risk of impacting on water quality within the aquatic environment.

Vegetation Structure and Composition

The construction of the River Maigue Bridge will result in the temporary loss of vegetation within the SAC above the level of the temporary sheet pile wall at the upper tidal level. This will not affect the plant community supporting Triangular Club-rush but will result in the loss of the freshwater marsh and reed swamp at the upper tidal limit, along with the dry meadows and grassy verge community on the flood embankments. While stripping and storage of topsoil from these areas with subsequent reinstatement post works is expected to result in a rapid recolonisation of the vegetation, there is a risk of invasive alien species also establishing on the disturbed ground and overshadowing the native suite of plants. Giant Hogweed (*Heracleum mantegazzianum*) is recorded from the proposed bridge crossing location in small amounts along with Water Fern (*Azolla filiculoides*), both species are listed on the Third Schedule to the Habitats Regulations. Himalayan Balsam (*Impatiens glandulifera*) (also listed on the Third Schedule), while not apparently within the Maigue catchment (Reynolds, 2013), was recorded as abundant along the River Deel during field surveys.

Conclusion

In the absence of appropriate mitigation, the construction and operation of the proposed road development has the potential to adversely affect the Conservation Objectives of the Qualifying Interest habitats 'Mudflats and sandflats not covered by seawater at low tide' and 'Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation' in the Lower River Shannon SAC, which may affect the vegetation structure and composition of these Qualifying Interests. This risk is most significant at the River Maigue Bridge location which is within the SAC, but as all drainage from the proposed road development will ultimately drain to the Lower River Shannon SAC, there is a level of risk at all watercourse crossings. The level of risk will be proportionally higher where the distance to the SAC is small, such as at watercourses which drain to the Churchfield Estuary where the Annex listed habitat mudflats and sandflats also occur.

There is also a risk of invasive alien species establishing on the disturbed ground at the River Maigue crossing location and over-shadowing the native suite of plants. Therefore, mitigation is required to avoid this adverse effect.

The proposed River Maigue Bridge will not affect the current distribution of either Triangular Club-rush or Opposite-leaved Pondweed, both key species in the Annex I habitat, 'Watercourses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation', as neither species is present at or in the immediate vicinity of the proposed works.

4.1.2 Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*) [91E0]

The priority habitat 'alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)' does not occur within the immediate vicinity of the proposed bridge location on the River Maigue. However, a belt of riparian woodland (WN5) occurs c. 160 m downstream of the proposed crossing point which is dominated by willows, including Osier (*Salix viminalis*), Grey Willow (*S. cinerea*) and Purple Willow (*S. purpurea*), and occasional Alder and Ash. The understorey includes Honeysuckle (*Lonicera periclymenum*), Bramble (*Rubus fruticosus* agg.), Meadowsweet, Wild Carrot (*Daucus carota*) and Fool's-water-cress. The woodland corresponds to the Annex I priority habitat 'alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)'.

An area of 'alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*)' also occurs along the Ahacronane River immediately upstream of the proposed crossing point. The Lower River Shannon SAC is located c. 500m downstream of the crossing point. The proposed alignment has been modified during the design to avoid this habitat. The woodland canopy is dominated by willows (*Salix* spp.), Ash, Hawthorn and Hazel, while the ground flora includes many aquatic or marginal aquatic species such as Water-cress, Dropwort (*Oenanthe* sp.), Marsh-marigold (*Caltha palustris*), Yellow Iris and Reed Canary-grass. Mosses, including Pointed Spear-moss (*Calliergonella cuspidata*), are widespread and in places dominant along with various ferns and leafy liverworts and Opposite-leaved Golden-saxifrage (*Chrysosplenium oppositifolium*). The alluvial woodland is up to approximately 70m at its widest after which the land rises and it changes to oak-ash-hazel woodland (WN2) with an associated dry herb community.

The Conservation Objective for this Qualifying Interest is to restore the favourable conservation condition of the habitat in the Lower River Shannon SAC. The potential impacts of the proposed road development on this habitat is now assessed in view of

the following key parameters reflected in the attributes and targets of the Conservation Objectives:

- Habitat area and distribution;
- Woodland size and structure;
- Hydrological regime (flooding depth/height of water table);
- Vegetation composition (non-native species and negative indicator species);

Habitat Area and Distribution

The location of the alluvial woodland on the River Maigue is outside of the proposed footprint of the bridge over the river including the required construction zone. There will therefore be no reduction in the area of this habitat in the Lower River Shannon SAC or any change in the distribution of this habitat type in the SAC as a result of the proposed road development. The alluvial woodland at the Ahacronane River is also outside of the footprint of the proposed construction works at that location.

Woodland Size and Structure

Due to the separation between the proposed River Maigue Bridge location and the alluvial woodland, there is no potential for effects on woodland size and structure. The Office of Public Works (OPW) undertake periodic vegetation management within the flood embankments of the river, which includes cutting back of establishing woody vegetation. There will be no change in woodland size or structure at the Ahacronane River.

Hydrological Regime

The proposed River Maigue Bridge will not give rise to alteration of the hydrological regime of the river as the bridge is a clear-span structure. There will be no change in the existing hydrological regime and, therefore, no adverse effect on this habitat type. The crossing of the Ahacronane River will not affect the hydrology or flood regime of the alluvial woodland at that site.

Vegetation Composition

The potential adverse effects of the proposed River Maigue Bridge and Ahacronane River crossings on the vegetation structure and composition of the Alluvial forests is confined to a potential risk of negatively affecting water quality during construction and operation and facilitating the spread of invasive alien species of plant during construction. These potential impacts require specific measures to mitigate effects. Mitigation measures with respect to invasive alien species are detailed within Section 5.2 of this NIS and the Invasive Species Management Chapter of the Environmental Operating Plan (see Appendix C).

Conclusion

In the absence of appropriate mitigation, the construction of the proposed River Maigue Bridge has the potential to adversely affect the Conservation Objectives for Alluvial Forests in the Lower River Shannon SAC through impacts on water quality and the risk of spread of invasive alien plant species, which may affect the vegetation composition of this Qualifying Interest. At the Ahacronane River, the woodland is upstream of the proposed crossing point and not at risk from effects on water quality but at risk from the spread of invasive alien species during construction. Therefore, mitigation is required to avoid these potential adverse effects. There will be no adverse effects on this habitat during the operational phase.

4.1.3 River Lamprey (*Lampetra fluviatilis*) [1099] and Atlantic Salmon (*Salmo salar*) [1106]

The migratory fish species listed as Qualifying Interests of the Lower River Shannon SAC and potentially adversely affected by the proposed road development are River Lamprey and Atlantic Salmon. There are no published reports of Sea lamprey from the River Maigue (Harrington, 2017). The Conservation Objectives for Atlantic Salmon is to restore the favourable conservation condition of Salmon in the Lower River Shannon SAC, while for River Lamprey it is to maintain their favourable conservation condition within the SAC. Salmon are not recorded from any of the other watercourses crossed by the proposed road development and are apparently unable to move upstream of the weir at Askeaton on the River Deel. While there are no records of lamprey from any other watercourses along the length of the route, it is possible that Brook Lamprey are present in some rivers and streams.

The Atlantic Salmon is an anadromous species, i.e. the adult life stage is marine, with mature fish returning to their natal freshwater streams to spawn. Adults can begin their spawning migration at any time of year, but there are two main migration periods: fish who have spent one winter at sea, known as “grilse”, ascend rivers in late winter, while fish who have spent more than one winter at sea, known as “multi-sea-winter (MSW)” (or “spring” salmon, if they enter fresh water before 1st June), generally enter rivers earlier in the year. Movement of spawning salmon upstream through the estuary is predominantly nocturnal and usually occurs on the ebb tide (Smith & Smith, 1997). Once spawning has occurred, most adults die, though as many as 36% may survive and return to sea as kelts (Hendry & Cragg-Hine, 2003). Only 3-6% survive to spawn in subsequent years (Mills, 1989; Hubley *et al.*, 2008).

The eggs hatch in spring and the young, known as “alevins”, remain within the gravel interstices until the yolk-sac is depleted, which takes a number of weeks, at which point they rise to the surface and begin their free-swimming phase. At this point the juvenile fish are known as “fry”. At the end of their first summer these fish develop parr marks on their sides and are thereafter known as “parr”. Juveniles spend 2-4 years in fresh waters (Hendry & Cragg-Hine, 2003), normally undergoing smoltification (a series of physiological changes or metamorphosis which prepares the young salmon for life in the marine environment) and migrating to sea in the spring (April-June) of their third year (King *et al.*, 2011). Out-migrating smolts are predominantly nocturnal (Moore *et al.*, 1995). However, they become increasingly active during daylight hours with increasing water temperatures (Thorpe *et al.*, 1994; Ibbotson *et al.*, 2006, 2011; Haraldstad *et al.*, 2017). Smolts do not require a period of acclimation to saline conditions and so tend not to delay in the estuary, preferring to move directly to sea (Moore *et al.*, 1995).

Lamprey have been recorded by Inland Fisheries Ireland (IFI) in the 2013 Fish Population Index survey mainly in the upper parts of the Maigue catchment, though the species does not appear to have been differentiated. Brook lamprey and River lamprey are difficult to distinguish from each other and their classification as separate species has been questioned (Schreiber & Englehorn, 1998). On account of the lack of lamprey recorded in the lower catchment, it is possible that the species present is the Brook Lamprey. Igoe *et al.* (2004) highlight the possibility “that the river lamprey is an anadromous form of the brook lamprey”. All lamprey species are semelparous (Maitland, 2003), i.e. adults undergo a single spawning event and then die.

Mature river lamprey, having spent one to two years mainly in estuaries, stop feeding in the autumn and move upstream into medium to large rivers, usually migrating into fresh water from October to December (Maitland, 2003), though this may extend into

the spawning season in spring (King *et al.*, 2008). Upstream migration is almost exclusively nocturnal (Maitland, 2003; Andrade *et al.*, 2007; Quintella *et al.*, 2009; Vrieze *et al.*, 2011). Spawning starts when the water temperature reaches 10-11°C, usually in March and April (Morris & Maitland 1987). The spawning grounds are areas of small stones and gravel in flowing water. Following hatching of the ova, Lamprey larvae, known as “ammocoetes”, burrow into fine sediments at the bottom of fresh waters and live as filter-feeders. Metamorphosis occurs after c. 3-5 years in River Lamprey (Maitland, 2003). The downstream migration of recently metamorphosed lampreys, known as “macrophthalmia”, is not well-studied, but Moser *et al.* (2014) suggested that newly metamorphosed River Lamprey “begin their downstream migration over an extended period from late winter to early summer”. Downstream migration by River Lamprey is predominantly nocturnal (Maitland, 2003; Potter, 1980; Lucas & Bracken, 2010; Silva *et al.*, 2013; Moser *et al.*, 2014; Dawson *et al.*, 2015).

The potential impacts of the proposed road development on these species is now assessed in view of the following key parameters reflected in the attributes and targets of the Conservation Objectives:

- Anadromy and barriers to migration;
- Noise and vibration during construction at river crossings;
- Artificial lighting and shade;
- Water quality.

Anadromy and Barriers to Migration

The presence of the Ardnacrusha and Parteen Dams on the Lower River Shannon are the principle reason that salmon are failing to achieve favourable conservation status within the SAC. While the River Maigue has numerous weirs along its length, many of which were established to fish for salmon, they represent a passable barrier in periods of high flow when adult fish are likely to move upstream from the estuarine reaches to spawning grounds. The numbers of spawning salmon have declined markedly in the Maigue in recent years. Consequently, the Maigue system has been closed to salmon angling since 2006 under the Wild Salmon and Sea Trout Tagging Scheme regulations administered by IFI (Harrington, 2017).

Weirs are likely to prove a more significant barrier to the upstream movement of river lamprey which do not have the capacity to leap vertical barriers as do salmon and rely on their sucker mouth to aid in ascending weirs or other man-made barriers (Maitland, 2003). They have been recorded moving upstream against flow velocities of 1.75m/s (Russon & Kemp, 2011) while the larger Sea Lamprey have been reported achieving speeds in excess of 4m/s for short periods (Hoover & Murphy, 2018).

The proposed bridge over the River Maigue and all other watercourse crossings will not, however, alter existing flow regimes in any way nor otherwise result in any barrier or impediment to upstream or downstream migration of salmon or lamprey species during either construction or operation.

Noise and Vibration during Construction at River Crossings

The main element of the proposed road development to present a risk of significant noise and vibration impacts on migratory fish species are piling operations during construction, including the driving of the temporary sheet piling wall for the temporary deck supports. These piles are being driven along the top of the riverbank at the high-water mark which will limit the propagation of sound and there will be no in-stream activity of any kind. Piles will also be driven as part of the pier foundation which will be located in the middle of the existing flood embankments. Pile driving activity for

river bridges will be confined to limited periods during the construction phase and conducted entirely during the daylight working hours.

The effects of noise on fish species include, in order of increasing severity: behavioural change, auditory tissue damage, which can be temporary, i.e. temporary threshold shift (TTS), or permanent, i.e. permanent threshold shift (PTS), non-auditory tissue damage and death. Effects vary greatly between individuals of different sizes or life stages, with smaller/younger individuals being more vulnerable to injury and death, and between different species, i.e. between species classed as “hearing generalists”, e.g. salmonids, and those classed as “hearing specialists”, e.g. clupeids, including the shads. The effects of noise on a wide range of fish species have not been studied extensively and so any predictive assessment of such noise impacts on fish must rely on extrapolations from what studies have been carried out and thereafter apply the Precautionary Principle when making any necessary assumptions.

As the up-estuary section of the migration of adult Atlantic Salmon is predominantly nocturnal, the vast majority of individuals will migrate past the bridge location during the hours of darkness, i.e. while works are suspended each night. During the winter, works may impede the salmon spawning migration during the first and last 1-2 hours of darkness, but not during the middle 12 hours. Therefore, piling noise is not likely to create a significant barrier to the spawning migration. Any adult salmon which may be present within the affected area during pile driving are considered likely to move out of range to avoid discomfort prior to any risk of injury. Owing to the large body mass of adult salmon and the fact that they are hearing generalists, individuals are considered to be significantly less vulnerable to injury from sound than other fish species.

Similarly, any out-migrating kelts are likely to migrate at night and are not considered to be particularly vulnerable to injury/death from noise impacts. In addition, these fish are likely to spend only a very short time in the estuary, instead migrating directly from the river to the sea. Furthermore, as such a small portion of kelts contribute to future spawning, any such effects will be imperceptible at the population scale. Therefore, any effects of piling activities on these individuals are both unlikely and insignificant.

Smolts are likely to pass through the construction area in significant numbers on their migration from the river to the sea in the period from March to May, inclusive. As with adult salmon, smolts migrate mostly at night, outside of the period when pile driving would be carried out. Any individuals which may be present within the affected area are likely to escape to avoid injury/death and continue their migration when works cease at night. As with kelts, smolts do not tend to delay in the estuary, preferring to migrate directly to sea. Therefore, owing to the predominantly nocturnal migration of smolts and the timing of the construction works, piling noise during construction is not likely to give rise to any significant barrier to out-migrating Atlantic Salmon smolts.

Upstream and downstream migration of River Lamprey is almost entirely nocturnal so that in the event they do occur, movement through the works area would primarily take place outside of the hours in which construction works would occur.

In summary, owing to the confinement of working hours primarily to daylight hours and the nocturnal migration patterns observed in both salmon and lamprey, noise and vibration impacts arising from the construction of the proposed River Mague Bridge are not likely to interfere with the migration of either River Lamprey or Atlantic Salmon through the construction area. There are no other watercourses crossed by the proposed road development that support migrations of salmon or lamprey.

Artificial Lighting and Shade

Construction

Inappropriate lighting during construction can cause disturbance to or form a barrier to connectivity for nocturnal species. Specifically, light spill onto the water during hours of darkness may cause migrating River Lamprey and Atlantic Salmon to avoid the area in the vicinity of the bridge, effectively preventing these species from moving past the construction area. Temporary lighting associated with the construction of the proposed road development will not be permitted at the river crossings so as not to affect the movements, particularly the spawning migrations, of these River Lamprey and Atlantic Salmon in the Maigue Estuary. There are no other watercourses crossed by the proposed road development that support migrations of salmon or lamprey.

Operation

Inappropriate lighting designs or regimes can cause disturbance to connectivity or form a barrier for nocturnal species. In the case of the proposed River Maigue and River Deel Bridges, lighting will not be provided.

Water Quality

There are no suitable spawning habitats for lamprey or salmon within the vicinity of the proposed River Maigue Bridge and no pathways for impacts from the proposed road development to such habitats. Juvenile habitat for both lamprey ammocoetes and salmon alevin, fry and parr is confined to freshwater habitat also. The proposed road development will not have any effect on the distribution, quantity or quality of spawning habitats for either species at any watercourse crossing locations.

Water quality impacts likely to arise from the construction of the proposed River Maigue Bridge are detailed in 5.1.1 above. While impacts would be of short duration and restricted extent, they could result in a reduction in water quality in the estuarine reaches of the river and will require mitigation. As River Lamprey reside within the estuary during their adult lives, they may be susceptible to reduced water quality indirectly as a result of reduced prey availability. Atlantic Salmon, however, spend only a short time in the estuary (during migrations) and generally do not feed there, so would not be as vulnerable to water quality impacts. On other watercourses, effects on spawning habitat for salmonids or lamprey species could result from pollution or siltation arising during construction without mitigation.

Conclusion

In the absence of appropriate mitigation, the construction of the proposed River Maigue Bridge is considered to have the potential to adversely affect the Conservation Objective for River Lamprey in the Lower River Shannon SAC through reduced water quality indirectly as a result of reduced prey availability. On other watercourses, effects on spawning habitat for salmonids or lamprey species could also result from pollution or siltation arising during construction without mitigation.

Noise and vibration impacts arising from construction activities, particularly pile driving are considered unlikely to give rise to any effect, significant or otherwise, on the movement of either River Lamprey or Atlantic Salmon upstream or downstream as the movement of these anadromous species occurs at night.

4.1.4 European Otter (*Lutra lutra*) [1355]

The Conservation Objective for European Otter in the Lower River Shannon SAC is to restore the favourable conservation condition of European Otter in the Lower River Shannon SAC. The potential impacts of the proposed road development on this

species is now assessed in view of the following key parameters reflected in the attributes and targets of the Conservation Objectives:

- Distribution, habitats and breeding and resting places;
- Barriers to connectivity;
- Disturbance;
- Prey availability.

Distribution, habitats and breeding and resting places

European Otter is recorded from more than 20 of the 1km x 1km squares within the study area (NBDC Database) and is likely to occur on all watercourses crossed by the proposed road development. Signs of otter activity (primarily in the form of spraints) were recorded from the Ahacronane, Deel, Greanagh, Clonshire and Maigne rivers during the current surveys. Given the distribution of lakes and fens within the study area, there is also a high potential for periodic movement of otters between these features which may be along drainage ditches but also potentially across open country.

No evidence of any otter holt or couch site was recorded in the vicinity of any of the proposed watercourse crossing points along the length of the proposed road development.

Barriers to connectivity

The proposed road development presents a risk of interruption to the movement of otters along watercourses and of mortality through traffic collision where animals attempt to cross the carriageway. Periodic mortality could result in the localised extinction of the species over time. To address this risk, all watercourse crossings along the proposed road development will accommodate mammal movement with associated guide fencing to prevent access to the carriageway. All the larger watercourses will be crossed with clear span structures retaining the existing channel and river banks intact which will allow for unimpeded otter movement (as detailed in Table 7.11 of the EIAR Biodiversity Chapter, appended to this NIS as Appendix B). Smaller watercourses that will be culverted will have either mammal ledges or adjoining mammal culverts (as detailed in Tables 7.12 a to d of Appendix B) which will allow for the continued movement of otter (and other mammals) across the landscape thereby reducing the fragmentation effect of the proposed road development.

Temporary restrictions in the movement of otter along watercourses may occur during construction works, but will be confined to working hours only. Unimpeded access by animals will be accommodated in the construction site fencing and given the primarily nocturnal activity of the otter, there will be no barrier to their movement across the site. The impact on movement will be confined to the construction stage and is therefore a temporary effect.

Minor watercourses will be realigned to provide shorter crossings in culverts (in accordance with details in Section 7.5.3.1 of Appendix B). The localised loss of habitat associated with culverting stretches of minor watercourses will not result in any substantial reduction in foraging area for otters. Culvert design avoids impacting on flow regimes and allows for unimpeded movement of fish by ensuring a minimum depth of water within the structure. New sections of channel developed to connect the existing channel will incorporate sinuosity and varied flow regimes to replicate a natural river system in both plan and profile, with appropriate landscaping to recreate riparian habitats.

Disturbance

European Otter is generally considered to be a nocturnal or crepuscular species, i.e. individuals are predominantly active at night, with peaks in activity shortly after dusk and just before dawn (Chanin, 2003; Garcia de Leaniz, 2006). Therefore, apart from at their breeding and resting sites, otters are not considered to be sensitive to noise and light impacts during daylight hours. Furthermore, the occurrence of otters in towns and cities suggests that this species is able to habituate to human activities.

Both noise/vibration and light arising from construction activities, especially pile driving and floodlighting, have the potential to cause disturbance to otters, leading to reduced connectivity between areas upstream and downstream of the watercourse crossings for the duration of the construction phase. Again, given the nocturnal or crepuscular nature of this species, the significance of any effects resulting from noise and lighting impacts depends on the daily programming and total duration of the construction activities and lighting of the construction area. While construction activities will be primarily confined to daylight hours, in winter this will extend in to dawn and dusk periods. The proposed crossing point of the River Maigue Bridge in the Lower River Shannon SAC is expected to have a longer construction period than other crossings due to the scale of the structure.

Mitigation is required to ensure that noise/vibration and lighting during the construction of the various watercourse crossings will not lead to significant effects in terms of barriers to connectivity for otters. This will entail limitations in the timing of pile driving activities and avoiding light spill from flood lighting for construction during winter months. Continued movement of otters will also need to be accommodated along the river banks during the construction phase. Subject to mitigation, this is considered to represent a short term and localised effect on otters which will not alter territorial occupancy.

During its operation, watercourse crossings along the proposed road development are not expected to result in any significant disturbance to otters or other fauna utilising the waterbodies. Noise and lighting impacts of road usage are within the limits of other road developments around the country where continued occupation by otters has been unaffected by development. Otter have shown high levels of habituation in many cities and urban environments where noise and light levels are far more elevated such as Limerick, Cork and Galway.

Prey Availability

Fish species, particularly salmonids and eels, form the majority of the diet of European Otter in Ireland (Chanin, 2003; Bailey & Rochford, 2006; Reid *et al.*, 2013). The diet of otters is, however, highly adaptable and varies considerably between habitats (Reid *et al.*, 2013). The diets of otters in both freshwater and coastal habitats have been studied extensively (Chanin, 2003). Salmonids, eels and White-clawed Crayfish (*Austropotamobius pallipes*) are important prey items in freshwater habitats while a variety of species including Shore Crab (*Carcinus maenas*) are taken in estuarine habitats, depending on availability.

The effects of the proposed road development on water quality during both construction and operation in relation to Atlantic Salmon and River Lamprey is assessed in Section 4.1.3 above and is pertinent for other aquatic species that may be preyed upon by otters. A reduction in water quality during construction has the potential to result in a reduction in prey availability and could have significant effects on otters. It can be concluded that mitigation is, therefore, required to prevent any adverse effect on prey availability for Otter.

Conclusion

In the absence of appropriate mitigation, the proposed road development has the potential to delay the restoration of the favourable conservation condition of European Otter, i.e. delay the achievement of the Conservation Objective for this Qualifying Interest, in the Lower River Shannon SAC, primarily through deterioration in water quality during construction affecting fish biomass available to otters as food. In addition, mitigation is required to ensure that noise/vibration during the construction of the various watercourse crossings will not lead to significant effects in terms of barriers to connectivity for European Otter.

The operation of the proposed road development will not be expected to result in any adverse effects on the movement or behaviour of otters.

Mitigation measures prescribed for the protection of the Lower River Shannon SAC are detailed in Section 5.2 of this NIS to mitigate the potential adverse effects identified above.

4.2 River Shannon and River Fergus Estuaries SPA

4.2.1 Whooper Swan (*Cygnus cygnus*) [A038]

The River Shannon and River Fergus Estuaries SPA supports an assemblage of over 20,000 wintering waterbirds which includes Whooper Swan. A wintering flock size of 118 birds is reported in the site synopsis. The Whooper Swan is listed on Annex I to the Birds Directive and is also an Amber-listed species of conservation concern by BirdWatch Ireland. Whooper swans frequently forage on improved agricultural grasslands which are outside of the designated area network. The status of the wintering population within the Shannon Estuary have been monitored since the early 1990s by the Irish Whooper Swan Study Group (IWSSG).

The conservation objective for the SPA is to maintain the favourable conservation condition of Whooper Swan in the SPA. The potential impacts of the proposed road development on this species is now assessed in view of the following key parameters reflected in the attributes and targets of the Conservation Objectives:

- Population trend and distribution.

Population Trend and Distribution

A background review of existing data on wintering birds was undertaken to identify known foraging areas for waterfowl including Whooper Swan, and to identify potential flight paths intersected by the proposed road development. Additional sites of potential value for wintering birds were also identified during earlier walkover surveys and review of aerial imagery in the vicinity of the proposed road development. A series of winter counts from known foraging sites in the vicinity of the proposed road development was undertaken by Gerry Murphy (Chairperson of the IWSSG) over the period December 2016 to March 2017. The sites were surveyed from vantage points at a total of 33 separate locations.

The maximum number of Swans recorded was 106 birds on 13th January 2017 at Mungret. A maximum of 19 birds were recorded at Cloonanna during the survey in February 2017. A flock of 17 Whooper Swan were also recorded to the west of the proposed road development along the River Deel callows at Ardnanean (R338384), c. 5km from the western limit of the proposed road development. This site was utilised in both January and February 2017 by a flock of 17 birds, while a flock of 15 swans were recorded at Ardbohill (R342392) in March 2017, c. 3 km from the western limit of

the proposed road development. This flock is considered a sub-unit of the Mungret flock and will probably use the Deel River as a corridor to connect to the River Shannon and other foraging areas. They occasionally use Doohyle Lough as a night-time roost, which is c. 800m north of the proposed road development at Blossomhill. There was no evidence of foraging elsewhere along the River Deel during the surveys undertaken and there are no records of Whooper Swans from the vicinity of the proposed River Deel crossing at Bullaun.

The nearest known swan foraging sites to the proposed development are at Cooperhill, Newtown, Carrig West and Cloonanna, the latter site (R485507) being the closest at c. 3 km from the proposed road development. Birds utilising these sites tend to move north to the confluence of the Maigue and Shannon Rivers as there are no known foraging areas to the south. These sites are considered to be well beyond any potential for disturbance during either construction or operation. While the flock utilising the Ardnanean callows may use the River Deel as a flyway connecting to the River Shannon and other foraging areas, the proposed road development would not impact on the use of this flyway, foraging areas or distribution of this Annex I-listed species as a result of the proposed road development.

4.2.2 Wetlands and Waterbirds [A999]

The River Shannon and River Fergus estuaries form the largest estuarine complex in Ireland and is the most important coastal wetland site in the country. The site comprises the entire estuarine habitat from Limerick City westwards as far as Doonaha in County Clare and Dooneen Point in County Kerry and regularly supports in excess of 50,000 wintering waterfowl (57,133 - five year mean for the period 1995/96 to 1999/2000), a concentration easily of international importance.

The site has vast expanses of intertidal flats which contain a diverse macro-invertebrate community which provides a rich food resource for the wintering birds. Salt marsh vegetation frequently fringes the mudflats, and this provides important high tide roost areas for the wintering birds. Elsewhere in the site the shoreline comprises stony or shingle beaches.

The site is an SPA under the Birds Directive, of special conservation interest for a range of species: Cormorant, Whooper Swan, Light-bellied Brent Goose, Shelduck, Wigeon, Teal, Pintail, Shoveler, Scaup, Ringed Plover, Golden Plover, Grey Plover, Lapwing, Knot, Dunlin, Black-tailed Godwit, Bar-tailed Godwit, Curlew, Redshank, Greenshank and Black-headed Gull. The Birds Directive pays particular attention to wetlands and, as these form part of this SPA, the site and its associated waterbirds are of special conservation interest for Wetland and Waterbirds.

The conservation objective for Wetlands within the SPA is to maintain the favourable conservation condition of the wetland habitat in the River Shannon and River Fergus Estuaries SPA as a resource for the regularly occurring migratory waterbirds that utilise it. The wetland habitat area was estimated as 32,261ha using OSI data and relevant orthophotographs (NPWS, 2012). The potential impacts of the proposed road development on wetland habitats within the SPA is now assessed in view of the following key parameters reflected in the attributes and targets of the Conservation Objectives:

- Habitat area and distribution;
- Water quality.

Habitat area and distribution

The proposed road development does not cross or impact directly on the River Shannon and River Estuaries SPA at any location. The nearest part of the site to the road development is at Sroolane North where the SPA boundary extends to include the Churchfield (Robertstown) Estuary c. 150m to the west of the road (see Plate 5.1). The Churchfield Estuary forms two separate lobes, with the western lobe being the outfall of the Robertstown Stream while the eastern lobe is the outflow of the Ahacronane River.

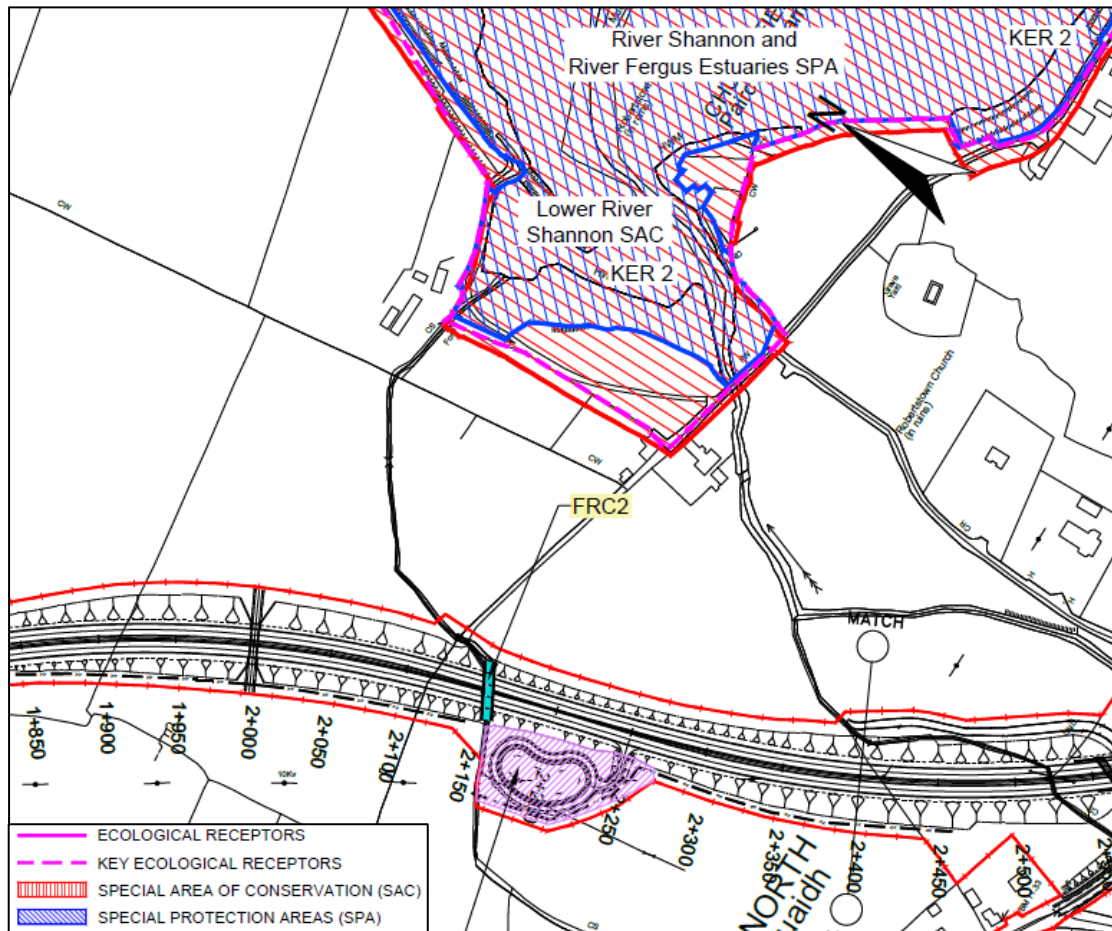


Plate 5.1. Proposed road alignment relative to Churchfield Estuary.

Significant populations of wintering water-birds use the Churchfield Estuary which is also part of the Lower River Shannon SAC. This area was surveyed monthly over the period November 2015 to March 2017 (spanning two winter seasons) as part of the EIAR prepared for the development of Shannon-Foynes Port (Capacity Extension at Shannon Foynes EIAR: Chapter 7 – Biodiversity). Peak numbers of birds were recorded in December 2016 and January 2017 with a maximum of 2,150 birds of a variety of species recorded in December 2016.

The most abundant species were Golden Plover, Dunlin, Lapwing, Wigeon, Teal and Black-headed Gull. A minor peak in activity was recorded in October 2016 during the migration period when migrant birds pass through the area, while summer numbers ranged from just over 100 birds to none.

The construction works in the vicinity of Churchfield Estuary presents a risk of giving rise to disturbance to wintering water-birds and resulting in a deterioration in water

quality due to its proximity to the proposed road. Construction activities would be limited at most to two winter seasons, and any disturbance would only be expected to occur over a limited length of the proposed road development, considered to be less than 1km at maximum. There is no evidence of roosting occurring in the western part of the estuary so potential disturbance impacts would be confined to foraging by birds. Due to the topography of the estuary and the screening afforded by treelines and hedgerows between the proposed road and the estuary, disturbance of birds would at worst, only be likely to result in a localised displacement in the extreme western end of the estuary, which forms only a small fraction of the total area of foraging habitat available. This potential impact on wintering birds is considered to be a temporary and localised impact which will not significantly affect the various waterbirds of conservation interest utilising the Churchfield Estuary. No specific mitigation is therefore considered necessary at this location.

The Institute of Estuarine and Coastal Studies (IECS) (Cutts *et al.*, 2009) showed that birds were found in general, to accept a wide range of steady state noise level from 55dB(A), up to 85dB(A), therefore complete exclusion within up to 250m was considered very unlikely. Evidence presented by Cutts *et al.* (2009) from repair work to a pipeline in the Humber Estuary has shown that disturbed birds (within 100m) are likely to return within a short time once disturbance ceases, potentially within 30 minutes, and with no evidence of effects on numbers during surveys the following week, emphasising the short-term nature of any impacts.

Small numbers of wintering water-birds also occur along the Mague Estuary (in the vicinity of the proposed bridge) though this is c. 8km from the SPA. The limited extent of intertidal habitat in this area limits the value of this area to birds and no significant effects of disturbance are likely at this location.

Water Quality

Water quality impacts likely to arise from the construction and operation of the proposed road development are detailed in Section 4.1.1 above. The crossing points of the Robertstown Stream and Ahacronane River by the proposed road development are both less than 0.5 km from the River Shannon and River Fergus Estuaries SPA at Churchfield Estuary, while the River Mague crossing is c. 8km from the SPA. However, all watercourses crossed by the proposed road development drain to the River Shannon estuary. The risk of effects on water quality during construction of the proposed road development would be of a limited duration over a period of approximately two years, while the risks during operation would be ongoing as pollutants from road run-off reaches watercourses leading to deterioration in water quality. The greatest risk to water quality that would affect waterbirds as a result of construction activity would be associated with hydrocarbons or other pollutants which could result in direct effects on birds' health or indirect effects on prey availability. Siltation would not present a significant risk to estuarine water quality in view of the typically high turbidity and silt levels associated with this habitat.

To avoid any risk to water quality within watercourses and within the estuarine reaches of the rivers during construction and operation, specific mitigation measures will be required.

Conclusion

The potential impact of construction activities on wintering birds in the vicinity of the River Shannon and River Fergus Estuaries SPA at Churchfield Estuary is considered to be a temporary and localised impact which will not significantly affect the various waterbirds of conservation interest utilising the estuary. Due to the topography of the

estuary, disturbance of birds would at worst, only be likely to result in localised displacement in the extreme western end of the estuary, which forms only a small fraction of the total area of foraging habitat available. Therefore, no specific mitigation is considered necessary at this location.

To avoid any risk to water quality within the River Shannon and River Fergus Estuaries SPA (into which all watercourses crossed by the proposed road development drain) during the construction and operational phases, specific mitigation measures will be required.

4.3 Curraghchase Woods SAC

4.3.1 Lesser Horseshoe Bat (*Rhinolophus hipposideros*) [1303]

While all bat species in Ireland are listed on Annex IV to the Habitats Directive, the Lesser Horseshoe Bat is the only resident bat species listed on Annex II. This species is a Qualifying Interest of the Curraghchase Woods SAC, which is both a hibernation and breeding site for the bat. The bats hibernate in the cellars of the former mansion Curraghchase House. The entrance to the cellar is now grilled and all other access points blocked to prevent disturbance. In recent years bats have remained within the cellar throughout the year.

The Conservation Objective for the SAC is to restore the favourable conservation condition of Lesser Horseshoe Bat in Curraghchase Woods SAC. The potential impacts of the proposed road development on this species is now assessed in view of the following key parameters reflected in the attributes and targets of the Conservation Objectives:

- Population and condition of roosts;
- Extent of foraging habitat and connectivity;
- Light pollution.

Population and condition of roosts

The route of the proposed road development was selected to avoid any proximity to the Curraghchase Woods SAC during the Route Selection Stage. The proposed road is c. 3 km south of the SAC at its nearest point, at Croagh. There was no confirmed Lesser Horseshoe Bat roost found within any of the buildings inspected immediately adjacent to the proposed road development during the surveys undertaken.

There is not considered to be any potential for any direct impacts on the Lesser Horseshoe Bat roosts at the Curraghchase Woods SAC as a result of the proposed road development. However, as bats commute and forage through the landscape and Lesser Horseshoe Bat tend to have a commuting radius of 2.5 km from the roosts (Schofield, 2008), linear commuting routes may be directly impacted by the proposed road development. Therefore, appropriate measures will be required to mitigate against this impact and, thereby, prevent any adverse effect.

Extent of foraging habitat and connectivity

Lesser Horseshoe Bats normally forage in woodlands/scrub within 2.5 km of their roosts (Schofield, 2008). Thus, the SAC can be considered outside of the zone of impact from the proposed road development. However, during surveys undertaken for the proposed road development, Lesser Horseshoe Bats were recorded along much of the length of the proposed road development on static recording units. It is considered therefore, that there is a potential for the proposed development to interfere

with the movement of Lesser Horseshoe Bats across the wider landscape, which could have long term implications for the Curraghchase Woods SAC due to genetic isolation of the population of bats. Compared to other regions on the west coast of Ireland where this species is found, the number of individuals and roosts in County Limerick is considered to be low, and therefore vulnerable. Roche *et al.*, (2014) reports that the knowledge of roosting sites for this species is extensive due to intensive survey completed for the six key range counties by the Vincent Wildlife Trust (VWT) in the 1990s.

One of the principal issues for Lesser Horseshoe Bats commuting in the landscape is the need for continuous linear habitats to fly along. The Irish Landscape Model (Roche *et al.*, 2014) indicated that the Lesser Horseshoe Bat habitat preference is for areas with broadleaf and mixed woodland and that a mosaic of habitats is important. The species roosting preference is for buildings constructed prior to the 1900s, built of stone with slate roofs (Schofield, 2008), while hibernation sites in Ireland are typically found underground or located in the basements or ground storey rooms of buildings.

The VWT has prepared a map documenting the potentially important flight paths for this species through the Limerick landscape linking the Curraghchase SAC to the south of the County. This has been overlaid with the proposed road development in Plate 5.2 below, and identifies where the proposed road development may intersect bat flightpaths.

As the Limerick Lesser Horseshoe Bat population is suffering from isolation, it is considered extremely important to ensure that the proposed road development does not result in a barrier to their movement. Mitigation measures are included to avoid these impacts in Section 5.4 and in Appendix D.

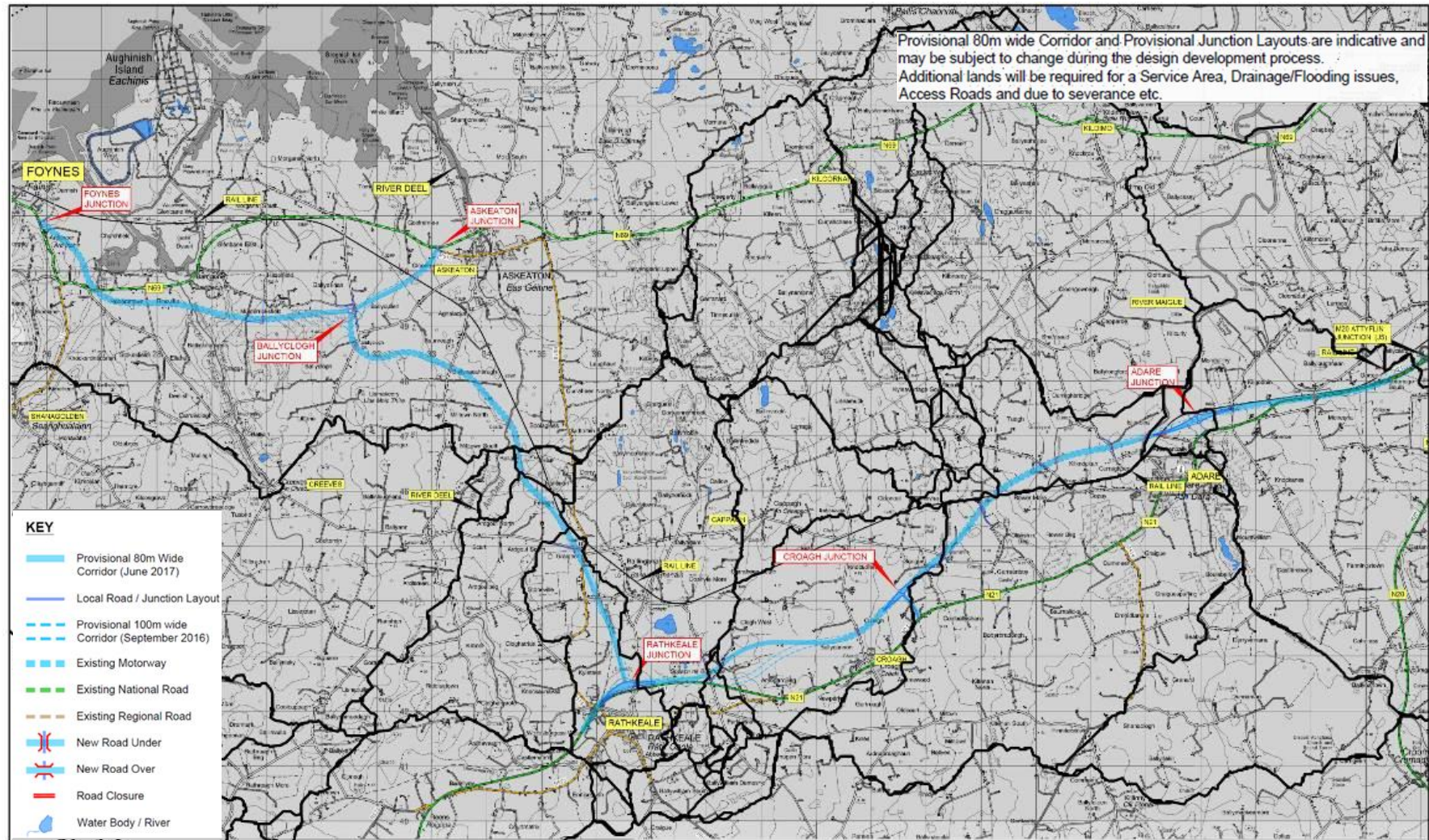


Plate 5.2 The proposed road development (in blue) showing overlay of potential Lesser Horseshoe Bat flight paths reported by the VWT (black).

Light pollution

Road lighting along the proposed road development will be very limited and will be confined to where roundabout junctions are provided at several locations, mainly near towns and villages. While bats tend to rely on echolocation for orientation and hunting during the hours of darkness, vision is still an important sense for bats. Lesser horseshoe bat regularly light sample before leaving the roost to feed at night-time. Light sampling is where the bat flies in and out of the exit point to determine the light levels. The bat will not fully leave the roost until the light levels are low enough for it to leave the roost safely. This process of light sampling emphasises the need to strictly control lighting being used around bat roosts. Delayed emergence can occur as a result of lighting and this can impact on the bats by reducing the time available for feeding.

Where there is too much luminance, bats' vision can be reduced resulting in disorientation. While light sensitivity varies between species, bats tend to have a higher tolerance for red visual light than white light. Short wave frequency (UV) light is most disturbing for bats. This is due to the fact that bats have a higher proportion of rods in their retina compared to cones. The rods allow greater absorption of light in dim conditions.

Lighting at bat roosts may cause bats to desert a roost or delay bats from emerging and thereby reduce feeding periods. As many night flying insects are attracted to lights especially those lamps that emit UV light, a single source of light in a dark area can cause local insect populations to congregate around the light source. The majority of Irish bat species including the Lesser horseshoe bat, are too sensitive to such light sources and may suffer from insect populations being reduced in traditional feeding areas. Lighting can be particularly harmful to bat populations along river corridors, woodland edges, along hedgerows and treelines and at lake edges.

This potential impact is avoided in the proposed road development by the very limited locations where road lighting will be provided which are remote from bat roosts and flightpaths.

Conclusion

There is considered not to be any potential for any direct or indirect impact on the Lesser Horseshoe Bat roosts at the Curraghchase Woods SAC as a result of the proposed road development.

To prevent the proposed road development acting as a barrier to the movement of Lesser Horseshoe Bats, dedicated passage facilities will be provided with appropriate landscaping to maintain habitat connectivity (which are described in Section 5.4 and in Appendix D).

4.4 Askeaton Fen Complex SAC

4.4.1 Annex I Habitats

The Askeaton Fen Complex SAC is designated for two separate Annex I listed habitats, namely *Calcareous fens with Cladium mariscus and species of the Caricion davallianae* [7210] (which is a priority Annex I habitat) and *Alkaline fens* [7230]. Calcareous fens are often dominated by saw sedge (*Cladium mariscus*) and occur in a variety of situations including fens found in valleys or depressions, floodplains, overgrown-ditches, extensive wet meadows, within tall reed beds, on the landward side of lakeshore communities, calcium-rich flush areas in blanket bogs, dune slack areas, fens adjacent to raised and blanket bogs, in turloughs, wet hollows in machair and

often in association with alkaline fen. The key ecological requirements are a high water table, a calcareous, low nutrient water supply and minimal water level fluctuation. Alkaline fens are typically calcareous basin or flush fen systems with extensive areas of species-rich small sedge communities. These fen systems are often a complex mosaic of habitats, with co-occurring tall sedge beds, reedbeds, wet grasslands, springs and open water. This habitat requires a high water table, a calcareous, low nutrient water supply and minimal water level fluctuation. Low intensity mowing and/or grazing is also very important for maintaining species richness.

The Askeaton Fen Complex includes a number of individual sites scattered to the north and south of the N69 between Askeaton and Kildimo. The fens occur in basins between undulating hills of Limestone in an otherwise intensive agricultural landscape. The isolated areas of fen habitat are interlinked by a groundwater fed system and there is therefore also a potential for hydrological connectivity with other wetland habitats along or in the vicinity of the proposed road development.

The conservation objective for the SAC is to maintain the favourable conservation condition of Calcareous fens and Alkaline fens in the SAC. The potential impacts of the proposed road development on these habitats is now assessed in view of the following key parameters reflected in the attributes and targets of the Conservation Objectives:

- Habitat area and distribution;
- Hydrological regime;
- Vegetation composition;
- Water quality.

Hydrological Regime

The Askeaton Fen Complex has been a focus of the design of the proposed road development since Route Selection Stage, with the preferred route option avoiding both individual elements of the SAC as well as potential effects on the hydrology between sites forming the Askeaton Fen Complex SAC. In addition, the vertical alignment of the proposed road development has been designed to be in fill for the majority of its length so as to avoid impacts on the groundwater regime through cutting. While the proposed road development avoids all elements of the Askeaton Fen Complex SAC, sections of cut along the proposed road have the potential to impact the level of the groundwater table in the surrounding area as well as to cause a deterioration in aquifer water quality, with potential consequences for groundwater dependent habitats. Typically, the impact increases:

- With increased depth of road cutting below groundwater table;
- With increased permeability of the soil and/or bedrock strata between the road cutting and groundwater feature;
- With increased lateral continuity and uniformity in soil and/or bedrock strata between the road cutting and groundwater feature; and,
- In the absence of any hydrogeological boundaries such as watercourses, between the road cutting and water supply well or groundwater feature.

The nearest part of the Askeaton Fen Complex SAC to the proposed road development is at Ballymorrisheen where it passes c. 0.5km to the west of the fen.

Road cuttings will increase the vulnerability of the underlying aquifer to pollution through either a complete loss of overburden where cuttings are into the bedrock or by reducing the protective overburden depth and thus increasing the vulnerability for

contaminated road drainage if not transmitted in a sealed drainage system to infiltrate to and potentially contaminate the groundwater.

Extensive road cuttings can, if not mitigated, significantly increase the runoff volume to be conveyed within the road drainage system and the volume to be ultimately discharged to receiving waters at road drainage outfalls. This can have an adverse effect on the receiving waters in terms of chemistry and water balance. Groundwater quality can be indirectly impacted if drainage systems are not adequately designed and maintained, to ensure conveyance of potentially contaminated surface run-off through these areas in sealed drains/channels where fissured/weathered bedrock is exposed and the aquifer is a regionally important karst bedrock aquifer.

Cut sections can also impact potential groundwater recharge and cause dewatering of the intercepted aquifer, as well as intercepting and truncating high yielding groundwater flows within the karst aquifer.

A portion of the proposed road development has a response of R4 as per the Groundwater Protection Response Matrix for the Use of Permeable Drains in Road Schemes (TII DN-DNG-03065) which is derived from the groundwater vulnerability rating and the resource protection area (aquifer category), indicating that the use of permeable road drainage systems is Not Acceptable. In this regard, where the proposed road development crosses areas of extreme (and high) aquifer vulnerability and where rock is at or close to the ground surface (i.e. all areas in which the overburden cover is less than 5m) a sealed drainage system will be provided so that infiltration to groundwater via the linear drainage system does not occur. This sealed system will also be used adjacent to sensitive ecological wetland areas.

An assessment of the potential impacts of the proposed road development was carried out whereby the water balance of the fen was examined including all surface outflows and likely zones of groundwater seepage. Each of the sections of the proposed road and their potential interactions with this SAC are described below.

Section A from Foynes to Ballyclogh

Groundwater flow in this section is generally in a northerly direction towards the River Shannon Estuary. Locally groundwater will discharge to springs or streams at changes in topography or in low-lying basins. The River Deel provides a groundwater divide between this section of the proposed road and the Askeaton Fen Complex SAC. There will therefore be no change to the groundwater balance within the SAC.

Section B from Ballyclogh to Askeaton

Groundwater flow in this section is either to the north towards the River Shannon Estuary or to the east towards the River Deel. The Deel again provides a groundwater divide between this section of the proposed road and the SAC. There will therefore be no change to the groundwater balance within the SAC.

Section C from Ballyclogh to Rathkeale

Groundwater flow in this section is generally north-east or north-west towards the River Deel or north towards the Shannon. Locally groundwater will discharge to springs or streams at changes in topography or in low-lying basins. This section of the proposed road is closest to the SAC (0.5km) and therefore has the greatest potential to have some impact. This entire section of the proposed road is either at grade or in slight embankment and therefore cuttings are avoided. Notwithstanding this fact, the water balance of the Fen Complex indicates that this section of the proposed road is actually located down-gradient of the SAC. A number of small watercourses flow out of the fen

complex towards the River Deel and are crossed by the proposed road at Nantinan and Feeagh. The drainage system proposed will be neutral in design and will not change the existing surface water flows. All existing channels will be piped or culverted to maintain existing flow conditions. There will therefore be no change to the groundwater and/or surface water balance within the SAC.

Section D from Rathkeale to Attyflin

This section of the proposed road is located south of a topographical groundwater divide and is within a different groundwater body. There will therefore be no change to the groundwater balance within the SAC.

Given the above, no impact to the SAC will occur during either the construction or operational phase.

Water Quality

The effects of water quality impacts associated with the construction and operation of the proposed road development on habitats is discussed in relation to the Lower River Shannon SAC in Section 4.1 above. In the case of the Askeaton Fen Complex, the types/nature of the water quality impacts which may arise from the proposed road development would be associated with both surface water and ground water quality. In view of the sensitivity of ground water within the study area (rated as a regionally important karst bedrock aquifer) the development has elicited a response of R4 as per the *Groundwater Protection Response Matrix for the Use of Permeable Drains in Road Schemes* (TII DN-DNG-03065) indicating that the use of permeable road drainage systems is *Not Acceptable*. The sealed drainage system to prevent infiltration to groundwater via the linear drainage system will also be used adjacent to sensitive ecological wetland areas identified along the proposed road to avoid any risk to water quality.

The proposed drainage system will also incorporate a range of appropriate pollution control features to limit the water quality impact to receiving waters. These include the use of filter drains, sealed drainage systems and the use of vegetated sediment bays for all attenuation ponds upstream of all drainage outfalls. Further detention storage is provided within the storm attenuation pond system for settlement of suspended pollutants while the vegetated system allows for the take up of nutrients in the drainage water.

Attenuation ponds or wetland treatment areas that are located in hydrogeologically sensitive locations, such as in the vicinity of groundwater-fed ecological receptors or where the groundwater vulnerability rating is *Extreme*, have been assessed regarding their potential impact on the hydrogeological environment. The principal impact arises from poorly constructed ponds where contaminated water would be able to percolate or infiltrate downwards through the pond lining into the underlying aquifer, overflows during sustained heavy rainfall events, or where discharge outfalls into ecologically sensitive surface water features.

Conclusion

The alignment for the proposed road development was selected to avoid potential impacts on the disparate suite of sites that comprise the Askeaton Fen Complex. A series of design measures have been incorporated to avoid any risks to either surface or ground water quality during both the construction and operational phases which may, in an extreme situation, affect the Askeaton Fen Complex SAC.

5. MITIGATION

5.1 Principles and Approach

Section 4.0 of this NIS identified adverse effects likely to arise from the proposed road development on the specific Attributes and Targets which define the Conservation Objectives for a number of Qualifying Interests or Special Conservation Interests of the four European Sites considered at risk of impact. This section prescribes measures to mitigate any adverse effects and details a protocol to ensure their full and proper implementation to ensure the protection of the integrity of these European Sites during both the construction and operation of the proposed road development.

The mitigation measures prescribed in this NIS have been designed according to the principle of a mitigation hierarchy, as outlined in the European Commission's guidance document *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, 2001). According to this hierarchy, the following mitigation approaches were adopted, in order of decreasing preference:

1. Avoiding impacts at their source;
2. Reducing impacts at their source;
3. Abating impacts on site; and,
4. Abating impacts at their receptor.

5.2 Lower River Shannon SAC

5.2.1 Mudflats and sandflats not covered by seawater at low tide [1140] and Water courses of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation [3260]

Invasive Species

A Biosecurity Protocol for the management of invasive species, which has been devised in accordance with best scientific knowledge and current best practice, has been included within the Environmental Operating Plan to detail the specific requirements and overall proposed approach to ensure that invasive species of plant or animal are not imported or spread during construction. The Protocol will also address potentially transmittable diseases, including crayfish plague, on watercourses across the entire development. An outbreak of Crayfish Plague was recorded on the River Deel in 2017 and on the River Maigue in 2019. The highest level of risk is moving equipment that has been used in an affected area to an unaffected catchment. The Crayfish Plague disease organism (a water-mould *Aphanomyces astaci*) is microscopic and invisible to the naked eye and is only viable in water. The Biosecurity Protocol will be developed on the presumption that any equipment which becomes wet and has been used in an affected catchment will be contaminated and is, therefore, at risk of spreading the disease to new sites. The EOP will be updated prior to construction by the Contractor and adherence to the Biosecurity Protocol will be enforced by the Ecological Clerk of Works.

Water Quality

Construction Phase

A suite of specific measures will be implemented during the construction phase to ensure the protection of water quality within the Lower River Shannon SAC at the River Maigue crossing point, but also on all watercourses which all drain to the Shannon Estuary and, thus, to the SAC. An Environmental Operating Plan (EOP) has been prepared, which contains a Construction Erosion and Sediment Control section, setting

out measures to ensure protection of watercourses from siltation and site run-off during the proposed works. The measures prescribed below detail the minimum requirements with regard to protection of water quality within the SAC:

Sedimentation and surface water run-off

- In order to attenuate flows and minimise sediment input into the watercourses from site run-off, all surface water run-off from the construction site shall be directed to attenuation facilities, where the flow rate will be attenuated and sediment allowed to settle out, before passing through a hydrocarbon interceptor and being discharged to the existing watercourse network. Ponds are provided at all outfalls and these will be constructed at the outset to protect the watercourses during construction as well as operation phases. Suspended solids in any runoff (either direct or via field drains) into any watercourse from the construction area, machinery access routes or any other source will not exceed 25mg/l.
- In the vicinity of the River Maigue crossing of the SAC, the site boundary will be defined at the outset of construction using rigid timber or equivalent robust fencing. Within this site boundary fence, earth bunds will be constructed to contain surface water run-off and channel it to the temporary attenuation facilities.
- All top-soil in the construction zone for the River Maigue bridge works within the SAC (i.e. between the sheet piling wall and the toe of the flood embankments) will be stripped and stored (in windrows no greater than 2m in height) on the landward side of the flood embankment for subsequent reinstatement post works.
- The Contractor will provide method statements for weather and tide/storm surge forecasting and continuous monitoring of water levels in the River Maigue and the removal of site materials, fuels, tools, vehicles and persons from flood zones as required in any flood events.

Cementitious materials

- The measures prescribed with regard to sedimentation and surface water run-off will also minimise the risk of any input of cementitious material into the SAC from the landside elements of the construction.
- All shuttering for concrete pours will be securely installed and inspected for leaks prior to cement being poured and all pouring operations will be supervised and monitored for spills and leaks at all times.
- In order to eliminate any remaining risk of input of cementitious material into the SAC from the bridge construction, all pouring of concrete, sealing of joints, application of water-proofing paint or protective systems, curing agents etc. for outfalls will be completed in dry weather.
- Where concrete or other wet materials are to be used, banded steel decks will be used to capture any spilled concrete, alkaline water displaced from inside tubular steel piles or spilled sealants or other materials.
- Any such materials collected on these platforms will be transferred to the landside construction areas and disposed of in accordance with the Construction and Demolition Waste Management Plan.

Hydrocarbons and other chemicals

- The measures prescribed with regard to surface water run-off will also minimise the risk of any input of hydrocarbons and other chemicals into the SAC from the landside elements of the construction.
- Vehicles and plant will be refuelled at a minimum of 10m from any watercourse.
- Standing plant and machinery will be placed on drip-trays adequately sized and securely positioned.
- All fuel, oils, chemicals, hydraulic fluids, on-site toilets etc. will be stored in the construction site compound, on an impervious base which will be bunded to 110% capacity and appropriately secured.
- All plant and construction vehicles will be inspected daily for oil leaks and a full service record shall be kept for all plant and machinery.
- Spill kits will be available on site during construction.

Any construction-phase water quality impacts remaining following the inclusion of the above mitigation measures are considered to be slight to imperceptible and the risk of such impacts occurring is negligible. The mitigation measures that will be implemented will ensure that the construction of the proposed road development will not adversely affect the integrity of intertidal mudflats or watercourses in the Lower River Shannon SAC, in view of their Conservation Objectives.

Operational Phase

The design of the drainage for the proposed road development adequately addresses all concerns in relation to water quality as a result of the operation of the road. The drainage design entails the collection of all road surface water run-off which will be directed through attenuation ponds. These ponds will function as spill-containment facilities and will also settle out particulate matter and allow for entrapment of pollutants. Hydrocarbon interceptors are proposed where the drainage from the ponds will discharge directly to a large or sensitive watercourse including the River Maigue, the River Deel, and both the Ahacronane River and Robertstown Stream which discharge into the Churchfield Estuary.

5.2.2 River Lamprey (*Lampetra fluviatilis*) [1099] and Atlantic Salmon (*Salmo salar*) [1106]

Lighting

Neither temporary nor permanent lighting will be provided at the Maigue Bridge and there will be no impact on the movements of these nocturnal species.

Water Quality

The mitigation measures detailed in Section 5.2.1 above will equally address risks to migratory fish species during either construction or operation. In-stream works on all watercourses will be undertaken during the period 1st July to 30th September to avoid the salmonid spawning season.

5.2.3 European Otter (*Lutra lutra*) [1355]

Barriers to Movement

The proposed road development poses a barrier to the movement of otters at all watercourse crossings with a risk of resultant mortality through traffic collision where animals attempt to cross the carriageway. To address this risk, all watercourse crossings along the proposed road development will accommodate mammal movement with associated guide fencing to prevent access to the carriageway. All the

larger watercourses will be crossed with clear span structures retaining the existing channel and river banks intact which will allow for unimpeded otter movement (as detailed in Table 7.11 of Appendix B of this NIS). Smaller watercourses that will be culverted will have either mammal ledges or adjoining mammal culverts, (as detailed in Tables 7.12a-d of Appendix B) which will allow for the continued movement of otters (and other mammals) across the landscape thereby reducing the fragmentation effect of the proposed road development.

Water Quality

Water quality impacts have the potential to indirectly affect otters through a reduction in prey biomass (primarily fish). The mitigation measures relating to water quality detailed in Section 5.2.1 (and those relating to lighting detailed in Section 5.2.2) will prevent any significant reduction in fish biomass during either the construction or operation of the proposed road development.

Noise and Vibration

There is potential for disturbance to otters from noise and vibration during the construction phase. To minimise this risk, the following limitations in the timing of pile driving activities will be adhered to for bridge construction activities for the River Maigue. Continued movement of otters will also need be accommodated along the river banks during the construction phase.

- All pile driving shall be restricted to Monday to Friday, inclusive, i.e. there shall be no pile driving on Saturdays or Sundays.
- All pile driving shall be restricted to between 8:00 am and 6:00 pm.
- A soft-start/ramp-up procedure shall apply to the first pile being driven.
- If there is a break of more than 90 minutes, a soft-start/ramp-up procedure shall apply.
- All of the above shall be supervised by an Ecological Clerk of Works appointed by the Contractor.

Conclusion

With the implementation of the mitigation measures identified above, any residual impacts associated with the proposed road development will not adversely affect the European Otter or the integrity of the Lower River Shannon SAC, in view of its Conservation Objectives.

5.3 River Shannon and River Fergus Estuaries SPA

5.3.1 Wetlands and Waterbirds [A999]

Disturbance

The potential impact of construction activities on wintering birds in the vicinity of the River Shannon and River Fergus Estuaries SPA at Churchfield Estuary is considered to be a temporary and localised impact which will not affect the various waterbirds of conservation interest utilising the estuary. Due to the topography of the estuary, disturbance of birds would only be likely to result in a localised displacement in the extreme western end of the estuary, which forms only a small fraction of the total area of foraging habitat available. Therefore, no specific mitigation is necessary in relation to disturbance.

Water Quality

The measures detailed in Section 5.2.1 above will mitigate risks to water quality within the SPA and any consequent effects on wetlands and waterbirds in the SPA during both the construction and operation of the proposed road development.

5.4 Curraghchase Woods SAC

Habitat and connectivity

There is potential for interference to the movement of bats between the SAC and other roosts in the wider landscape. To prevent the proposed road development acting as a barrier to the movement of Lesser Horseshoe Bat, dedicated passage facilities will be provided at locations identified as being potentially important flight paths for this species through the landscape, linking the Curraghchase Woods SAC to the south of the County. Fifteen locations have been identified for specific Lesser Horseshoe Bat movement while a further nineteen locations have been identified where generic bat movement will be accommodated in underpasses, culverts or bridges. See Appendix D Four-Season Bat Report for details of the mitigation measures to be included in the proposed road development.

Where bat movement is being accommodated through underpasses and at river bridges in various locations across the proposed road development, appropriate landscaping will be undertaken to develop scrub and woodland habitat to link with existing hedgerows or treelines for habitat connectivity.

With the implementation of the mitigation measures identified above, any residual impacts associated with the proposed road development will not adversely affect the Lesser Horseshoe Bat or the integrity of the Curraghchase SAC, in view of its Conservation Objectives.

5.5 Askeaton Fen Complex SAC

5.5.1 Annex I Habitats

Mitigation by design has been incorporated through the Route Selection Stage of the proposed road development. The alignment for the proposed road development was selected to avoid potential impacts on the disparate suite of sites that comprise the Askeaton Fen Complex SAC.

Water Quality

Construction

Prior to the commencement of construction works, clean run-off water from lands adjacent to and up gradient of the works area will be diverted to local watercourses through the installation of cut-off ditches. Soiled construction site run-off will undergo treatment before discharge by being passed through a settlement pond (either temporary or permanent pond system). The treated water may be discharged to a surface water body or, depending on the subsoil conditions, to ground so as to maintain the existing recharge conditions. Further details on the protection of groundwater from pollution during construction are given in the CЕСP section of the EOP (in Appendix C to this NIS).

The main construction compound will be located at Rathkeale and remote from key hydrogeologically sensitive areas and features (watercourses, wetland habitats etc.). Minor construction compounds are necessary at the proposed river bridges where there will be protective measures adopted as set out in the CЕСP section of the EOP in order to manage any spillages of pollutant materials. Locations and details for

protective measures are included in the Environmental Operating Plan as included in Appendix C.

5.6 Implementation of Mitigation

This NIS has set out mitigation measures which will ensure that the proposed road development will not, by itself or in combination with other plans or projects, adversely affect the integrity of any European Sites. These mitigation measures will be included in the contract documents for the construction of the proposed road development.

Water Quality Monitoring

Monitoring of water quality will be undertaken in the River Maigue, with samples taken monthly for at least 6 months prior to commencement, weekly for the entire duration of construction and monthly for at least 24 months post-completion. The parameters which shall be monitored, include but are not limited to:

- Suspended solids and turbidity;
- Total hydrocarbons;
- Ammonia, nitrates, nitrites and total nitrogen;
- Phosphates and total phosphorus;
- Dissolved oxygen and biological oxygen demand; and,
- Temperature and salinity.

Samples shall be taken from at least two different locations, including at least one location upstream of the proposed road development and one downstream of the proposed road development. Given the strong tidal influence at the location of the proposed road development, the date and exact time at which each sample is taken, as well as the direction of flow, must be recorded in order to ensure that comparative analysis of samples can control for tidal influence, as well as other variables, e.g. fluvial conditions.

The results of the water quality monitoring programme will be reviewed by the Site Environmental Manager and Ecological Clerk of Works on an ongoing basis during construction.

Record of habitats within the Lower River Shannon SAC at the Maigue crossing

In order to record any changes in the riparian habitats within the flood embankments along the River Maigue in the vicinity of the proposed road development, a photographic record will be made of these habitats. This record will cover both sides of the river between the site boundaries upstream and downstream of the proposed bridge location. All photographs will be taken at low tide, every two months, beginning 6 months prior to commencement of construction and finishing 12 months after completion.

During construction, all works will comply with relevant legislation and guidelines in order to reduce and minimise environmental impacts and to protect the integrity of the Lower River Shannon SAC, the River Shannon and River Fergus SPA, the Curraghchase Woods SAC and the Askeaton Fen Complex SAC and all other ecological receptors. In particular, there will be full compliance with the following:

- The Schedule of Commitments.

- The mitigation prescribed in Section 5 of this NIS, Chapter 7 (Biodiversity) of the EIAR (as per Appendix B of this NIS) and Chapters 9 (Hydrogeology) and 10 (Hydrology) of the EIAR (as per Appendices E and F of this NIS).
- Any conditions which might be attached to the proposed development's planning consent.
- Any requirements of stakeholders and statutory bodies, e.g. the NPWS and IFI, including:
 - *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters* (IFI, 2016).
- All applicable legislative requirements in relation to environmental protection.
- All relevant construction industry guidelines, including:
 - *C532 Control of water pollution from construction sites: guidance for consultants and Contractors* (CIRIA, 2001); and
 - *C648 Control of water pollution from linear construction projects: technical guidance*. (CIRIA, 2006).
- The Biosecurity Protocol developed for the construction phase of the proposed road development.
- The Transport Infrastructure Ireland (TII) Environmental Assessment and Construction Guidelines, specifically:
 - *Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes*.
 - *Guidelines for the Treatment of Bats during the Construction of National Road Schemes*.
 - *Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes*.
 - *Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes*.
 - *Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes*.
 - *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes*.
 - *Guidelines on the Management of Noxious Weeds and Non-native Plant Species on National Roads*.
 - *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*.
 - *Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes*.
 - *Management of Waste from National Road Construction Projects*.
 - *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan*.

This list is non-exhaustive. All environmental commitments/requirements and relevant legislation and guidelines which are current at the time of construction will be followed.

5.6.1 Site Environmental Manager

To ensure the successful development, implementation and maintenance of the EOP, the Contractor will appoint an independent Site Environmental Manager (SEM). He/she must possess training, experience and knowledge appropriate to the role,

including a National Framework of Qualifications (NFQ) Level 8 qualification (or equivalent) or other acceptable qualification in environmental science, environmental management, hydrology or engineering. The principal functions of the SEM will be to ensure that the mitigation prescribed in this NIS, the EIAR and the Environmental Operating Plan (EOP) is fully and properly implemented and to monitor the construction stage from an environmental perspective. The SEM will also provide independently verifiable audit reports.

Separate from the on-going and detailed monitoring carried out by the Contractor as part of the EOP, the SEM will carry out the inspection and monitoring described below on behalf of client. The results will be stored in the SEM's monitoring file and will be available for inspection or audit by Limerick City and County Council (LCCC), the National Parks and Wildlife Service (NPWS) and / or Inland Fisheries Ireland (IFI).

- Daily reporting on weather and flood forecasting and daily reporting on the monitoring of water levels in the River Maigue.
- Weekly inspections of the principal control measures described in the EOP and reporting of findings to the Contractor.
- Daily inspections of surface water treatment measures and all outfalls to watercourses.
- Daily visual inspections of watercourses to which there are discharges from the works and those in the vicinity of construction works.
- Weekly inspections of wheel-wash facilities.
- Daily monitoring of any stockpiles.
- Auditing at least six times per quarter of the Contractor's EOP monitoring results.

5.6.2 Ecological Clerk of Works

In order to ensure the successful development and implementation of the EOP, the Contractor will appoint an independent Ecological Clerk of Works (ECoW). The ECoW must possess training, experience and knowledge appropriate to the role, including:

- An NFQ Level 8 qualification or equivalent or other acceptable qualification in ecology or environmental biology; and,
- Demonstrable experience in the protection of European Sites.

The principal functions of the ECoW are:

- To provide ecological supervision of the construction of the proposed road development and thereby ensure the full and proper implementation of the mitigation prescribed in this NIS and in Chapter 7 (Biodiversity) of the EIAR;
- To regularly review the outcome of the specialist hydroacoustic monitoring and, on that basis, make any necessary adjustments to the mitigation; and,
- To carry out weekly inspections and reporting on the implementation of the Contractor's Biosecurity Protocol.

During the preparation of the Contractor's EOP, the SEM may, as appropriate, assign other duties and responsibilities to the ECoW. In exercising his/her functions, the ECoW will be required to keep a monitoring file and this will be made available for inspection or audit by LCCC, the NPWS or IFI at any time.

6. RESIDUAL EFFECTS

6.1 Annex I Habitats

The implementation of the mitigation measures in Section 5.2 to 5.6 above will ensure that there will be no loss of any Annex I habitats within the Lower River Shannon SAC, the River Shannon and River Fergus SPA, Askeaton Fen Complex SAC or the Curraghchase SAC.

The potential for impacts on water quality in all watercourses along the length of the proposed road development arising from both the construction and operation of the proposed road development have been assessed and a suite of measures detailed to adequately avoid or minimise any risks.

In view of the occurrence of crayfish plague within the River Maigue and the presence of invasive alien species of plant at the Maigue and the Deel, a strict Biosecurity Protocol will be enforced by the ECoW to ensure that the risk of transfer is effectively managed during construction.

The suite of measures detailed 5.5.1 above will prevent any risk of either temporary or permanent deterioration in water quality within any fen or wetland habitats either within the Askeaton Fen Complex SAC or in any other non-designated sites which could result in any alteration of the groundwater hydrology.

Therefore, with the full and proper implementation of the mitigation prescribed in this NIS, it can be concluded beyond all reasonable scientific doubt that construction and operation of the proposed road development will not adversely affect the integrity of any European Site in view of its Conservation Objectives including the Lower River Shannon SAC, in view of its Conservation Objectives for Watercourse of plain to montane levels with the *Ranunculus fluitantis* and *Callitriche-Batrachion* vegetation, Mudflats and sandflats not covered by seawater at low tide, or Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (Alno-Padion, Alnion incanae, Salicion albae).

Neither will the proposed road development adversely affect the integrity of the Askeaton Fen Complex SAC, in view of its Conservation Objectives for Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* or Alkaline fens.

6.2 Annex II Species

The mitigation prescribed in respect of water quality impacts and invasive species will provide for the protection of any protected aquatic species including otter, salmon and lamprey present within the likely zone of impact of the proposed road development. The facilitation of otter passages on all watercourse crossings in tandem with fencing to prevent access to the road will avoid any impact on movement or habitat continuity.

Dedicated passage facilities with appropriate landscaping to maintain habitat connectivity will prevent the proposed road development acting as a barrier to the movement of Lesser Horseshoe Bats. There will be no loss of any Lesser Horseshoe Bat roosts as a result of the proposed road development. The loss of potential tree roosts for other bat species will be compensated for by the provision of artificial roosts in suitable locations.

Lighting along river crossings and proposed bat passage will be limited to junctions and roundabouts, facilitating the movement or foraging behaviour of Lesser Horseshoe Bat and other bat species.

Therefore, with the full and proper implementation of the mitigation prescribed in this NIS, it can be concluded beyond all reasonable scientific doubt that construction and operation of the proposed road development will not adversely affect the integrity of the Lower River Shannon SAC, in view of its Conservation Objectives for Salmon, Lamprey and Otter, or on the Curraghchase SAC in view of its Conservation Objectives for Lesser Horseshoe Bat.

6.3 Wintering Bird Species

The potential impact of construction activities on wintering birds in the vicinity of the River Shannon and River Fergus Estuaries SPA at Churchfield Estuary is considered to be a temporary and localised impact which will not significantly impact on or affect the various waterbirds of conservation interest utilising the estuary and no specific mitigation is considered necessary at this location.

The inclusion of the mitigation measures in Section 5.3 above to avoid any risk to water quality within the River Shannon and River Fergus Estuaries SPA (into which all watercourses crossed by the proposed road development drain) will ensure there is no deterioration in water quality that might adversely affect any of the various species during either the construction or operational phases.

Therefore, with the full and proper implementation of the mitigation prescribed in this NIS, it can be concluded beyond all reasonable scientific doubt, that construction and operation of the proposed road development will not adversely affect the integrity of any of the bird species listed as special conservation interests for the River Shannon and River Fergus Estuaries SPA, in view of their Conservation Objectives or of the wetland habitat.

7. IN-COMBINATION EFFECTS

7.1 Introduction

Article 6(3) of the Habitats Directive requires that AA be carried out in respect of plans and projects that are likely to have significant effects on European Sites “*either individually or in combination with other plans or projects*”. Therefore, the combined effects of the plan or project under assessment and other past, present or foreseeable future plans or projects must also be examined, analysed and evaluated. This section provides an assessment of the likelihood of significant effects arising from the proposed road development in combination with other plans or projects.

7.2 Methodology

In-combination effects were assessed by examining all proposed and existing plans and projects within 10 km of the proposed road development. There is too much uncertainty associated with development proposals beyond 5 years into the future and this NIS can only be based on data that is readily available.

A search for plans or projects with the potential to adversely affect European Sites in combination with the proposed road development was carried out using the following data sources:

- Limerick City and County Council (Planning and Roads Sections);
- Clare County Council (Planning and Roads Sections);
- An Bord Pleanála website;
- Web search for windfarm developments in County Limerick;
- Web search for major infrastructure developments in Limerick;
- Limerick County Development Plan 2010-2016 (as extended and amended);
- Relevant Local Area Plans;
- National Planning Framework;
- Inland Fisheries Ireland (IFI) website; and,
- Coillte website.

In addition, a number of small-scale developments (including dwelling houses and extensions), which are not detailed individually, were identified from the wider area surrounding the proposed road development.

Section 6.3 below lists the plans and projects identified in this search and assesses the risk of adverse effects on European Sites arising from those plans and projects in combination with the proposed road development. This assessment was undertaken in view of the Conservation Objectives of the relevant European Sites.

7.3 Assessment of In-combination Effects

Shannon-Foynes Port Expansion

The Shannon-Foynes Port Company was granted permission in December 2018 for Port Expansion works to include: an area of 0.51 ha for quay/jetty development and 33.95 ha undeveloped land at Durnish to the east for port related storage and ancillary Activities (**ABP Ref: 301561-18**).

Modifications to the existing jetties and quays are to include: connection of the existing West Quay to the existing East Jetty for the purpose of extending the length of the existing quay to facilitate the mooring of vessels and Port related operations.

Phased Expansion of the Port Estate on 33.95 ha of land immediately adjacent to the east of the existing port estate to provide serviced industrial land, and, to accommodate marine related industry, port centric logistics and associated infrastructure that will be provided in accordance with a development framework programme prepared for the overall 'expansion' area and which is lodged with the planning application.

The development includes:

- (I) Site development and infrastructure works to the entire expansion lands on a phased basis including:
 - (a) raising of ground levels with fill material to a typical height of +4.44 mOD Malin;
 - (b) provision of all associated services including storm water infrastructure and modification to the existing OPW drainage attenuation system;
 - (c) provision of 2.4 m high perimeter fencing,
 - (d) landscaping berms and treatments, and
 - (e) all associated site development works; all to be delivered on a phased basis; and
- (II) Implementation and use of 'Phase 1' of port expansion works including:
 - (a) modification and realignment to part of the existing port estate access road including provision of new roundabout and junction arrangements on that road, and associated lighting, and storm water drainage;
 - (b) provision of new internal Port access road (with associated footpath and combined cycle path) including the provision of bridge structures to facilitate access across existing drainage channels;
 - (c) construction of three covered industrial type warehouse units (with typical maximum ridge height of 15.1 m above raised ground level) with associated external storage, parking and circulation areas;
 - (d) the provision of separate dedicated uncovered 'open' storage area/ container storage area and associated circulation and service area (with maximum container stacking height of 8 m if/when container storage required);
 - (e) provision of foul water treatment system with polishing filter and discharge to ground to serve the Phase 1a expansion area;
 - (f) modifications to existing 'Foynes Engineering' industrial building which involves the removal of the 'lean-to' structure affixed to the main building and remedial building and site development works;
 - (g) provision of an ESB electrical substation;
 - (h) provision of lighting columns within the 'Phase 1' expansion area;
 - (i) provision of a new security kiosk and access control barrier on the existing Port access road;
 - (j) provision of noise attenuation measures along parts of the southern and western boundary of 'Phase 1' expansion area;
 - (k) provision of a 'bus-stop' on the existing Port access road;
 - (l) landscaping; and

- (m) all associated site development works.

An EIAR and NIS were submitted as part of the application to An Bord Pleanála. At the AA Screening stage, the possibility of likely significant effects could not be ruled out in relation to water quality, habitat deterioration, underwater noise/disturbance, aerial noise/visual disturbance and habitat loss in the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. In the NIS, it was determined that any aerial noise/visual disturbance and habitat loss arising from the project were of such a low magnitude that they did not constitute adverse effects on the European Sites concerned. Mitigation was proposed in relation to water quality, habitat deterioration and underwater noise/disturbance impacts such that they no longer constituted adverse effects.

Given the low magnitude of the residual effects of the proposed road development in terms of aerial noise/visual disturbance in the Shannon Estuary and that the proposed road development does not provide for any loss of estuarine habitat, it will not give rise to such adverse effects in combination with the Shannon-Foynes Port Expansion. Similarly, given the mitigation prescribed in terms of water quality/habitat deterioration in relation to the Shannon-Foynes Port Expansion and the absence of underwater noise/disturbance arising from the proposed road development, there is no potential for such adverse effects arising from the combination of these projects.

Limerick County Development Plan 2010-2016 (as varied) (as extended)

The Limerick County Development Plan 2010-2016 (as varied) (as extended) includes transport and development objectives to ensure that the transportation, infrastructure, natural and energy resources shall be developed in a sustainable and efficient manner. Variation No. 6 was adopted as part of the Plan in April 2018, which sees policy support for *“Design, reserve land for and commence construction of a bypass of Adare and N21 Route Improvements from Adare to the County boundary, as resources become available”* and *“Design, reserve land for and commence construction of a new road between the N21 at Rathkeale and the N69 at Foynes as resources become available”*. The environmental and ecological impacts of this variation were assessed in the Strategic Environmental Assessment and AA carried out in respect thereof. Mitigation measures were included in the variation text to ensure that significant impacts would not occur at project level.

The County Development Plan also outlines proposed National Road Improvements, of which the N20 Cork Road is included: *“Design, reserve land and commence construction of the N20 upgrade to Motorway standard, which forms part of the strategic Atlantic Corridor and is included in “Transport 21” from Patrickswell to Charleville in County Limerick.”*

As the Limerick County Development Plan 2010-2016 (as varied) (as extended) is a high-level plan which sets out policies, strategies and objectives, it does not in itself provide for any real-world ecological effects which could combine with those arising from the proposed road development. Furthermore, the proposed road development is consistent with the plan, as varied by Variation No. 6. Therefore, there is no potential for adverse effects on any European Sites arising from the combination of the County Development Plan and the proposed road development.

N/M20 Cork to Limerick Road Improvement Scheme

In 2008, a study was commissioned by Cork County Council to identify a preferred route corridor for an upgraded road between Cork and Limerick, and proposals for the M20 Cork Limerick Motorway Scheme were lodged with An Bord Pleanála in 2010.

The 2010 scheme included a proposed motorway between the existing N20 at Blarney, Cork, and the existing N21 west of Attyflin, Limerick. The M20 Cork Limerick Motorway Scheme was withdrawn from An Bord Pleanála in 2011 due to the economic downturn.

An improved transport network between Cork and Limerick has been identified in the 2018 – 2027 National Development Plan (NDP) as a major enabler for balanced regional development. Since the identification and appraisal of the preferred route for the M20 Cork Limerick Motorway Scheme in 2010, assessment methods for environmental and economic impacts have been updated and these may affect the suitability of any previously selected corridors.

In May 2019, LCCC appointed Technical Advisors to progress the planning and design for the N/M20 Cork to Limerick Road Improvement Scheme. The Technical Advisors have been commissioned to deliver the planning and development of the scheme encompassing Concept and Feasibility, Options Selection, Design and Environmental Evaluation and Statutory Processes.

Given the scale of this project, the fact that it is also a major road infrastructure project and its interconnection to the proposed road development, it is likely that it will provide for similar ecological effects on at least some of the same European Sites the proposed road development. There is, therefore, potential for adverse in-combination effects. However, as no planning application has yet been lodged in respect of this project, an assessment of such effects is not possible and would be premature. During the assessments which will be undertaken in respect of that project, potential adverse effects in combination with the proposed road development will have to be assessed by the relevant competent authority.

Shannon-Foynes Port Company Masterplan – Vision 2041 (2013)

The Shannon-Foynes Port Company's ambition to provide a new deep-water berth (c. 15 m draught) at Foynes and the continued expansion of existing infrastructure at Foynes in order to capitalise on the trend toward larger vessels will all lead to increases in traffic at the port. The Shannon Foynes Annual Report 2016 states continued growth is strongly dependent on good-quality road and rail connection. It also states the implementation of the preferred route for the Foynes to Limerick Road is critical infrastructure required for the development of the Shannon-Foynes Port Company and its hinterland. Provision of improved road access to Shannon-Foynes Port will provide a key support for the growth of the port and associated industries.

The Vision 2041 Masterplan also includes for the reinstatement of the Foynes to Limerick Railway Line. Objectives included in relation to the railway line include:

- *Protection of the permanent way of the existing line should be ensured at a minimum*
- *A programme of maintenance and inspection should be put in place to ensure that the line does not fall into further disrepair*
- *Clarification should be received from IE regarding a definitive reinstatement timeline, so that the line can have a specific re-opening timeline in place in the event of a trigger event becoming likely*

A Strategic Environmental Assessment (SEA) was carried out for the Vision 2041 Masterplan which concluded that potential impacts included increased road traffic and emissions. However, the proposed road development will provide a less congested route for the Shannon-Foynes Port traffic and has taken into account the impact of Heavy Goods Vehicle (HGV) levels and traffic counts projected by Vision 2041 in the

traffic analysis for the proposed road development. The proposed road development will intersect with the Foynes to Limerick Railway Line at three locations, providing overbridges for the proposed road to travel over the railway line, so as to preserve the railway for further development.

As Vision 2041 is a strategic vision for the provision of port infrastructure and services and for their operation on the Shannon Estuary, it does not in itself provide for any real-world ecological effects which could combine with those arising from the proposed road development. Furthermore, in its design, the proposed road development has accounted for the road and rail infrastructure elements of the vision. Therefore, there is no potential for adverse effects on any European Sites arising from the combination of Vision 2041 and the proposed road development.

Bord na Móna

Limerick City and County Council Planning Ref. 15/468 relates to a smokeless and biomass-based solid fuel manufacturing and packaging facility adjacent to existing coal storage and bagging facility, c. 750 m north of the western tie in of the proposed road development and within the industrial lands at Shannon-Foynes Port. The works will include demolition of buildings and storage structures, changes to an existing warehouse building and construction of a new administration block and car park, installation of weighbridges, kiosk, drainage system and construction of storage areas, an electricity substation and other site works.

Permission was granted to Bord na Móna Fuels Ltd in February 2016. An appeal was taken to An Bord Pleanála and Bord na Móna was granted permission in July 2016 with revised conditions (Planning Ref. PL91.246279). The NIS in respect of this project identified potential adverse effects arising from both the construction and operation of the project on the Lower River Shannon SAC and the River Shannon and River Fergus Estuaries SPA. These effects related to pollution of surface waters and disturbance to fauna in the Shannon Estuary. The NIS prescribed mitigation measures to avoid such adverse effects and their implementation is a condition of the planning consent.

Given the mitigation measures which will be implemented in the construction and operation of the Bord na Móna project, the magnitude of any residual impacts will be such that there is no risk of adverse effects in-combination with those of the proposed road development.

Nestlé – Wyeth Nutritionals Ireland Ltd

A number of planning applications have been submitted in the past few years for the site at Tomdeely North, Askeaton, 780 m north of the proposed Askeaton Link tie-in. Planning Ref. 17/617 was granted permission in August 2017 to demolish the existing temporary building and link corridor to the existing production building, relocation of an external fire escape stairs, construction of a one-story staff locker room, an enclosed loading area to the existing warehouse building and minor internal alterations. Also in 2017, permission was granted for the demolition of two existing Oil Tanks and bund wall, and the construction of a two-storey Water Treatment Building and a two-storey Waste Treatment Building in Planning Ref. 17/584.

Two planning applications were also granted in 2016 for the site (Planning Ref. 16/249) comprised permission for construction of two proposed new buildings that will adjoin the existing building, a new entrance lobby and exit lobby onto the existing building and construction of a surface car park to the south of the new pilot plant building to accommodate 9 visitor car parking spaces. Planning Ref. 16/194 granted permission for the construction of a two-storey extension to the existing High-level Warehouse at

ground floor level consisting of a two-storey Intermediate Hopper Room and a single-storey Plant/Equipment Room at its manufacturing facility.

Previous to this, in 2015, Planning Ref. 15/1057 granted permission for a surface car park for 156 parking spaces and site development works include the demolition of two vacant residential dwellings. While Planning Ref. 14/895 granted permission for 5 Air Handling Unit Rooms, 1 Plant Room and 1 Transformer Room including link corridors and equipment platforms, all on the roof of the existing single storey production building at its manufacturing facility. Wyeth Nutritionals are regulated by the Environmental Protection Agency (EPA), Integrated Pollution Control (IPC) Licence No. (P0395-03). The 2018 annual report found that all emissions were within their licensed emission limit values.

Given the nature of these developments and the regulatory controls on the operations at the Wyeth Nutritionals facility, the only risk to European Sites is of temporary water quality impacts during construction. Due to the scale and short duration of these impacts, they will not give rise to adverse effects on any European Sites in combination with the proposed road development.

Great Southern Greenway

An extension to the Great Southern Greenway walking and cycling route was submitted as a Part VIII application (Planning Ref. 17/8002) in 2017. The section from Rathkeale to Ballingarrane along the former Limerick to Kerry line will include development of a c. 3 km section to include the provision of a rolled gravel surface path and all associated drainage, fencing, signage and repair works to structures. As the proposed development crosses over the route of this proposed greenway extension, an underpass will be provided to allow the planned development of the greenway, despite the development of the proposed road development.

Given the nature and scale of this greenway project and its location along a disused railway line, it will not give rise to any effects on European Sites which would have the potential to combine with such effects arising from the proposed road development. Thus, there is no risk of adverse in-combination effects in relation to this project.

Adare Manor Hotel & Golf Resort (Planning Ref. 15/920) Tizzard Holdings

The refurbishment of Adare Manor Hotel and Golf Resort was granted permission in January 2016 for refurbishment and expansion works. Construction was carried out in 2016 and 2017, of which the key elements of the works included a conference / ballroom wing and bedroom wing attached to the hotel extension at the manor, a refurbished golf clubhouse and carriage house, and reorganised support buildings such as a facilities complex and an energy centre, in addition to reorganised car parks and new entrance gates.

An EIS was completed for this development, in which works were stated to have potential to interfere with bat roosts and feeding areas. It was also stated that an ecologist will monitor any such activity and liaise with the NPWS, as required. The potential impacts on bats have been assessed in detail within the EIAR and this NIS prepared for the proposed road development. Due to the distance of the proposed road development from the Adare Manor Hotel, and the suite of mitigation measures proposed as part of the proposed road development, there will be no in-combination effects on Lesser Horseshoe Bat as a result of the two developments.

Irish Cement Ltd

Irish Cement Ltd was granted a 10-year permission for development to allow for the replacement of fossil fuels through the introduction of lower carbon alternative fuels and to allow for the use of alternative raw materials in their Limerick Cement Works. The works included the construction of: a tyre storage area and associated conveyor; a proposed pumpable fluids storage tank; a proposed fine solids dosing building; an alternative raw materials storage building; 3 silos; and a by-pass filter. The works will also include for the demolition of 4 steel and metal clad covered car park bay structures and ancillary works. The application (Planning Ref. 16/345) for the works in Castlemungret, approximately 6.5 km northeast of the eastern tie in at the Attyflin Junction was appealed to An Bord Pleanála in April 2017 and was subsequently granted permission by the Board, with conditions, in April 2018.

Given the distance of 6.5 km between the Irish Cement facility and the proposed road development and regulatory controls on the operations of the facility, the possibility of in-combination effects can be ruled out.

Greenstar Environmental Services Ltd

Greenstar Environmental Services Ltd was granted planning permission in 2014 under Planning Ref. 13/300 to increase the amount of waste accepted annually to their company in Ballykeeffe, Dock Road, Limerick to 130,000 tonnes. The application was accompanied by an EIS and a revision will be required to their EPA IPC License on expansion of capacity. The proposed expansion does not require the construction or provision of any new buildings.

The planning application for the proposed increase in capacity relates to the Greenstar holding on Dock Road, c. 8.2 km north east of the proposed road development. Given this distance of 6.5 km and regulatory controls on the operations of the Greenstar facility, the possibility of in-combination effects can be ruled out.

CPL Fuels Ireland Ltd (Planning Refs. 14/603, 15/818 and 18/491)

CPL Fuels Ireland Ltd (located 1 km north of the proposed Foynes tie-in) were granted planning permission in 2015 for works including the alterations and extension to the existing industrial building, erection of new buildings and hard-core area for processing and storage of solid fuel briquettes and to use the property for the import and export of products through Shannon-Foynes Port. The development includes the construction of two weighbridges, a wastewater treatment system and drainage infrastructure etc. An EIS and NIS were prepared for the application, which found that it would not have any adverse effects on the Lower River Shannon SAC and River Shannon and River Fergus Estuaries SPA alone or in-combination with other Shannon-Foynes Port activities.

Minor amendments were made to this application in 2015 through a further planning application (Planning Ref. 15818). This was granted by the Local Authority in January 2016. The proposed road development will provide improved road infrastructure for companies such as CPL Fuels Ireland for the distribution of their product. Significant negative cumulative impacts are not anticipated as a result of the mitigation measures provided in the EIS and NIS and the conditions attached to the planning permission. Minor amendments to this approved development were granted permission in July 2018, to include additional covered storage area and reduced packaging area, and the relocation of the permitted biomass building to accommodate such.

Given the nature of this project and the mitigation measures prescribed in the NIS in respect thereof, it will not give rise to any effects which might in turn adversely affect European Sites in combination with the proposed road development.

Housing Developments

Permission was granted in 2014 to Nasso Property Holdings Ltd to extend the duration of Planning Ref. 08/1900 for development comprising 28 dwellings of various bed numbers, three blocks comprising apartments and commercial/retail units, a crèche, retirement village of 70 units, and the demolition of two agricultural buildings. Permission is granted until 2nd March 2020 and the site is located at Graigue, Adare, approximately 2 km south of the proposed road development. Given the nature and scale of this project, it will not give rise to any effects which might in turn adversely affect European Sites in combination with the proposed road development.

7.4 Additional Mitigation Measures

Following the assessment of in-combination effects, it is not proposed that any further mitigation measures are necessary at this stage as no adverse in-combination effects were identified, as per Section 6.3 of this NIS.

7.5 Residual In-Combination Effects

Following the assessment of in-combination effects above, it has been found that there will be no residual adverse effects arising from the proposed road development in combination with other plans and projects.

8. CONCLUSION

This NIS has been prepared in accordance with the relevant provisions of the Habitats Directive, the Habitats Regulations and the Planning and Development Act, as well as the relevant case law and current guidance. It has demonstrated that, in the absence of appropriate mitigation, the proposed Foynes to Limerick Road (including Adare Bypass), individually or in combination with other plans or projects, has the potential to adversely affect the integrity of four European Sites, namely the Lower River Shannon SAC, the River Shannon and River Fergus Estuaries SPA, the Curraghchase Woods SAC and the Askeaton Fen Complex SAC, in view of their Conservation Objectives.

This NIS has assessed the effects on these sites, prescribed appropriate mitigation measures to eliminate or minimise such effects and assessed the potential for in-combination effects with other plans or projects. These mitigation measures will ensure that the proposed road development would not, by itself or in combination with other plans or projects, adversely affect the integrity of any of these sites. European Sites. This assessment has been undertaken on the basis of the best scientific knowledge in the field and the Precautionary Principle. No reasonable scientific doubt remains as to the conclusion reached.

It is the recommendation of the authors of this NIS that, when carrying out its Appropriate Assessment, the Competent Authority may determine that, given the full and proper implementation of the mitigation measures prescribed herein, the proposed development will not adversely affect the integrity of any European Site, either individually or in combination with other plans or projects.

9. REFERENCES

Bailey, M. and Rochford, J. (2006) Otter Survey of Ireland 2004/2005. *Irish Wildlife Manuals* 23. National Parks & Wildlife Service, Department of Environment, Heritage and Local Government, Dublin.

Caltrans (2015) *Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish*. July 2015. California Department of Transport, Sacramento.

Chanin, P. (2003) Ecology of the European Otter. *Conserving Natura 2000 Rivers Ecology Series* 10. English Nature, Peterborough.

Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd ed.). The Bat Conservation Trust, London.

Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive). Official Journal of the European Communities, L206/7.

CRFB & DCMNR (2005) *Guidelines on the Construction & Operation of Small-Scale Hydro-Electric Schemes and Fisheries. Consultation Document*. June 2005. Central & Regional Fisheries Boards and the Engineering Division of the Department of Communications, Marine and Natural Resources.

Dawson, H., Quintella, B., Almeida, P., Treble, A. and Jolley, J. (2015) *The Ecology of Larval and Metamorphosing Lampreys*. In: Docker, M. (eds) *Lampreys: Biology, Conservation and Control*. *Fish & Fisheries Series* 37. Springer, Dordrecht.

Deegan, B.M. (2000). *Ecology of Triangular club-rush (Schoenoplectus triqueter) in the Shannon Estuary*. MSc. Thesis University of Limerick

DEHLG (2010) *Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities*. Department of the Environment, Heritage and Local Government, Dublin.

Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds (the Birds Directive). Official Journal of the European Union, L20/7.

EC (2000) *Managing Natura 2000 sites: The Provisions of Article 6 of the Habitats Directive 92/43/EEC*. Environment Directorate-General of the European Commission.

EC (2001) *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*. Environment Directorate-General of the 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 European Commission.

European Communities (Birds and Natural Habitats) Regulations, 2011. *SI No. 477/2011*.

European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2013. *SI No. 499/2013*.

European Communities (Birds and Natural Habitats) (Amendment) Regulations, 2015. *SI No. 355/2015*.

European Commission (2013). *Interpretation manual of European Union Habitats*. Version EUR 28.

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

Foster-Turley, P., Macdonald, S.M. and Mason C.F. (eds.) (1990) *Otters: An Action Plan for their Conservation*. International Union for the Conservation of Nature and Natural Resources (Species Survival Commission) Otter Specialist Group.

Gallagher, T., O'Gorman, N.M., Rooney, S.M., Coughlan, B., and King, J.J. (2016) *National Programme: Habitats Directive and Red Data Book Species Executive Report 2015*. Inland Fisheries Ireland, Dublin.

Gallagher, T., O'Gorman, N.M., Rooney, S.M., Coughlan, B., and King, J.J. (2017) *National Programme: Habitats Directive and Red Data Book Species Summary Report 2016*. Inland Fisheries Ireland, Dublin.

Haraldstad, T., Kroglund, F., Kristensen, T., Jonsson, B. and Haugen, T.O. (2017) Diel migration pattern of Atlantic salmon (*Salmo salar*) and sea trout (*Salmo trutta*) smolts: an assessment of environmental cues. *Ecology of Freshwater Fish* 26(4):541-551.

Hendry, K. and Cragg-Hine, D. (2003) Ecology of the Atlantic Salmon. *Conserving Natura 2000 Rivers Ecology Series* 7. English Nature, Peterborough.

Hoover, J.J. and Murphy, C.E. (2018) *Maximum swim speed of migrating Sea Lamprey (Petromyzon marinus): reanalysis of data from a prior study*. ERDC/TN ANSRP-18-1. Vicksburg, MS: U.S. Army Engineer Research and Development Center.

Hubley, P.B., Amiro, P.G., Gibson, A.J.F., Lacroix, G.L. and Redden, A.M. (2008) Survival and behaviour of migrating Atlantic salmon (*Salmo salar* L.) kelts in river, estuarine, and coastal habitat. *ICES Journal of Marine Science* 65:1626-1634.

Ibbotson, A.T., Beaumont, W. R. C., Pinder, A., Welton, S. and Ladle, M. (2006) Diel migration patterns of Atlantic salmon smolts with particular reference to the absence of crepuscular migration. *Ecology of Freshwater Fish* 15(4):544-551.

Ibbotson, A.T., Beaumont, W.R.C. and Pinder, A.C. (2011) A size-dependent migration strategy in Atlantic salmon smolts: Small smolts favour nocturnal migration. *Environmental Biology of Fishes* 92(2):151-157.

IFI (2012) *National Programme: Habitats Directive and Red Data Book Fish species. Executive Report 2011*. IFI Report Number: IFI/2012/1-4103. Inland Fisheries Ireland, Dublin.

IFI (2013) *National Programme: Habitats Directive and Red Data Book Fish Species. Summary Report 2013*. Inland Fisheries Ireland, Dublin.

IFI (2014) *National Programme: Habitats Directive and Red Data Book Fish Species. Summary Report 2014*. Inland Fisheries Ireland, Dublin.

IFI (2016) *Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters*. Inland Fisheries Ireland, Dublin.

Irish Ramsar Wetlands Committee (2018). *Irish Wetland Types*.

King, J.J. (2007) *Ecological Impact Assessment (EclA) in relation to Atlantic Salmon in Special Areas of Conservation and potential for impact of OPW's channel maintenance work*. Series of Ecological Assessments on Arterial Drainage Maintenance 3. Environment Section, Office of Public Works, Headford.

King, J.J. and Linnane, S.M. (2004) *The status and distribution of lamprey and shad in the Slaney and Munster Blackwater SACs*. Irish Wildlife Manuals 14. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

King, J.J. and Roche, W.K. (2008). *Aspects of anadromous Allis shad (Alosa alosa Linnaeus) and Twaite shad (Alosa fallax Lacépède) biology in four Irish Special Areas of Conservation (SACs): status, spawning indications and implications for conservation designation*. Hydrobiologia 602, 145-154.

King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. & Cassidy, D. (2011). *Ireland Red List No. 5: Amphibians, Reptiles & Freshwater Fish*. National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.

Lindberg, D.E. (2011). *Atlantic salmon (Salmo salar) migration behavior and preferences in smolts, spawners and kelts*. Introductory Research Essay 14. Department of Wildlife, Fish, and Environmental Studies, Swedish University of Agricultural Sciences, Umeå.

Lucas, M. and Bracken, F. (2010). *Potential impacts of hydroelectric power generation on downstream-moving lampreys at Howsham, Yorkshire Derwent*. School of Biological and Biomedical Sciences, Durham University.

Lyons and Kelly (2016). *Monitoring guidelines for the assessment of petrifying springs in Ireland*. Irish Wildlife Manuals, No. 94.

Maitland, P.S. (2003). *Ecology of the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers Ecology Series 5. English Nature, Peterborough.

Mills, D.H. (1989). *Ecology and Management of Atlantic Salmon*. Chapman and Hall, London.

Moore, A., Potter, E.C.E., Milner, N.J. and Bamber, S. (1995). *The migratory behaviour of wild Atlantic salmon (Salmo salar) smolts in the estuary of the River Conwy, North Wales*. Canadian Journal of Fisheries and Aquatic Sciences 52:1923-1935.

Moser, M.L., Jackson, A.D., Lucas, M.C. and Mueller, R.P. (2014). *Behavior and potential threats to survival of migrating lamprey ammocoetes and macrophthalmia*. Reviews in Fish Biology and Fisheries 25(1):103-116.

NBDC (2018). *Biodiversity Maps* <<https://maps.biodiversityireland.ie>> National Biodiversity Data Centre, Waterford.

NPWS (2018). *Conservation Objectives: Curraghchase Woods SAC 000174*. Version 1. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht.

NPWS (2009). *Threat Response Plan: Otter (2009-2011)*. National Parks & Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin.

NPWS (2010). *Circular NPW 1/10 & PSSP 2/10 Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities*. Department of the Environment, Heritage and Local Government, Dublin.

NPWS (2013a). *The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 3. Version 1.0*. National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.

NPWS (2013b). *The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.1*. National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.

NPWS (2018) *Online Map Viewer* <<http://webgis.npws.ie/npwsviewer/>>. Department of Culture, Heritage and the Gaeltacht, Dublin.

TII (2006). *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes*. National Roads Authority, Dublin.

TII (2007). *Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan*. National Roads Authority, Dublin.

TII (2008). *Guidelines for Crossing Watercourses during the Construction of National Road Schemes*. National Roads Authority, Dublin.

TII (2014). *Management of Waste from National Road Construction Projects*. National Roads Authority, Dublin.

O'Neill et al. (2013). *The Irish semi-natural grasslands survey 2007-2012*. Irish Wildlife Manuals, No. 78.

OPW (2006). *The Office of Public Works Ecological Impact Assessment (EcIA) of the Effects of Statutory Arterial Drainage Maintenance Activities on the Otter (Lutra lutra)*. Series of Ecological Assessment on Arterial Drainage Maintenance. Office of Public Works.

People Over Wind and Peter Sweetman v. Coillte Teoranta [2018] C-323/17.

Perrin, P., Martin, J., Barron, S., O'Neill, F., McNutt, K. and Delaney, A. (2008) *National Survey of Native Woodlands. Volume II: Woodland classification*. Report prepared for NPWS.

Planning and Development Act, 2000. No. 30 of 2000.

Planning and Development (Amendment) Act, 2002. No. 32 of 2002.

Planning and Development (Strategic Infrastructure) Act, 2006. No. 27 of 2006.

Planning and Development (Amendment) Act, 2010. No. 30 of 2010.

Potter, I.C. (1980) Ecology of Larval and Metamorphosing Lampreys. *Canadian Journal of Fisheries and Aquatic Sciences* 37(11):1641-1657.

Quintella, B.R., Póvoa, I. and Almeida, P.R. (2009). Swimming behaviour of upriver migrating sea lamprey assessed by electromyogram telemetry. *Journal of Applied Ichthyology* 25(1):46-54.

Reid, N., Hayden, B., Lundy, M.G., Pietravalle, S., McDonald, R.A. and Montgomery, W.I. (2013). *National Otter Survey of Ireland 2010/12*. Irish Wildlife Manuals 76. National Parks & Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin.

Rossmore v. An Bord Pleanála [2014] IEHC 557.

Russon, I.J. and Kemp, P.S. (2011). *Experimental quantification of the swimming performance and behaviour of spawning run river lamprey *Lampetra fluviatilis* and European eel *Anguilla anguilla**. *Journal of Fish Biology* 78:1965-1975.

Silva, S., Servia, M.J., Vieira-Lanero, R. and Cobo, F. (2013). *Downstream migration and hematophagous feeding of newly metamorphosed sea lampreys (*Petromyzon marinus* Linnaeus, 1758)*. *Hydrobiologia* 700:277-286.

Smith, I.P. and Smith, G.W. (1997). *Tidal and diel timing of river entry by adult Atlantic salmon returning to the Aberdeenshire Dee, Scotland*. *Journal of Fish Biology* 50(3):463-474.

Smith, G.F., O'Donoghue, P., O'Hora, K. and Delaney, E. (2011). *Best Practice Guidance for Habitat Survey and Mapping*. The Heritage Council, Kilkenny.

Sweetman & Others v. An Bord Pleanála [2013] C-258/11.

Thorpe, J.E., Metcalfe, N.B and Fraser, N.H.C. (1994). *Temperature dependence of switch between nocturnal and diurnal smolt migration in Atlantic salmon*. In: MacKinlay, D.D. (ed.) *High Performance Fish*. International Fish Physiology Symposium, Vancouver, pp. 83-86.

Vrieze, L.A., Bergstedt, R.A. and Sorensen, P.W. (2011). *Olfactory-mediated stream-finding behavior of migratory adult sea lamprey (*Petromyzon marinus*)*. *Canadian Journal of Fisheries and Aquatic Sciences* 68(3):523-533.