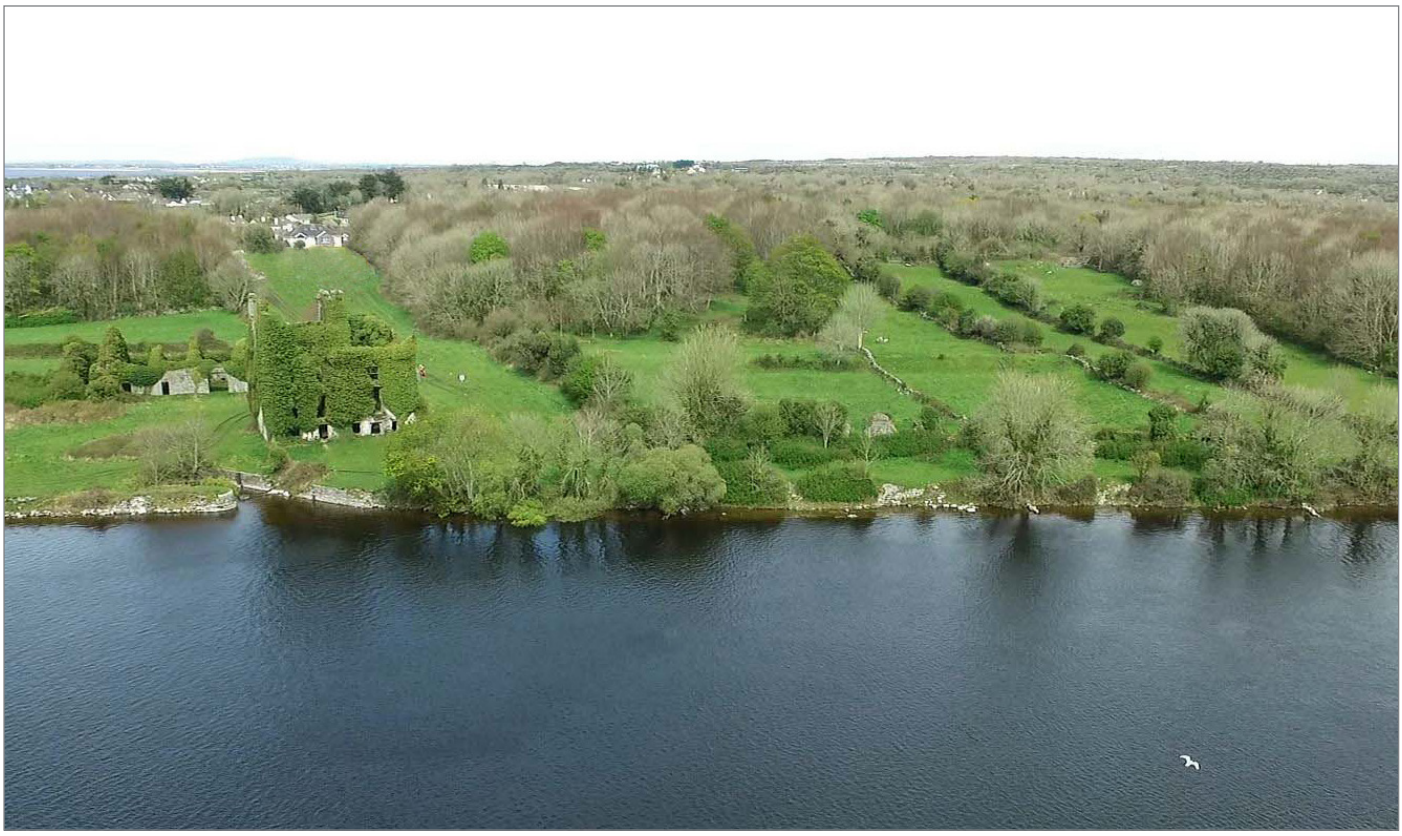
N6 Galway City Ring Road
Natura Impact Statement

Galway City Transport Project

Volume 2
Main Report

September 2018



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NIS Flowchart for the N6 GCRR

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5	**Existing Ecological Baseline** Description of the local ecological baseline, including European sites, and an overview of the local hydrological and hydrogeological baseline data.
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Glossary of Terms

Terms	Meaning
AA	Appropriate Assessment An assessment carried out under Article 6(3) of the Habitats Directive of the implications of a plan or project, either individually or in combination with other plans and projects, on a European site in view of the site's conservation objectives.
ABP	An Bord Pleanála
Alkalinity	Is a measure of the ability of a solution to neutralise acids.
Alluvium	Sediment deposited by flowing water.
Annex I habitat	Habitat types listed on Annex I of the EU Habitats Directive whose conservation requires the designation of Special Areas of Conservation.
Annex II species	Species listed on Annex II of the EU Habitats Directive whose conservation requires the designation of Special Areas of Conservation.
Annex IV species	Species listed on Annex IV of the EU Habitats Directive which are afforded strict protection under EU and national legislation.
aOD	Above ordnance datum
Aquifer	A subsurface layer or layers of rock that store and transmit water in significant quantities.
Arterial Drainage	Artificial drainage work carried out to support natural drainage networks.
Attenuation pond	Water pond used for the collection and slow release of water runoff from the road.
At-Grade Junction	Junction where roads converge at the same level.
At-grade signalised junctions	Road junction, where roads converge at the same level, which is controlled by traffic signals.
AQS	Air Quality Standards
Batholith	A very large igneous intrusion extending to an unknown depth in the earth's crust.
Bathymetric	Bathymetry is the measurement of the depth of water in oceans, rivers, or lakes. Bathymetric maps look a lot like topographic maps, which use lines to show the shape and elevation of land features.
BCI	Bat Conservation Ireland
Benthic	Relating to the bottom of a sea or lake or to the organisms that live there.
Biodegradation	Biodegradation is the decomposition of organic material by micro-organisms.
Biological Oxygen Demand (BOD)	A parameter used to quantify how fast biological organisms use up oxygen in a body of water. The testing for BOD is not an accurate quantitative test, although it could be considered as an indication of the quality of a water source.
Biotite	Biotite is a name used for a large group of black mica minerals that are commonly found in igneous and metamorphic rocks.
Bivalves	An aquatic mollusc which has a compressed body enclosed within a hinged shell, such as oysters, mussels, and scallops.
Blasting	Breaking apart or blowing up solid rock with explosives
Bored tunnel	The excavation of a tunnel using a machine with circular cross section through rock, i.e. the constructed using a boring machine.
BoCCI	Birds of Conservation Concern in Ireland
BSBI	Botanical Society of Britain & Ireland
BWI	BirdWatch Ireland
cSAC	candidate Special Area of Conservation
Catchment	The entire surface area feeding water to a given surface or groundwater feature.
Carriageway	The particular part of the road used by vehicular traffic.
C_6H_6	Benzene
CEMP	Construction Environmental Management Plan
Ch.	Chainage
Cherry picker	A hydraulic crane with a railed platform at the end for raising and lowering people, for instance to work on overhead cables
Chlorophyll	Chlorophyll is a green pigment found in most plants, algae, and cyanobacteria.
CIRIA	Construction Industry Research and Information Association
CO	Carbon Monoxide
CO_2	Carbon Dioxide
Conductivity	Conductivity (or specific conductance) of a solution is a measure of its ability to conduct electricity. It is linked directly to the total dissolved solids in the solution.
Conservation objectives	The overall target for the species and/or habitat types for which an SAC or SPA site is designated in order for the site to contribute to maintaining or reaching favourable conservation status of those species and/or habitat types. For some SAC/SPA sites this includes a detailed set of targets and attributes against which favourable conservation status can be measured.
Construction stage	The stage during which the proposed road development (N6 Galway City Ring Road) will be constructed. This includes advance contracts such as fencing, archaeological testing and the diversion of utilities/services, site set up and mobilisation.
Conveyance	The ability of a river to carry water flow
Cofferdam	A watertight enclosure pumped dry to permit construction work below the waterline, for example foundations for a bridge structure.

Terms	Meaning
Collection System	A system of gathering, sorting or mixing of waste for the purpose of it being transported to a waste recovery or disposal facility.
Conduit flow	Groundwater flow though large conduits within the rock mass typical of karstic aquifers.
Culvert	A structure that allows water to flow under an obstruction such as a road or railway.
cSAC	candidate Special Area of Conservation
Cu	Copper
Cumec	A cubic metre per second, as a unit of rate of flow of water
Cut and cover tunnel	'Cut and cover' is an approach used for constructing shallow tunnels in situations where all the ground above the tunnel can be cleared (cut), the structural element for the tunnel is then constructed before the top of the tunnel is covered over with earth, topsoil and grass
DCHG	Department of Culture, Heritage and the Gaeltacht
DAU	Development Applications Unit of the DCHG
dB (decibel)	The unit of sound pressure level, calculated as a logarithm of the intensity of sound.
dB(A)	Unit used to measure the intensity of sound. The "A" denotes that levels were "A" weighted
Designated sites	Sites which have special status as protected areas because of their natural and cultural importance.
DHPLG	Department of Housing, Planning and Local Government
DEFRA	UK Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges, UK
Dolerite	A dark, medium-grained igneous rock, typically with ophitic texture, containing plagioclase, pyroxene, and olivine. It typically occurs in dykes and sills
Doline	A shallow usually funnel-shaped depression of the ground surface formed by solution in limestone regions
Drawdown	A withdrawal of water from a reservoir or repository.
Dykes	A subvertical sheet-like intrusion of magma or sediment.
Effects	The term effects and impacts are used interchangeably in this NIS to mean the result of an action on the ecological receptor/European site under discussion. The term "effect" does have a specific meaning under the Habitats Directive when used in the context of discussing "likely significant effects" on a European site. In that context, it refers to an impact/effect that has the potential to affect the conservation objectives of a European site and hence adversely affect the integrity of that European site.
Effective rainfall	That part of the total precipitation which remains after evaporation and which is available for vegetation and percolation.
EQS	Environmental Quality Standard
EIA	Environmental Impact Assessment
Enabling works	Preparations to make a site ready for construction. It covers activities from site preparation, creation of access routes, and the installation of facilities like security fencing, ramps, and placing of signs.
EPA	Environmental Protection Agency
Epikarst	The thin zone near the karst surface. It includes the solutionally modified (karren) bedrock surface and the overlying and included regolith. The epikarst frequently supports a perched aquifer and serves to retard and store infiltrating rainwater. It also serves as a habitat for a variety of organisms that live in the interstices.
Estavelles	Estavelles are orifices with a dual function. They either discharge water as a spring or allow water to sink, depending on groundwater conditions. Typically estavelles are the connection of karst lakes with the karst ground water table.
EU	European Union
European site	Collective term used in national legislation when referring to nature conservation sites protected under the Habitats or Birds Directives (i.e. SAC or SPA sites).
Favourable Conservation Condition	In the context of assessing effects on the QIs/SCIs of European sites and their conservation objectives, favourable conservation condition is achieved when the QI habitats have sufficient range, area and quality, and QI/SCI species have a sufficient population size range and habitat area, to ensure their survival into the medium to long term, along with favourable future prospects in the face of pressures and threats.
Favourable Conservation Status	In the context of assessing the conservation status of Annex I habitats and Annex II/IV species at a national level, favourable conservation status is achieved when the habitats have sufficient range, area and quality, and the species have a sufficient population size range and habitat area, to ensure their survival into the medium to long term, along with favourable future prospects in the face of pressures and threats.
Fissure	Natural crack in rock which allows rapid water movement.
FPO	Flora (Protection) Order, 2015
Fracture	A discontinuity across which there has been separation.
GHG	Greenhouse Gases
GI	Ground Investigation
GIS	Geographic Information System

Terms	Meaning
Grade Separated Junction	Road junction where roads converge and at which at least one road passes over another.
Groundwater	That part of the subsurface water that is in the saturated zone, i.e. below the water table.
Groundwater vulnerability	Vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities.
GSI	Geological Survey of Ireland
GTS	Galway Transport Strategy – an overall transport strategy for Galway City and its environs with a clear implementation framework for transportation over the next 20 years.
GWDTE	Groundwater Dependent Terrestrial Ecosystems
Habitat	The dwelling place of a species or community which provides a particular set of environmental conditions.
ha	Hectare (one hectare is equal to 10,000 square meters)
HAWRAT	Highways Agency Water Risk Assessment Tool
HGV	Heavy Goods Vehicle
Horizontal Alignment	Direction and course of the roadway in plan.
Hydraulic barrier	A general term referring to modifications of a ground-water flow system to restrict or impede movement of contaminants.
Hydrodynamics	The branch of science concerned with forces acting on or exerted by fluids (especially liquids).
Hydrocarbon interceptor	Trap used to filter out hydrocarbon pollutants from rainwater runoff. It is typically used in road construction to prevent fuel contamination of streams carrying away the runoff.
Hydrometric Area	An area defined by the EPA covering a region of river catchments.
Hummocky	An elevated tract of land rising above the general level of a marshy region.
Hz	Hertz
IEEM	Institute of Ecology and Environmental Management
IFI	Inland Fisheries Ireland
IGI	Institute of Geologists of Ireland
Impact	The term effects and impacts are used interchangeably in this NIS to mean the result of an action on the ecological receptor/European site under discussion.
In combination impacts/effects	Term for cumulative impacts used when considering impacts on European sites in the context of an NIS/AA – cumulative effects caused by a project currently under consideration together with the effects of any existing or proposed projects or plans.
In-situ	In its original place, for construction of a headwall it is built on site.
IPPC	Integrated Pollution Prevention and Control
IRP	Incident Response Plan
Karst	Terrain created by limestone solution and characterised by a virtual absence of surface drainage, a series of surface hollows, depressions and fissures, collapse structures and an extensive subterranean drainage network.
Karstic	Descriptor for bedrock conditions in limestone that contain solution features such as fissures and caves, and potentially, underground watercourses.
Karstification	Formation of the features of karst topography by the chemical, and sometimes mechanical, action of water in a region of limestone, dolomite, or gypsum bedrock.
km	Kilometres
kph	Kilometers per hour
kPa	Kilopascal, a unit of pressure measurement
kV	A unit of electromotive force, equal to 1000 volts.
LAP	Local Area Plan
L_{den}	The day-evening-night composite noise indicator adopted by the EU for the purposes of assessing overall annoyance. L_{day} is the A-weighted long term average sound level as defined in ISO1996-2: 1987, determined over all the day periods of a year. L_{night} is the A-weighted long term average sound level as defined in ISO1996-2: 1987, determined over all the night periods of a year.
Luft	TA Luft Guidance Technical Instructions on Air Quality Control
Macro-invertebrates	Animals without backbones that are big enough to see with the naked eye.
Made Ground	Deposits which have accumulated through human activity and may consist of natural materials, e.g. clay and/or man made materials
Meander	A meander in general is a bend in a watercourse.
Mesotrophic	A lake or pond that has a moderate amount of plants.
mgbl	Metres below ground level
Micro-climatic	The atmospheric conditions affecting an individual or a small group of organisms, especially when they differ from the climate of the rest of the community.
Morphology	Morphology is the science of the forms of natural water bodies such as rivers, lakes, estuaries, lagoons, coastal zones and seas, as well as with the processes that create and modify these forms.
N6 GCRR	N6 Galway City Ring Road, the subject of the NIS
N6 GCOB	A previous application to ABP in 2006 for the then defined 'N6 Galway City Outer By-pass' (GCOB)

Terms	Meaning
NHA	Natural Heritage Area
NIS	Natura Impact Statement
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NPF	National Planning Framework
NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NTA	National Transport Authority
O_2	Oxygen
OD	Ordnance Datum
Oligotrophic	Characterized by a low accumulation of dissolved nutrient salts, supporting but a sparse growth of algae and other organisms, and having a high oxygen content owing to the low organic content.
OPW	The Office of Public Works
Operational phase	The period of time in which the proposed road is in use.
OS	Ordnance Survey
OSI	Ordnance Survey Ireland
Outcrop	An exposure of bedrock
PAH	Polycyclic Aromatic Hydrocarbons
Paleokarst	The general term for ancient karst features that have been fossilized or preserved. Most commonly these features are filled with lithified sediments.
Paleolandscape	A landscape as it was in ancient times.
Parent material	The bedrock type from which the rock fragments within a till are derived. For instance, the parent material of a Limestone Till is Limestone.
Particulate Matter	Tiny particles of solid or liquid suspended in liquid or gas.
Pb	Lead
Permeability	A measure of the ability of a given rock to transmit water.
PM_{10}	Particulate matter measuring 10 micrometers (microns) in diameter or less.
$PM_{2.5}$	Particulate matter measuring 2.5 micrometers (microns) in diameter or less.
pNHA	proposed Natural Heritage Area
Pre-earthworks drains	Where surface water and sub-surface water from adjoining land will flow towards the road, it will generally be necessary to construct intercepting drains at the tops of cuttings and the toes of embankments. In rural areas these may be ditches rather than filter drains because of their greater capacity and comparative cheapness.
Priority Annex I habitat	Annex I habitat types which are in danger of disappearance, and for which the European Community has particular responsibility in view of the proportion of their natural range which falls within the territory
Protected road	A protected road, as defined under Section 45 (1) of the Roads Act, means a public road or proposed public road specified to be a protected road in a protected road scheme approved by An Bord Pleanála. A protected road scheme approved by An Bord Pleanála may provide for the prohibition, closure, stopping up, removal, alteration, diversion or restriction of any specified or all means of direct access to the protected road from specified land or from specified land used for a specified purpose or to such land from the protected road.
Qbar	The mean annual maxima flow recorded or calculated at a location.
pH	pH is a measure of the acidity or basicity of a solution.
Pluvial flooding	This flooding occurs when surface water accumulating from the result of intense rainfall saturates the urban drainage system, and the excess water cannot be absorbed.
Podzols	A type of soil formed in cool, seasonally humid climatic regions where leaching (percolation of water) is a dominant process.
Proposed Road Development	The proposed N6 Galway City Ring Road which is the subject of assessment of this Natura Impact Statement and application to An Bord Pleanála.
Proposed Development Boundary	The extents of the lands to be compulsory acquired for the construction and operation of the proposed road development is referred to as the proposed development boundary
QI	Qualifying Interest – Annex I habitat or Annex II species for which a cSAC/SAC is designated under the Habitats Directive.
Radio-tracking	Use of radio receivers, directional antennae and radio-transmitters (attached to the target species) to monitor and record species movements and locations.
Receptors	Receptors are people or other organisms that may have sensitivity or exposure to contaminants by virtue of their age and health (e.g. schools, day care centers, hospitals, nursing homes), status (e.g. sensitive or endangered species), proximity to the contamination, dwelling construction (e.g. basement), or the facilities they use (e.g. water supply well).
Recharge	The addition of water to the zone of saturation; also, the amount of water added.
Rhizome	Underground stem of plants, laterally growing and capable of producing the root and shoot system of a new plant.
Riparian vegetation	Riparian vegetation is the diversity of native vegetation contained on 'land which adjoins or is influenced by a body of water. Riparian habitats have been defined as places 'where terrestrial and aquatic ecosystems meet'.
Rockhead	A raised rocky area or prominence; a summit or extremity of rock. The upper surface of bedrock.

Terms	Meaning
Rock outcropping	The part of a rock formation that appears above the surface of the surrounding land.
Runoff	Water leaving a drainage area or water running across the land surface.
SAC	Special Area of Conservation
Saturated zone	The zone below the water table in which all pores and fissures are full of water. Also known as the phreatic zone.
SCI	Special Conservation Interest – Annex I bird species for which an SPA is designated under the Birds Directive
Sensitivity	Vulnerability of a sensitive receptor to change.
Severance	Where a portion of land is separated or isolated from the main land holding or where a portion of habitat is separated/isolated form the main habitat area.
SI	Site Investigation
S.I.	Statutory Instrument
Signalised junction	Road junction where roads converge and traffic flow is controlled by traffic signals.
SO_2	Sulphur Dioxide
SOx	Sulphur Oxides expressed as Sulphur Dioxide
SPA	Special Protection Area
Sub-catchment	A portion of a river catchment.
Subsoils	The material between the topsoil and the bedrock.
Subtidal zone	Subtidal zone is that portion of a tidal-flat environment which lies below the level of mean low water for spring tides. Normally it is covered by water at all states of the tide. The word is often used as a general descriptive term for a subaqueous but shallow-marine depositional environment.
Substructure	An underlying or supporting structure
SuDS	Sustainable urban drainage systems (SUDS) are a natural approach to managing drainage in and around properties and other developments. They work by slowing and holding back the water that runs off from a site, allowing natural processes to break down pollutants.
Superstructure	A structure built on top of something else.
SPA	Special Protection Area (for birds). Part of the Natura 2000 network of European sites, designated under the EU Birds Directive (79/409/EEC).
TII	Transport Infrastructure Ireland
TOC	Total Organic Carbon
Tufa	A porous rock composed of calcium carbonate and formed by precipitation from water, e.g. around mineral springs.
Turbidity	Turbidity is the measure of relative clarity of a liquid. It is an optical characteristic of water and is an expression of the amount of light that is scattered by material in the water when a light is shined through the water sample. The higher the intensity of scattered light, the higher the turbidity.
Turlough	Seasonal lakes found in the lowland karsts of western Ireland.
Scheme study area	The term "scheme study area", when used in this EIAR, refers to the wider study area at which constraints were initially identified during the constraints and route selection studies for the project.
Seep	A diffuse discharge of groundwater.
Seepage	The slow escape of a liquid through porous material or small holes.
Soil retention	Soil water retention is a major soil hydraulic property that governs soil functioning in ecosystems and greatly affects soil management. Soil moisture forms a major buffer against flooding, and water capacity in subsoil is a major steering factor for plant growth.
Stabilisation	The process of making something physically more secure or stable.
Study area	The area studied in order to inform the Environmental Impact Assessment. The study area will vary depending on the environmental factor being considered
Unsaturated zone	The zone between the land surface and the water table, in which pores and fissures are only partially filled with water. Also known as the vadose zone.
µg/m3	micrograms per metre cubed
Vertical Alignment	Direction and course of the roadway in profile.
Viaduct	A long bridge-like structure, typically a series of arches, carrying a road or railway across a valley or other low ground.
VOC	Volatile organic compounds (VOC).
Water table	The uppermost level of saturation in an aquifer at which the pressure is atmospheric.
WFD	Water Framework Directive
Windblow	Carried or driven by the wind
Windrose	Map diagram that summarizes information about the wind at a particular location over a specified time period.
Zone of Contribution	The groundwater catchment area that contributes water to a well.
ZoI	Zone of Influence
%ile	Percentile

1 Introduction

Galway County Council on behalf of itself and on behalf of Galway City Council is proposing to develop the N6 Galway City Ring Road (GCRR) around Galway City, hereinafter referred to as the proposed road development.

The proposed road development, comprises the construction of approximately 6km of a single carriageway from the western side of Bearna Village as far as Ballymoneen Road and approximately 12km of dual carriageway from Ballymoneen Road to the eastern tie in with the existing N6 at Coolagh, Briarhill, and associated link roads, side roads, junctions and structures, as shown on **Figure 1.1** to **1.15** and localised works to the existing electricity transmission and distribution networks (specifically comprising of the diversion of 110kV and 38kV services). The section of the proposed road development from the tie-in with the R336 Coast Road to the N59 Letteragh Junction will be a protected road[1] and the section from this junction to the tie-in with the existing N6 at Coolagh, Briarhill will be a motorway. A full description of the proposed N6 GCRR is provided in **Section 2**. A location plan for the proposed N6 GCRR is presented in **Plate 1.1** below.

This Natura Impact Statement (NIS) has been prepared in accordance with the provisions of Part XAB of the Planning and Development Act, 2000 (as amended) and in accordance with the requirements of Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive), the Planning and Development Acts, 2000-2016 and the European Communities (Birds and Natural Habitats) Regulations, 2011-2015 (the Birds and Habitats Regulations).

It considers the implications of the proposed road development, on its own and in combination with other plans or projects, for European sites in view of the conservation objectives of those sites. It includes a scientific examination of evidence and data to identify and assess the implications of the proposed road development for any European sites in view of the conservation objectives of those sites. It considers whether the proposed road development, by itself and in combination with other plans or projects, would adversely affect the integrity of European sites. In reaching a conclusion in this regard consideration is given to any mitigation measures necessary to avoid or reduce any potential negative impacts.

The purpose of this NIS is to provide an examination, analysis and evaluation of the potential impacts of the proposed road development on European sites and to present findings and conclusions with respect to the proposed road development in light of the best scientific knowledge in the field. This NIS will inform and assist the competent authority, An Bord Pleanála, in carrying out its Appropriate Assessment as to whether or not the proposed road development will adversely

[1] A protected road means a public road or proposed public road specified to be a protected road in a protected road scheme approved by An Bord Pleanála. A protected road scheme approved by An Bord Pleanála may provide for the prohibition, closure, stopping up, removal, alteration, diversion or restriction of any specified or all means of direct access to the protected road from specified land or from specified land used for a specified purpose or to such land from the protected road.

affect the integrity of European sites, either alone or in combination with other plans and projects, taking into account their conservation objectives.

It is the considered view of the authors of this NIS (Scott Cawley Ltd.) that, following the implementation of the mitigation measures prescribed in **Section 10** (the effectiveness of which is also set out in **Section 10**), the proposed road development will not, by itself or in combination with other plans or projects, have any adverse effect on the integrity of any European sites in view of their conservation objectives and there is no reasonable scientific doubt as to that conclusion.

1.1 Background

The proposed road development as a component of the Galway Transport Strategy, which has been adopted into the Galway City Council and County Council Development Plans, has been subject to Strategic Environmental Assessment (SEA) and Appropriate Assessment thus supporting and providing the planning framework for this road. The mitigation measures identified by the SEA and AA with respect to the proposed road development are now being implemented at this stage of the project and address the potential adverse effects of this project, including in combination effects.

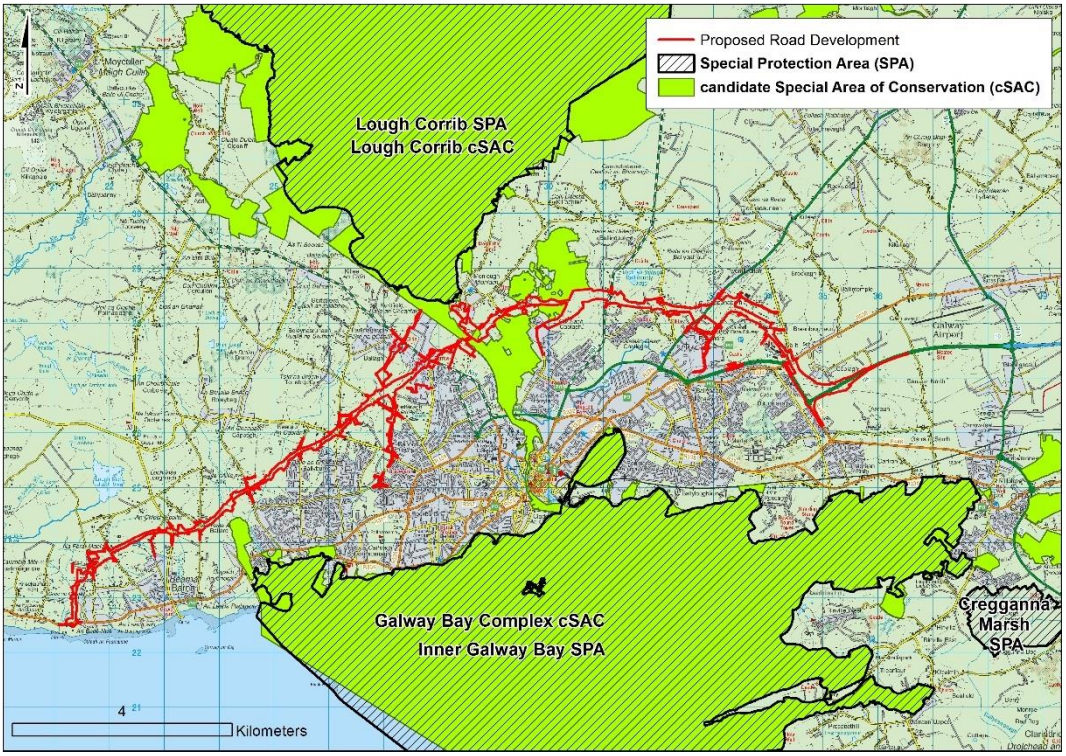
Scott Cawley Ltd. prepared a Provision of Information for Appropriate Assessment Screening report (Scott Cawley, 2018), for the proposed road development, in order to enable the competent authority, An Bord Pleanála, to comply with Article 6(3) of Council Directive 92/43/EEC (the Habitats Directive).

The proposed road development is neither connected with nor necessary to the management of any Natura 2000 site (hereinafter referred to as European sites)[2].

The Provision of Information for Appropriate Assessment Screening Report (Scott Cawley, 2018), concluded that the possibility of significant effects on Lough Corrib candidate Special Area of Conservation (cSAC), Galway Bay Complex cSAC, Lough Corrib Special Protection Area (SPA) and Inner Galway Bay SPA could not be ruled out and that an Appropriate Assessment is required. The report demonstrates that the scope of this Appropriate Assessment may be limited to these four European sites (Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA and Inner Galway Bay SPA, see **Plate 1.1**) as the possibility of significant effects on any other European sites could be ruled out. This is discussed further in **Sections 7** through **9** of this Natura Impact Statement (NIS).

[2] The Natura 2000 network of sites are defined under the Habitats Directive (Article 3) as a European ecological network of special areas of conservation, composed of sites hosting the natural habitat types listed in Annex I and species listed in Annex II, and special protection areas classified pursuant to the Birds Directive (2009/147/EC). The aim of the network is to aid the long-term survival of Europe's most valuable and threatened species and habitats. In Ireland, these sites are designed as *European sites* – as defined under the Planning and Development Acts and/or Birds and Habitats Regulations as (a) a candidate site of Community importance, (b) a site of Community importance, (c) a candidate special area of conservation, (d) a special area of conservation, (e) a candidate special protection area, or (f) a special protection area. They are commonly referred to in Ireland as candidate Special Areas of Conservation (cSACs) and Special Protection Areas (SPAs).

Plate 1.1: Proposed Road Development and European sites



Screening for Appropriate Assessment was carried out by Galway County Council which concurred with the conclusions and recommendations set out in a Provision of Information for Appropriate Assessment Screening Report (Scott Cawley, 2017) and determined that it cannot be excluded, on the basis of objective scientific information and in view of the conservation objectives of Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA and Inner Galway Bay SPA that the proposed road development, individually or in combination with other plans or projects, will have a significant effect on these European sites.

1.2 Legislative Context

The Birds and Habitats Regulations transpose into Irish law, 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) and Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive).

These Directives require Ireland to establish protected sites as part of a European wide network of sites (known in Ireland as European sites) for habitats and species that are of international importance for conservation. In Ireland, European sites include Special Areas of Conservation (SACs, including candidate SACs) and Special Protection Areas (SPAs). SACs are selected for habitats listed on Annex I of the Habitats Directive (including priority types which are in danger of disappearance) and species listed on Annex II. SPAs are selected for bird species (listed on Annex I of the Birds Directive), regularly occurring populations of migratory bird species (such as ducks, geese or waders), and areas of international importance for migratory birds. The specified habitats and species for which each

SAC and SPA is selected correspond to the Qualifying Interests (QIs) (in the case of SACs) or Special Conservation Interests (SCIs) (in the case of SPAs) for the sites, for which conservation objectives are developed.

Article 6(3) of the Habitats Directive states that:

"*Any plan or project not directly connected with or necessary to the management of the site 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 and subject to the provisions of paragraph 4, 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 and, if appropriate, after having obtained the opinion of the general public.*"

This provision is transposed into Irish law by Part XAB of the Planning and Development Acts, 2000-2015. Section 177U(4) of the said Acts provides for screening for Appropriate Assessment as follows:

"*The competent authority shall determine that an appropriate assessment of [...] a proposed development [...] is required if it cannot be excluded, on the basis of objective information, that the [...] proposed development, individually or in combination with other plans or projects, will have a significant effect on a European site*."

Section 177T(1) and (2) provide for an NIS as "*a statement, for the purposes of Article 6 of the Habitats Directive, of the implications of a proposed development, on its own or in combination with other plans or projects, for one or more than one European site, in view of the conservation objectives of the site or sites*" and specifies that it "*shall include a report of a scientific examination of evidence and data, carried out by competent persons to identify and classify any implications for one or more than one European site in view of the conservation objectives of the site or sites*".

The European Court of Justice has made a relevant ruling in relation to when an Appropriate Assessment is required and its purpose[3]:

"*Any plan or project not directly connected with or necessary to the management of the site is to be subject to an appropriate assessment of its implications for the site in view of the site's conservation objectives if it cannot be excluded, on the basis of objective information, that it will have a significant effect on that site, either individually or in combination with other plans or projects" and that the plan or project may only be authorised "where no reasonable scientific doubt remains as to the absence of such effects*".

[3] Case C-127/02 Landelijke Vereniging tot Behoud van de Waddenzee, Nederlandse vereniging tot Bescherming van Vogels v. Staatssecretaris van Landbouw, Naturbeheer en Visserij (Waddenzee) [2004] ECR I-7405

The European Court of Justice has also made a relevant ruling on what should be contained within an Appropriate Assessment[4]:

"*[The Appropriate Assessment] cannot have lacunae and must contain complete, precise and definitive findings and conclusions capable of removing all reasonable scientific doubt as to the effects of the works proposed on the protected site concerned*".

1.3 EU Guidance & Approach to Article 6 Assessment

The European Commission Guidance *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* prescribes a staged process, as set out below, the need for each stage being dependent on the outcomes of the preceding stage. The sequence is designed to test the potential effects of plans and projects on European sites:

1. Screening for Appropriate Assessment
2. Appropriate Assessment
3. Assessment of Alternative Solutions
4. Assessment where no alternative solutions exist and adverse impacts remain, *i.e.* the Imperative Reasons of Overriding Public Interest test, and compensatory measures

Stage 1 of the process is referred to as screening for Appropriate Assessment and identifies whether the proposed road development, either on its own or in combination with other plans or projects, would be "*likely to have a significant effect*" upon any European site. A likely effect is one that cannot be ruled out on the basis of objective information. The test is a '*possibility*' of effects rather than a '*certainty*' of effects. The test of significance is whether a plan or project could undermine the site's conservation objectives (See **Section 4.3**).

If effects are considered likely to be significant, potentially significant or uncertain, or if the screening process becomes overly complicated, the process must proceed to Stage 2: Appropriate Assessment, with the preparation of a Natura Impact Statement to inform the Appropriate Assessment that is to be conducted by the competent authority.

[4] Case C-258/11Sweetman v. An Bord Pleanála [2013] ECR I – 0000 (11 April 2013)

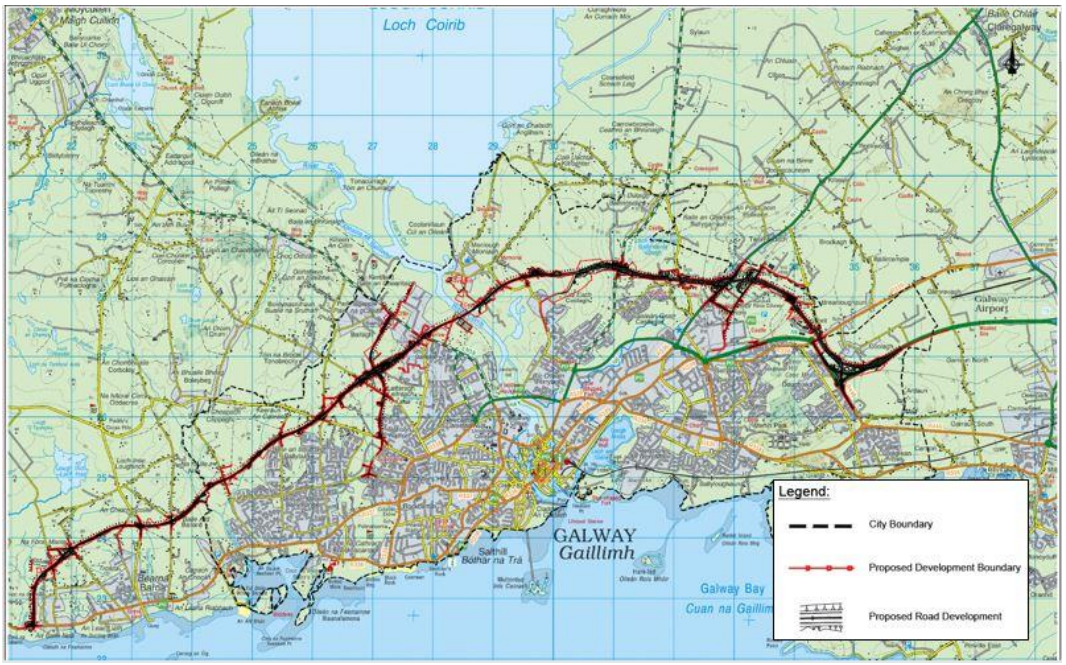
2 Description of the Proposed Road Development

2.1 Overview

The proposed road development comprises of the construction of approximately 5.6km of a single carriageway from the western side of Bearna as far as the Ballymoneen Road and approximately 11.9km of a dual carriageway from there to the eastern tie in with the existing N6 at Coolagh, Briarhill, along with associated link roads, side roads, junctions and structures and localised works to the existing electricity transmission and distribution networks (specifically comprising of the diversion of 110kV and 38kV services), as shown in **Plate 2.1** below and **Figures 1.1** to **1.15**.

The total area within the footprint of the proposed development boundary[5] is 280ha. Of this total area, an area of 180ha is required for the footprint of the proposed road development.

Plate 2.1: Proposed Road Development Overview



The proposed road development ties into the existing R336 Coast Road in An Baile Nua with an at-grade roundabout junction approximately 2km to the west of Bearna Village and then proceeds north and east as a single carriageway to the north of Bearna Village and onwards towards Ballymoneen. Connectivity is maintained via the Troscaigh/Na Foraí Maola Overbridge Link whilst an at-grade roundabout is proposed at the Bearna to Moycullen Road L1321. An at-grade roundabout is proposed at the Bearna to Moycullen Road L1321, and at-grade signalised junctions are proposed at Cappagh Road and Ballymoneen Road.

5 The extents of the lands to be compulsory acquired for the construction and operation of the proposed road development is referred to as the proposed development boundary.

To the east of the Ballymoneen Road Junction the proposed road development is a dual carriageway and continues east to a grade separated N59 Letteragh Junction located in Letteragh. The junction connects to the N59 Moycullen Road via the proposed N59 Link Road North, and to the Letteragh Road and Rahoon Road via the proposed N59 Link Road South. The proposed road development continues eastwards to cross the existing N59 Moycullen Road at Dangan and travels on a viaduct over the NUIG Sporting Campus before crossing the River Corrib (and the Lough Corrib cSAC) on a bridge structure.

The proposed road development impacts the NUIG Sporting Campus at Dangan with direct impacts on one of the two existing GAA pitches adjacent to the River Corrib and a training pitch to the front of the existing sports pavilion. To mitigate the impact to these two pitches, it is proposed to construct an all-weather full size GAA pitch and a training pitch at the location of the existing GAA pitches adjacent to the River Corrib as shown on **Figure 1.7**.

East of the River Corrib, the proposed road development continues east on embankment toward the townland of Menlough. Additional lands to the north of Menlo Castle are included as part of the proposed road development to provide lands for the enhancement of the core foraging habitat for the Lesser horseshoe bat known to roost at Menlo Castle and mitigate against potential impacts to this species. These lands will be planted with additional hedgerows and maintained as agricultural lands by the local authority and will remain in their ownership.

Continuing east the proposed road development crosses over Bóthar Nua and remains on a viaduct section, the Menlough Viaduct, towards Seanbóthar before entering a section of cut preceding Lackagh Tunnel, immediately west of Lackagh Quarry, and exits the tunnel in the quarry.

There is a tunnel maintenance building located adjacent to Lackagh Tunnel as shown on **Figure 1.8**. The proposed road development continues east with a grade separated junction located at the N84 Headford Road Junction at Ballinfoyle and continues east through the townland of Castlegar to the grade separated junction at the N83 Tuam Road[6]. This junction provides access to both the N83 Tuam Road and the proposed Parkmore Link Road between the Ballybrit Business Park and the Parkmore Industrial Estate via the proposed City North Business Park Link Road to provide full connectivity at this location.

The proposed road development then continues southeast entering the Galway Racecourse Tunnel at Ballybrit to the north of the racetrack. There is a tunnel maintenance building located adjacent to the Galway Racecourse Tunnel as shown on **Figure 1.10** and new stables provided for the Galway Racecourse to mitigate the loss of the existing stables. On emerging from the tunnel the proposed road development continues southeast, crossing over the R339 Monivea Road on embankment and continuing south to enter a cutting as it reaches its junction with the existing N6 at Coolagh Junction. The proposed Coolagh Junction will be a fully grade separated junction with partial free flow on the major movements.

6 Formally known as the N17 Tuam Road

The proposed road development will also include extensive landscape planting and the creation of Annex I habitat areas[7] (e.g. Calcareous grassland habitat within Lough Corrib cSAC on the east bank of the River Corrib). Noise barriers will also be installed at locations along the proposed road development.

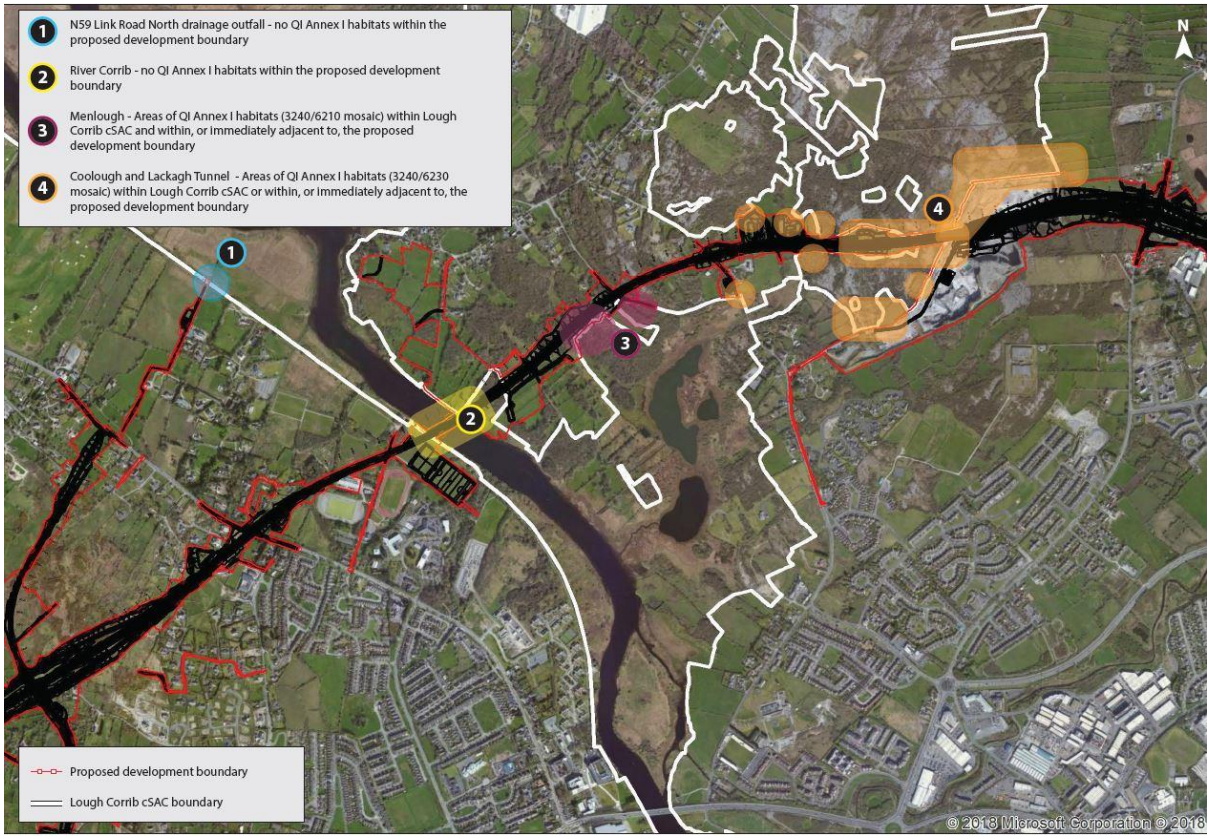
2.2 Overlap with European sites

There are many European sites present in the local and surrounding areas. Lough Corrib cSAC is the only European site traversed by the proposed road development. Galway Bay Complex cSAC and Inner Galway Bay SPA are downstream of the proposed road development. Galway Bay Complex cSAC lies c.160m to the south of the proposed road development at Bearna. Inner Galway Bay SPA also lies to the south of the proposed road development at Bearna (c.1.1km). Lough Corrib SPA is c.200m to the north of the proposed road development at Kentfield and c.70m from it at Menlough. While Lough Corrib SPA is generally upstream of the proposed road development, a single outfall (the proposed drainage outfall for the N59 Link Road North) eventually discharges to a part of the River Corrib which falls within the SPA designation. All other European sites are at a greater distance from the proposed road development.

The proposed road development and its boundary overlaps with, i.e. traverses through or adjacent the Lough Corrib cSAC at four locations: at the termination of the proposed drainage outfall from the N59 Link Road North at Kentfield; at the site of the proposed River Corrib Bridge between Dangan and Menlough; to the west of the Coolagh Lakes (Ch. 9+850 to Ch. 10+100); and, to the west and north of Lackagh Quarry where the proposed road development will consist of a tunnel (Lackagh Tunnel) and approach road infrastructure (Ch. 10+620 to Ch. 11+800). Refer to **Plate 2.2** below. The total area within the proposed development boundary is 280ha and approximately 4ha of the proposed road development lies within this European site (c0.6ha above Lackagh Tunnel and c0.5ha beneath River Corrib Bridge). The proposed road development also traverses a number of groundwater bodies that support groundwater dependant wetland habitats within European sites which are discussed further in **Section 5.2** below and traverses a number of watercourses that lie within or drain to a European site.

[7] The Annex I habitat creation relates to addressing residual impacts to Annex I habitats outside of any European sites in the EIA Report. It is not in response to any impacts on Annex I habitats that relate in any way to effects on QIs or the conservation objectives of any European sites and that habitat creation does not constitute “compensatory measures” in the meaning of that term in Article 6(4) of the Habitats Directive.

Plate 2.2: Proposed Road Development overlap with European sites



Through the evolution of the proposed road development however, elements were included in the design which allowed the proposed road development to avoid some direct and indirect effects on European sites. These avoidance measures include the following:

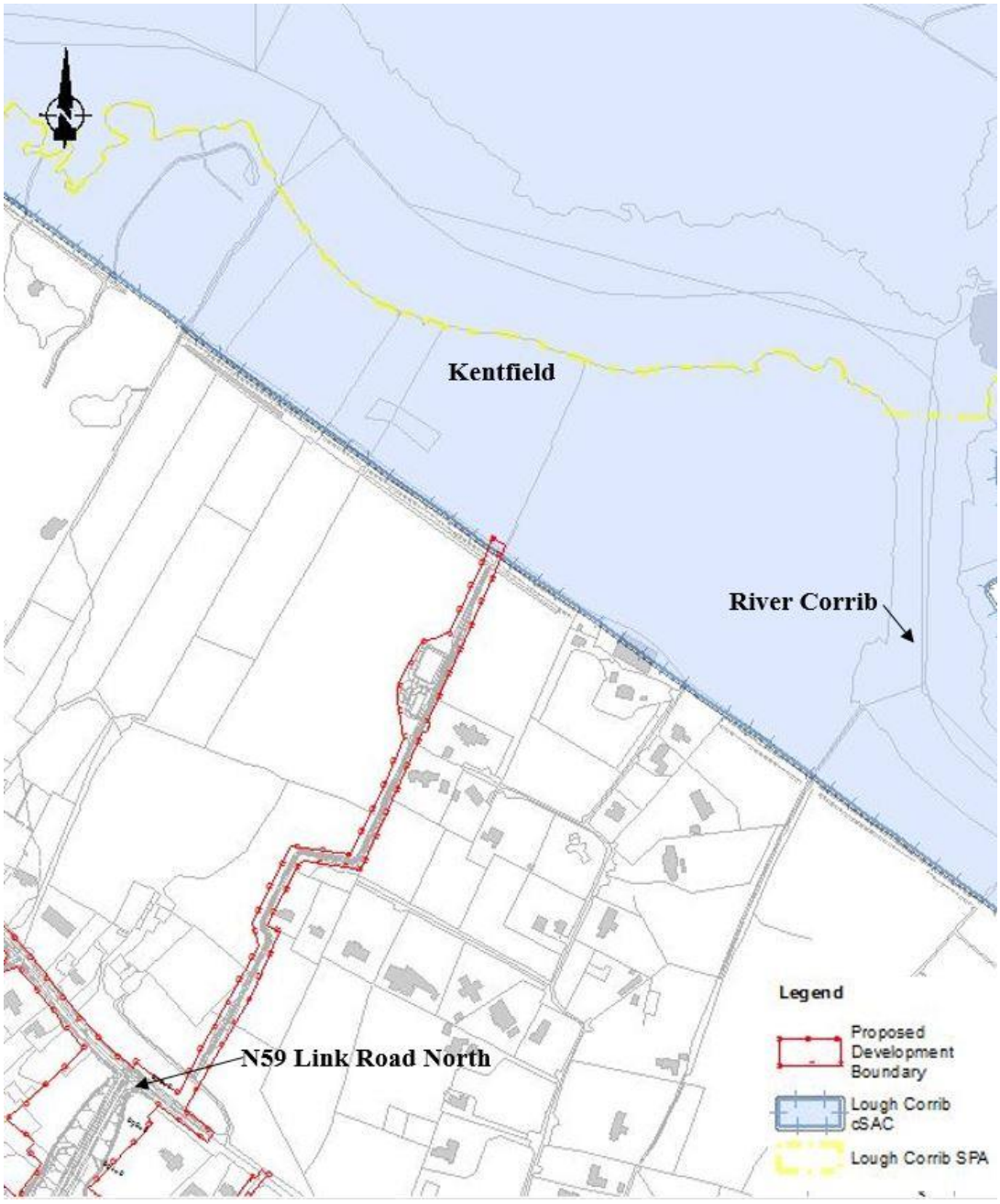
- Lackagh Tunnel: A tunnel beneath a narrow section of the Lough Corrib cSAC in Menlough at Lackagh Quarry
- Retaining walls: A retaining wall on the southern side of the proposed road development at approximately Ch. 9+880 to Ch. 10+050 and on both sides of the proposed road development at approximately Ch. 10+850 to Ch. 11+150 to avoid the encroachment on Annex I habitat within the Lough Corrib cSAC
- River Corrib Bridge: A bridge over the River Corrib (which forms part of the Lough Corrib cSAC) with no instream piers. Whilst the supporting piers do lie with the terrestrial habitat areas of Lough Corrib cSAC, they are not located in areas of qualifying interest habitat

The following presents the sections of the proposed road development which traverses immediately adjacent to or through the Lough Corrib cSAC.

Termination of the proposed drainage outfall from the N59 Link Road North at Kentfield

The proposed drainage outfall from the N59 Link Road North will discharge to an existing drainage ditch which will ultimately outfall to the River Corrib within the Lough Corrib cSAC and Lough Corrib SPA. This is discussed further below in **Section 2.4** and **2.5.7.1**. The proposed development boundary also overlaps with the Lough Corrib cSAC at this location, as shown in **Plate 2.3** below, to a drainage ditch in Lough Corrib cSAC at Kentfield.

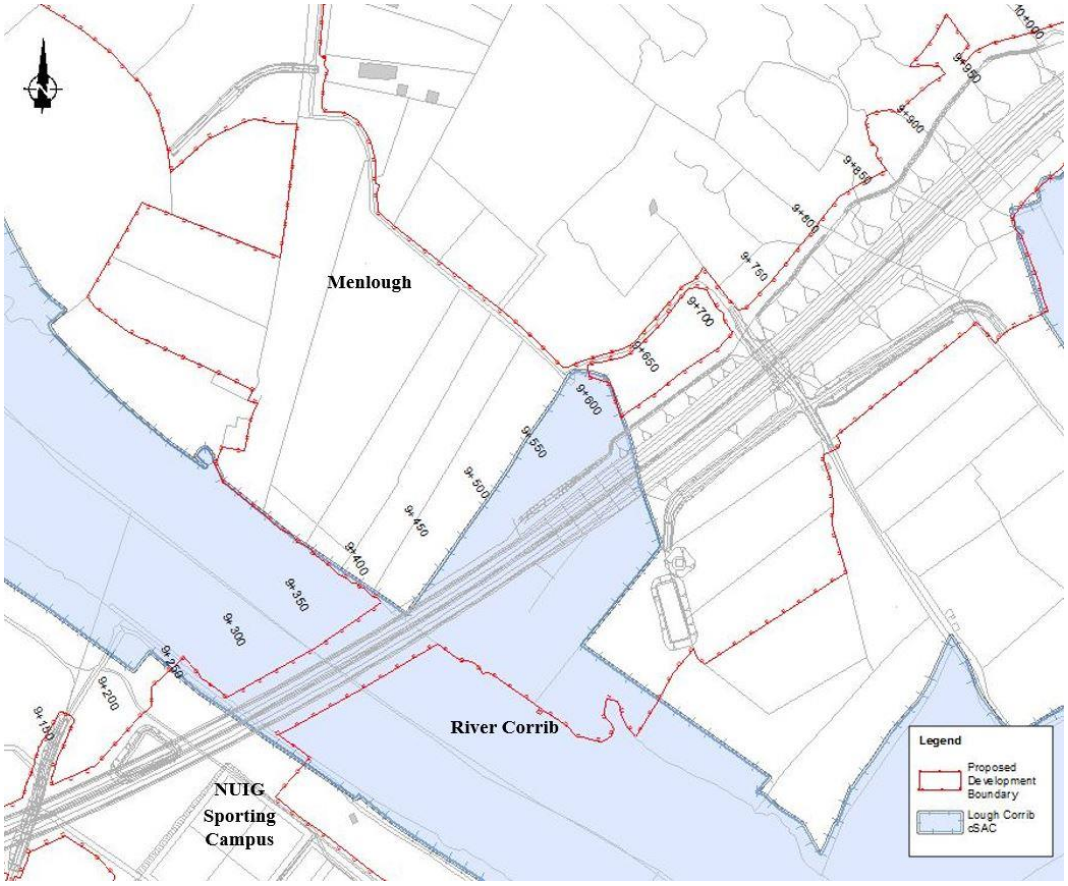
Plate 2.3: Proposed Road Development at Kentfield



River Corrib - Ch. 9+250 to Ch. 9+550

The width of the River Corrib Bridge is 21m. The footprint of the proposed road development (including associated earthworks and interceptor ditches) widens to 27.5m on the eastern bank of the River Corrib and within the Lough Corrib cSAC between Ch. 9+250 to Ch. 9+550 widening to a maximum width of approximately 90m to allow for the road embankment and drainage design. **Plate 2.2** below shows the proposed road development as it traverses the Lough Corrib cSAC and the area of overlap with this European site.

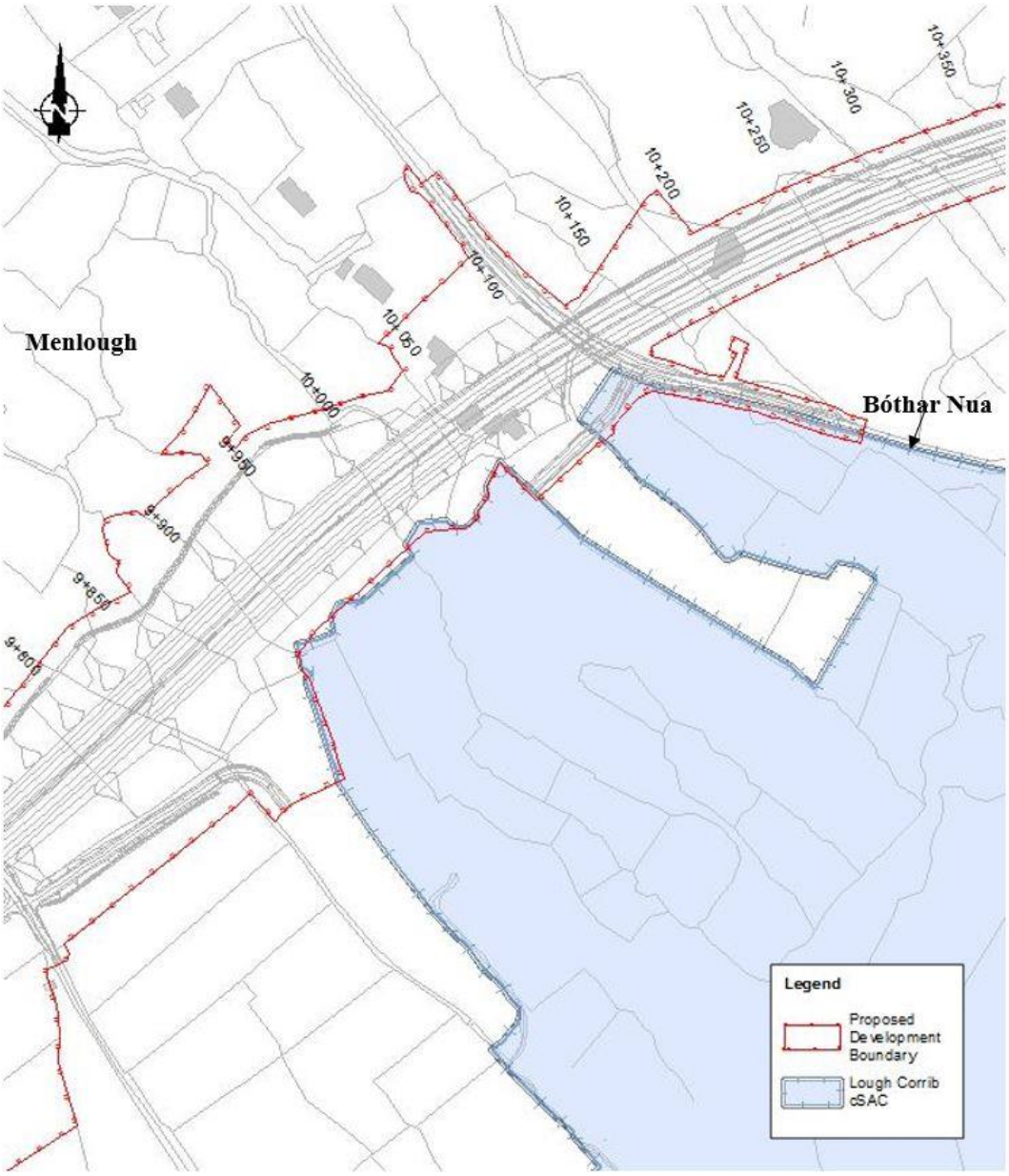
Plate 2.4: Proposed Road Development Ch. 9+250 to Ch. 9+550



Menlough - Ch. 9+850 to Ch. 10+150

Between Ch. 9+850 and Ch. 10+150 sections of the proposed road development lies within, or immediately adjacent to the Lough Corrib cSAC. **Plate 2.3** below shows the proposed road development adjacent to the Lough Corrib cSAC and the area of overlap with this European site.

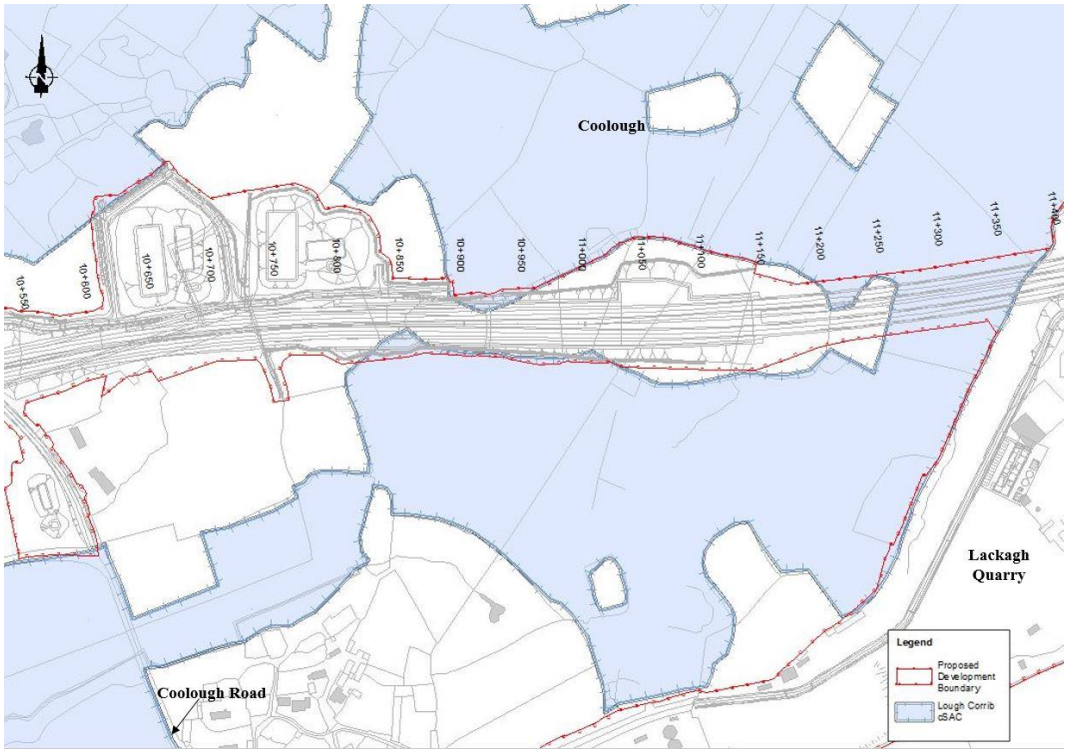
Plate 2.5: Proposed Road Development Ch. 9+850 to Ch. 10+150



Coolough and Lackagh Tunnel - Ch. 10+620 to Ch. 11+420

The proposed development boundary overlaps with the boundary of the Lough Corrib cSAC at the following locations between Ch. 10+620 and Ch. 11+420, including the western approach to Lackagh Tunnel and its associated drainage lies partly within Lough Corrib cSAC (Ch. 10+750 to Ch. 11+000), with the tunnel itself passing beneath the cSAC (Ch. 11+140 to Ch. 11+420). **Plate 2.4** below shows the proposed road development as it traverses adjacent to, within and beneath the Lough Corrib cSAC and the area of overlap with this European site.

Plate 2.6: Proposed Road Development Ch. 10+620 to Ch. 11+420



2.3 Structures

There are numerous structures proposed across the length of the proposed road development. Bridges, culverts, accommodation underpasses and mammal underpasses are required to provide mitigation for existing watercourses, local access routes and mammals by maintaining access under the mainline of the proposed road development.

There are four significant structures included in the design of the proposed road development, namely the River Corrib Bridge, Menlough Viaduct, Lackagh Tunnel and Galway Racecourse Tunnel. The following is a summary of these structures.

2.3.1 River Corrib Bridge

The proposed road development crosses the River Corrib on a bridge structure (ST09/01) 620m in length between Ch. 8+850 to Ch. 9+500. The proposed structure comprises of an eight span bridge carrying the proposed road development over the

River Corrib adjacent to a retained embankment with five culvert openings on the eastern approach. The proposed structure is a variable depth single concrete box without supports in the river with the main span over the river being 153m. There is no encroachment by the bridge structure into the Lough Corrib cSAC on the west side of the River Corrib. On the east side, retaining structures are provided on the approach embankment to limit encroachment of the embankment into the Lough Corrib cSAC. The structural depth of the main span of the river bridge varies from approximately 7m near the supports on either side of the river and reducing to approximately 3m at mid-span over the river, with no associated cables or trusses protruding above the deck.

2.3.2 Menlough Viaduct

A viaduct structure, Menlough Viaduct (ST10/01) is proposed from Ch. 10+100 to Ch. 10+420. The viaduct has a total length of approximately 320m, and the proposed road development is on embankment on both approaches to it. It is located outside but adjacent to the Lough Corrib cSAC, between 45m and 140m north of the cSAC boundary.

The total length of the viaduct is governed by the area of priority Annex I habitat over which it crosses, namely Limestone pavement and a Turlough. Both of these Annex I habitats are located outside of the Lough Corrib cSAC boundary and do not provide a supporting role to, nor form part of the QI for this cSAC. The viaduct contains eight spans of a similar 40m span length. The span lengths have been adjusted to reduce the impact of the substructure and foundations on the Limestone pavement and Turlough (both of which fall outside of the Lough Corrib cSAC boundary). The position of the substructure and foundations will minimise the potential impact on these Annex I habitats. No substructure supports are proposed within the extents of the Turlough.

2.3.3 Lackagh Tunnel

Lackagh Tunnel (ST11/01) is a 270m long mined (drill and blast) tunnel and is located between Ch. 11+150 to Ch. 11+420. The eastern portal of Lackagh Tunnel is located within the inactive Lackagh Quarry, a limestone quarry. The central section of the tunnel will pass under the Lough Corrib cSAC (as detailed previously in **Section 2.2**) while the western portal is proposed to be located in agricultural fields, outside of Lough Corrib cSAC.

The primary function of the Lackagh Tunnel and its Western Approach is to traverse the Lough Corrib cSAC between Lackagh Quarry and Menlough without directly impacting on the surface structure and function of the QI Limestone pavement and Calcareous grassland habitats within the Lough Corrib cSAC. This requires a safe method of excavation and construction of the tunnel such that there will be no impact on the Lough Corrib cSAC during the construction or operation of the tunnel, as discussed in **Appendix F**.

2.3.4 Galway Racecourse Tunnel

The proposed Galway Racecourse Tunnel (ST14/02) consists of a 240m twin tube reinforced concrete cut and cover tunnel with central wall from Ch. 14+950 to Ch. 15+190. The purpose of the Galway Racecourse Tunnel is to avoid adverse impacts by design, namely disruption to operations and functioning, on the Galway Racecourse. The proposed mainline passes through the north western corner of Galway Racecourse property. This tunnel does not traverse through and is not immediately adjacent to any European site.

2.4 Drainage

2.4.1 Overview

The proposed road development involves the construction of a new drainage system which includes the provision of a surface water collection system, earthworks drainage, sub-surface drainage, attenuation and pollution control, and the culverting of existing streams (**Figures 2.1** to **2.15**). The proposed road development has been designed such that surface water drainage and sub-surface drainage will be provided for the proposed mainline carriageway, junctions, link roads and all new sections of local roads.

Due to the contrasting geological features across the proposed road development extents, the type of natural drainage can be split into two different broad categories west and east of the N59 Moycullen Road.

The natural discharge of rainfall and surface water drainage west of the N59 Moycullen Road is overland to low points in the topography where shallow ditches and streams are present. The underlying bedrock is granite. This is a low importance, poor aquifer where the bedrock is generally unproductive except for local zones (refer to **Appendix A**). In general, the water table is quite close to the surface.

The natural discharge of rainfall and surface water drainage east of the N59 Moycullen Road is directly to ground with extreme events accumulating at low points and seasonal lakes within the topography. The underlying bedrock is limestone. The aquifer is a regionally important karstified aquifer which is dominated by conduit flow. Except for the River Corrib, Terryland River, Ballindooley Lough and Coolagh Lakes there are no other significant watercourses in the area east of the N59 Moycullen Road.

The two different categories of natural drainage inform the approach to drainage design for the proposed road development. As well as the efficient removal of water from the road surface and pavement, the drainage design aims to minimise the impact of runoff from the proposed road development on the receiving environment by replicating, as much as possible, the natural water flows across the proposed road development. This is achieved using a variety of sustainable drainage measures.

All surface water collected by the proposed carriageway drainage system will be discharged to watercourses or existing storm sewers crossed by or adjacent to the

proposed road development if present, or will be discharged to ground via infiltration. Flow control measures will be provided at outfalls and discharge points along the length of the mainline of the proposed road development to ensure discharge does not cause any adverse effects upstream or downstream of the receiving watercourse or sewer, in terms of flow rate. Infiltration basins have been sized to allow sufficient time for infiltration to discharge to the ground. Pollution control measures will be provided on all mainline road drainage networks prior to outfalling/discharging to ensure that receiving water bodies are not contaminated by runoff from the proposed road development.

In summary, the design basis for the drainage strategy is as follows:

- West of the N59 Moycullen Road the surface water collected by the carriageway drainage system will be discharged into watercourses crossed by, or adjacent to, the proposed road development that eventually outfall to Galway Bay or the River Corrib. A number of these watercourses outfall to either the area of Galway Bay that is within the Galway Bay Complex cSAC and Inner Galway Bay SPA, or to the River Corrib, either directly or to a tributary, which is within the Lough Corrib cSAC.
- East of the N59 Moycullen Road the surface water collected by the carriageway drainage system will be discharged to ground via infiltration, with the exception of two drainage networks (S18A and S18B refer **Figure 2.7**) which will discharge directly to the River Corrib and three networks (S14A, S14B refer to **Figure 2.6** and S15 refer to **Figure 2.12**) which discharge to tributaries which eventually outfall to the River Corrib. The outfall from the proposed NUIG pitches (S44) will also outfall indirectly to the Lough Corrib cSAC via an existing stream which flows south of the existing pitches. One infiltration basin for the drainage design (outfall S19B) is within the Lough Corrib cSAC and the groundwater to which this and other infiltration basins discharge interacts with the groundwater and water bodies within the Lough Corrib cSAC.
- The drainage design will include combined filter drains, carrier drains, surface water channels, narrow filter drains, cut-off and toe drains, attenuation ponds, grassed surface water channels, petrol and oil interceptors, wetlands and infiltration basins.

The procedures below have been adopted for the drainage design of the proposed road development in accordance with current TII Publications, guidance documents and best practice methods.

2.4.2 Culverts

Culverts have been designed to minimise impact on both upstream and downstream flood risk. In addition to the hydraulic requirements for the proposed road development crossings, consideration has also been given to the passage of mammals at some ecologically sensitive areas. Some of the hydraulic culverts have been increased in size to allow passage for a range of mammal species; for example, otters, badgers and bats.

2.4.3 Interceptor ditches

Interceptor ditches are included where required to intercept the overland flow from the natural catchment adjacent to the proposed road development (during both construction and the operational phases) and to prevent ponding of water adjacent to embankments. The use of interceptor ditches is to prevent drainage from the road curtilage running onto adjacent lands and vice-versa. Therefore, the interceptor ditches serve a function to maintain the existing natural catchments.

2.4.4 Collection Systems

In the western section of the proposed road development from the R336 Coast Road to the N59 Moycullen Road, the drainage network will comprise of a combination of surface water channels, filter drains, carrier drains or similar. However, in the eastern section of the proposed road development from the N59 Moycullen Road to the connection point with the existing N6 at Coolagh, due to the karstic nature of the underlying bedrock and the vulnerability of the underlying aquifers, there is a requirement for a fully sealed system to accept the proposed carriageway runoff. Therefore, the network collecting the drainage from the proposed carriageway will remain separate and independent of the groundwater. This is achieved by using either a kerb, gully and carrier pipe system or a concrete surface water channel and carrier pipe system. For cuttings and low embankments, a separate narrow filter drain will be provided. The sealed drainage system outlined above allows for controlled treatment of surface waters prior to discharge to the ground thereby reducing the risk to the underlying aquifer.

2.4.5 Structure Drainage

A separate isolated sealed drainage system will be utilised for the Lackagh Tunnel and the Galway Racecourse Tunnel structures. The sealed system will be used in both tunnels to pick up groundwater ingress, surface water from wheels, fire flows and tunnel wash down, all of which will be drained to sumps and pumped to the closest foul sewer. The foul effluent flow discharges via gravity to the Mutton Island Waste Water Treatment Plant where it is treated. This sealed system controls the drainage of these tunnel structures; it also mitigates against the potential for pollution of groundwater and minimises the risk to the Lough Corrib cSAC and any surface water bodies.

For the long lengths of the Menlough Viaduct and the River Corrib Bridge a specialised sealed drainage system will capture the runoff on the bridge deck, transport it in a network of sealed carrier drains, before descending into the ground at suitable pier locations and discharging to a wetland and attenuation treatment area. This is required due to the sensitivity of the areas above which the bridges are crossing and of wetland habitats supported by the receiving environment i.e. Limestone pavement and Turlough (Priority Annex 1 habitats, which fall outside of the Lough Corrib cSAC boundary and do not form part of its Qualifying Interests) at Menlough and wetland habitats associated with the Coolagh Lakes and the River Corrib (QI Annex I habitats, and supporting QI species of Lough Corrib cSAC).

2.4.6 Link Road and Side Road Drainage

The side roads require kerbs at locations such as at bridge or junction locations or where footways are required and will therefore be drained using gullies with carrier drains or combined filter/carrier drains. Piped drains will discharge to an outfall, a sealed drain or to the mainline drainage system. Side roads that do not require kerbs will be drained using either over-the edge drainage or combined filter drains where appropriate in accordance with the principles described above. The swales or filter drains will discharge to an outfall, a sealed drain or to the mainline drainage system.

2.4.7 Outfalls, Attenuation Ponds and Infiltration Basins

West of the N59 Moycullen Road the surface water collected by the carriageway drainage system will be discharged to watercourses crossed by, or adjacent to, the proposed road development. Attenuation is provided prior to discharge in order to prevent discharge from the road increasing the peak flow rate of water within the watercourses, which may compound any flooding downstream of the proposed road development. Various storage options are available, the most sustainable of which is the use of attenuation ponds, which become a feature of the landscape in time and is in line with current best practice guidelines. The proposed outfalls, with proposed attenuation ponds, have been chosen at appropriate locations along the route of the proposed road development typically as close as possible to an existing watercourse. Where the drainage system outfalls to a watercourse the final outfall level (after the attenuation and treatment measures) shall be set above the 1 in 5 year flood level of the watercourse. Furthermore, an assessment of the impact of the pond on the hydraulic regime of the watercourse has been undertaken (**Appendix B**).

A flow control device (Hydrobrake or similar) will be installed at the outfall location of all attenuation ponds to control the flow rate from the pond to the receiving watercourse. The discharge rate for each drainage catchment is set to the Qbar greenfield runoff rate to replicate the existing environment or to a minimum of 5 l/s on smaller catchments to minimise the risk of blockage from debris within the network.

East of the N59 Moycullen Road the surface water collected by the carriageway drainage system will be discharged to ground via an infiltration basin where a positive outfall to a watercourse is not available or where the catchment is not served by a public storm sewer. Ground investigation works at the proposed locations of the infiltration basins have been undertaken to mitigate risk to the design by informing the permeability of the existing soil and bedrock. Where the infiltration rate is outside the range of the permissible flow rates (e.g. discharge directly to karst limestone bedrock) then the base layer of the infiltration basin will be created to reduce the infiltration rate artificially. The infiltration basins will not be lined so as to allow for infiltration to ground.

The attenuation ponds and infiltration basins will cater for a 1 in 100 year storm event minimising any increase in flood risk to adjacent properties up to this return period. A minimum freeboard of 300mm is provided between the maximum water level in the attenuation pond or infiltration basin and the top level of the pond/basin or the pond/basin protection bund. Peak discharge rates from the development will

not exceed the peak discharge rates in the greenfield scenario for the critical storm return period. The pond/basin will be bunded to a level 500mm above any adjacent 1 in 100 year flood levels. To reduce the risk of receiving water and groundwater being contaminated by runoff from the proposed road development, pollution control measures will be provided as detailed in the following section.

2.4.8 Pollution Control

Pollution control measures are proposed prior to each outfall/discharge point from the carriageway to reduce the risk of watercourses or groundwater being contaminated by runoff from the proposed road development. A range of pollution control measures have been adopted along the length of the proposed road development which includes combined and narrow filter drains, attenuation ponds, grassed surface water channels, petrol and oil interceptors, spill containment areas, wetlands and infiltration basins.

SuDS systems will be implemented in the first instance. In general, where the risk to groundwater is low combined filter drains or grassed surface water channels will form the first treatment against pollutants making their way into surrounding water bodies. The filter material will trap suspended solids and other contaminants thus reducing downstream pollution risk. Where the road carriageway runoff drains into grassed surface water channels, the slow moving surface flow through shallow swales will allow for the processes of sedimentation and absorption to take place while carrying the runoff to the outfall.

Where the groundwater is highly vulnerable a sealed drainage system (e.g. carrier pipe with gullies, concrete surface water channels, slot drains etc.) will collect and distribute surface water runoff to a suitable outfall location/discharge point. Sub surface flow will be collected in a series of narrow filter drains.

Wetlands will be provided upstream of each attenuation pond and infiltration basin to treat runoff and are included in the design of the proposed road development. The wetlands are designed to have a permanent 600mm pool of water which will further encourage settlement of suspended solids and will be lined to reduce the risk of watercourses or groundwater being contaminated by runoff from the proposed road development. Suitable planting and additional measures will be employed to encourage the settlement of silt and absorption of any remaining pollutants i.e. silt traps, reed beds. The increased retention time provided by the wetland will provide additional time for further adsorption and sedimentation to take place and will also allow for a range of natural biological processes (including biodegradation, microbial action and plant uptake) to further remove waterborne pollutants. These ponds have been sized to store the ‘First Flush’ runoff from their associated road pavement catchments. This comprises a volume equal to a 15mm depth of rainfall on the road catchment. This ‘First Flush’ runoff carries the highest load of pollutants, compared to runoff discharged later in the rainfall event.

Oil and petrol interceptors will be provided upstream of the wetland and attenuation pond/infiltration basin to prevent any contamination from hydrocarbons, such as oil or petrol spillages, from entering the receiving water or groundwater. The interceptors will be sized for each drainage catchment according to the inflow. A

minimum emergency spill containment volume of 25m^3 will be provided at all outfall locations.

2.5 Construction Activities

2.5.1 Overview

This section outlines the construction activities of relevance to European sites. These activities include construction phasing, enabling works (including archaeological test trenching and ground investigations), site preparation and clearance works, main construction activities (including mitigation measures such as landscaping measures and ecological habitat planting), proposed construction methodologies, material sources and transportation including, earthworks quantities, proposed haul routes and construction compounds, service and utility diversions, commissioning and decommissioning of proposed road development.

It is estimated that the overall construction period will last for approximately 36 months. A variety of construction activities will occur simultaneously at a number of locations along the route of the proposed road development, but will be in a phased manner. Construction will be undertaken using internationally accepted methods. Construction of the proposed road development will include activities such as excavation, embankment and structural construction, tunnelling, piling, rock breaking and movement of materials within the fenced off working area. This will generate noise, dust and movement of machinery which will potentially impact on the surrounding environment. The duration of these works will vary. A series of best practice mitigation measures will be incorporated during the construction phase to ensure that strict limit values set to avoid significant impacts will not be exceeded at sensitive locations.

A strategy for construction has been developed with the aim of minimising potential environmental impacts at each subsequent phase of the project. Major construction activity such as excavation work, requires the use of powerful and often large and heavy equipment. These works take a significant time period to complete and progressive phases of construction entail different activities and require the use of various types of equipment. Overall, however, construction is a temporary activity. Modern machinery and techniques are sophisticated and are designed to be operated to minimise the impact on their surroundings. Any residual impact, which may arise as a result, is for a limited period of time. The works required to construct the proposed road development are essentially similar to other major construction projects in Ireland and across the world.

The general activities and potential direct and indirect impacts associated with the construction of the proposed road development include:

- Site clearance including demolitions and vegetation clearance
- Fencing
- Site access
- Construction compounds

- Site investigations and archaeological testing
- Quarrying and processing of aggregates
- Material requirement and source of material
- Temporary road closures and diversions
- Water management/treatment
- Temporary storage of materials, surplus materials or wastes arising

The above activities of relevance to European sites are discussed below. In addition to the above list the following are also discussed:

- Construction form and duration of works
- Construction constraints
- General construction methods
- Construction programme, staging and working hours

2.5.2 Construction Phasing

An east to west build sequence is likely to be adopted and construction may be completed in two concurrent phases or a single overall contract:

- Phase 1 – N6 Coolagh to N59 Letteragh Junction – 9.9km (Including the Parkmore Link Road and N59 Link Road North and South)
- Phase 2 – N59 Letteragh Junction to R336 Coast Road west of Bearna - 7.5km

2.5.3 Enabling Works

Enabling works are those generally undertaken to existing facilities in order to provide space or access for the permanent works and or construction. By their nature, these works must be complete before the main works can start. The timing of enabling works depends on the programmed start of the phase of main works that they are designed to enable. Some may start well in advance of the main construction activities.

Before the start of the main construction works, there will be elements of enabling and preparatory works, such as ground investigation, treatment of non-native invasive plant species and archaeological investigations within or immediately adjacent to the Lough Corrib cSAC, which are designed essentially to clear the ground for the main activities. These activities have been considered at this stage to ensure all necessary land and access is included within the proposed development boundary and all potential direct and indirect impacts considered.

2.5.4 Site Clearance and Preparation Works

Site clearance including vegetation clearance will be undertaken within the proposed development boundary. The clearance of vegetation including the treatment of non-native invasive plant species will be done in accordance with the Construction Environmental Management Plan (CEMP) in **Appendix C**.

Within the Lough Corrib cSAC, all areas of the site required for the construction of the proposed road development will be cleared down to ground level. Trees will be protected where practicable when construction accesses are formed. The presence and nature of items of heritage significance will be recorded and preserved where possible. Archaeological monitoring and investigations will also be undertaken in order to record and preserve any buried findings using the appropriate methods.

Access for ground investigation work and archaeological testing have been considered and are included within the proposed development boundary.

The diversion of utilities is not required within the Lough Corrib cSAC. There is no demolition of a structure within the Lough Corrib cSAC.

Surplus materials will be reused within the proposed road development where feasible and subject to appropriate testing to ensure it is suitable for its end use. Unavoidable wastes generated will be managed as outlined in the CEMP in **Appendix C**.

2.5.5 Fencing

At the beginning of the construction phase the land to be acquired as per the proposed development boundary will be fenced and access across it restricted. Temporary construction fencing or hoarding may be required during construction prior to the installation of permanent fencing to secure the site and prevent unauthorised access. Fencing will be erected from the proposed road side of the fence. In areas where the proposed development boundary includes Annex I habitat within Lough Corrib cSAC the permanent fencing will be located between the proposed road and the Annex I habitat and will not be located within the habitat areas.

Fence types will vary across the proposed road development depending on the different requirements and may be temporary in nature. Temporary fencing required to secure the construction site for the construction of the River Corrib Bridge will be outside the Lough Corrib cSAC on the western river bank and set back 10m from the bank edge. On the eastern bank and the other sections within or adjacent to the Lough Corrib cSAC the permanent fencing will be erected within the Lough Corrib cSAC prior to construction. Mammal proof fencing, related to the protection of Otter, will be provided as shown on **Figure 6**.

2.5.6 Site Offices and Compounds

Site preparation works will also include the provision of facilities for the contractors and the construction management team. The proposed locations of site compounds have been identified within the proposed development boundary as shown on

Figures 3.1 to **3.2**. There will be no site office or compound located within the Lough Corrib cSAC. There are two site compounds (SC 09/01 and SC 11/01) proposed to be located immediately adjacent to the boundary of the Lough Corrib cSAC.

Lackagh Quarry (Site Compound SC 11/01) will be one of the principal site compounds across the proposed road development, given its size and location in relation to the overall proposed road development. It is proposed to include a concrete batching and rock crushing plant at Lackagh Quarry. A rock crushing and grading plant may be included at any of the proposed site compounds with the exception of site compound SC 09/01. This has been considered in the potential impacts assessment. The appropriate authorisation for crushing plants such as waste facility permits will be obtained by the operator prior to commencement of the activity.

2.5.7 Main Construction Works

The main construction works will involve the excavation and placement of material for the construction of cuttings and embankments as well as the hauling of materials and importation/exportation of materials to complete the road formation for the proposed road development. Materials for the road construction will include materials that need to be brought to site including gravels and bituminous pavement and surfacing materials. In addition to the earthworks construction the main activities will involve the following:

- Road Works – sub-base and base construction, bituminous pavement, surfacing
- Drainage – the installation of pipe culverts, filter drains, linear grassed channels and wetlands
- Structures – the construction of retaining walls, piling works, construction of bridges and viaducts including their foundations, piers, abutments and the installation of large beams and other reinforced concrete works
- Tunnels – the construction of a mined (drill and blast) tunnel and a cut and cover tunnel
- Blasting – excavation of rock for cuttings and tunnels
- Ancillary roadworks including the installation of safety barriers, signage and road marking
- Accommodation works for landowners such as access roads, entrances, fences, gates, walls, ducting and reconnection of severed services
- Temporary traffic management

The main construction activities within or immediately adjacent to the Lough Corrib cSAC include the construction of:

- drainage measures including the N59 Link Road North Outfall (S15) and outfalls S18A and S18B
- the River Corrib Bridge

- retaining walls
- earthworks and pavement works
- the Menlough Viaduct
- the Lackagh Tunnel and its western approach

Each of these are discussed in more detail in the following sections

2.5.7.1 Drainage Outfalls

There are three drainage networks which discharge directly to the Lough Corrib cSAC, namely S15, which drains the proposed N59 Link Road North and outfalls to an existing drainage ditch which ultimately outfalls to the River Corrib (part of both the Lough Corrib cSAC and Lough Corrib SPA at this location), S18A and S18B which both directly discharge to the River Corrib.

Additionally, there are two road drainage networks (S14A and S14B) which outfall indirectly to the Lough Corrib cSAC via an existing stream[8] which flows to the west of Aughnacurra residential estate. The outfall from the proposed NUIG pitches (S44) will also outfall indirectly to the Lough Corrib cSAC via an existing stream which flows south of the existing pitches.

A working width of 15m is available for the construction of the above drainage networks to allow room for the necessary machinery and equipment to operate. The extent of the proposed development boundary does not include any Annex I habitat within the Lough Corrib cSAC in these areas.

The headwall at the outfalls in to the Lough Corrib cSAC will be constructed flush with the existing drainage bank. The headwall can be constructed using either a precast headwall or by casting the headwall in-situ. For either method, the construction process will be undertaken using standard best practices. Where the headwall will be constructed using a precast headwall, a temporary cofferdam structure can be constructed if necessary to allow the precast concrete headwall to be lowered into position. Where the headwall is to be cast in-situ, a temporary cofferdam will be constructed to allow the necessary ground works to be completed and to cast the headwall. This cofferdam is used to prevent any potential impact to the water quality of the river/stream/drainage ditch. Where any pumping of water is required, this water will go through environmental treatment to remove all pollutants before being reintroduced to the local surface water drainage network. Once the headwall has been constructed the temporary cofferdam is removed.

2.5.7.2 River Corrib Bridge

The River Corrib Bridge clear spans the river (i.e. with no piers in the river) and as such a balanced cantilever construction is proposed over the river section and the spans over the river banks. Due to the larger span, the superstructure structural depth is significantly larger at the pier locations and varies in depth along the span.

[8] It should be noted that a section of this stream is partially culverted through Ard na Locha and is referenced as a sewer on **Figure 2.6**.

This increases the construction complexity of the deck. Post-tensioned in-situ concrete deck can be built using travelling formwork over the river and side spans; and using falsework or travelling formwork on approach spans. There will be no in-stream works with the River Corrib. For full details of the proposed construction of the River Corrib Bridge see **Appendix D**.

2.5.7.3 Retaining walls adjacent to Lough Corrib cSAC

A retaining structure, reinforced soil embankment, between Ch 9+850 to Ch 10+050 will retain the proposed road development from encroachment on the Annex I habitat of the Lough Corrib cSAC. The construction of the retaining structure will be undertaken within the proposed development boundary and outside the areas of Annex I habitat. The reinforced soil embankment will be constructed using heavy plant machinery with the height of the retaining structure increasing at the same rate as the embankment height increases.

A combination of retaining systems will be implemented along the Western Approach and above the western tunnel portal at Lackagh Tunnel (Ch. 10+850 to Ch. 11+150) where the use of unsupported slopes is not used as they would encroach on areas of Annex I habitats. The retaining system type is governed by the ground conditions encountered at that particular location. Within this area the rock head level changes significantly, requiring retaining system solutions for shallow and deep rock ground conditions which can be constructed outside the Lough Corrib CSAC Annex I habitat.

The retaining systems constructed in this area include the following construction methodologies:

- In areas of shallow rock:

  The overburden will be removed followed by rock excavation which will be progressed in levels in a cyclic manner including drilling, blasting, rock mapping by a geotechnical expert and mucking out. A composite rock stability support system in the form of rock bolts, rock dowels, steel mesh and sprayed concrete will be implemented where required for stability on the rock face prior to excavation to the next excavation level based on the rock mapping results. A watertight reinforced concrete retaining structure will be constructed within the rock excavation cutting, generally at the base of the excavation (where the excavation is below +17.7mOD).

  Prior to undertaking this excavation, a detailed ground investigation, including down the hole geophysical survey to determine the rock mass geometry will be completed to inform the detailed design and ensure that this method is feasible. In the event that this method is not feasible a piled solution from surface level will be implemented, which is described below.

  A trial blast, as per the Schedule of Commitments and will be carried out as part of a blast assessment. The monitored trial blast will be undertaken in the same bedrock formation by the blasting contractor in a controlled location, not exceeding the vibration limitations of the local sensitive receptors, posing no risk to sensitive receptors including Annex I habitat in

Lough Corrib cSAC. The trial blast will calibrate the blast design to a site specific design.

- In areas of deep rock (overburden only) or a combination of overburden and rock:

  Piled retaining walls, with ground anchors will be implemented in these areas. The piled wall will be either a contiguous or secant piled wall. Both of these wall types are installed using the same rig and construction methods. A contiguous piled wall is not watertight as it is a linear series of individual piles whilst a secant piled wall can be designed to be watertight as it is a linear series of interconnected/overlapping piles. A watertight system is only required below +17.7mOD, therefore contiguous piled walls will be implemented with a watertight structure constructed within the excavation.

  The piles will be installed from the existing ground level prior to excavation works or from a reduced excavation level where potential impacts to the Annex I habitat in Lough Corrib cSAC can be avoided. The piling rig will be set up outside of the footprint of the Annex I habitat. Once the piles have been installed, the excavation of the overburden and bedrock will be completed. The bedrock will be broken using a hydraulic hammer or by blasting with the piled wall acting as an additional buffer to the rock blast.

  A watertight reinforced concrete retaining structure will be constructed within the excavation footprint where required.

  Prior to undertaking the piling works, a detailed ground investigation, will be completed to inform the detailed design and ensure it is site specific.

Each of these options has been considered and assessed throughout the assessment in **Sections 6** through **9** of this NIS.

2.5.7.4 Earthworks and pavement works

Topsoil and subsoil will be excavated and replaced with road construction. Stripped topsoil and subsoil will be stored within the site boundary and reused within the construction of the proposed road development where feasible subject to testing to ensure it is suitable for its proposed end use. Where off-site storage is required for any period the contractor will ensure that these storage facilities have the appropriate waste licences or waste facility permits in place. All earthworks shall be managed having regard to the TII Guidelines for the Management of Waste from National Road Construction Projects.

Materials will be transported to and from the site using the existing road network. Excavation and filling will be carried out using mechanical plant.

Road embankments will be constructed using excavated material or, where necessary, imported fill material and will generally be compacted using static and vibrating rollers or similar equipment.

The majority of the embankments will be constructed from self-supporting fill material. In some instances, steepened earthworks which shall have a vegetated

finish or reinforced soil or reinforced concrete retaining walls have been used in areas where the need for soil retention in a tighter space is required.

Paving will be undertaken throughout the extent of the proposed road development with the thickness of new paving layers to be in the order of 350mm. All new blacktop material will be transported to site in trucks designed for the transportation of materials at high temperatures. The material shall be transferred directly to paving machines, which spreads the blacktop onto the road in layers. The spread material is then compacted using rollers.

2.5.7.5 Menlough Viaduct

There are three alternative construction methods possible for constructing Menlough Viaduct to reduce the potential direct and indirect impacts to the Annex I habitat. The Menlough Viaduct is located outside but adjacent to the Lough Corrib cSAC and this area of Annex I habitat does not provide a supporting role to, nor form part of the QI for, this cSAC.

Construction Method 1 includes the construction of a protection system over the Limestone pavement and uses this as a construction platform and Construction Method 2 utilises the balanced cantilever system in conjunction with a protection system over the Limestone pavement. Construction Method 3 is a prestressed precast beam superstructure construction method. This method is similar to Method 1 and also includes a protection system over the Limestone pavement which will be provided. No construction works will take place directly within the extents of the Turlough for any of the three methods.

The stages of the construction under the proposed methodologies are as follows:

- Stage 1 - Site access and enabling works
- Stage 2 - Construction of the Limestone pavement protection system
- Stage 3 - Viaduct construction

All three construction methodologies are described in full in **Appendix E** and there is some scope to integrate the Method 1 and 2 to incorporate aspects of the cantilever method and to add false work if required.

Each of these three options has been considered and assessed throughout the assessment in **Sections 6** through **9** of this NIS.

A specialised sealed drainage system will capture the runoff on the bridge deck, transport it beneath the structure in a network of sealed carrier drains, before discharging to a wetland and infiltration basin at a suitable location located east of the viaduct.

2.5.7.6 Lackagh Tunnel

Excess excavated material can be hauled back to Lackagh Quarry site compound (SC 11/01) for temporary stockpiling after crushing and re-grading and used elsewhere on the proposed road development.

The construction activities for Lackagh Tunnel are split into three sections:

Section 1: Stabilisation of the Lackagh Quarry face

Section 2: Construction of the eastern entry portal

Construction of tunnel (from east to west) – Mined (drill and blast)

Stabilisation of the connection to Section 3 (Western Approach)

Section 3: Installation of retaining wall structures where required

Excavation of overburden

Installation of retaining wall temporary/permanent support

Construction of western approach road

The following construction sequence is envisaged. It is possible for Section 3 to be constructed in parallel with the construction of Sections 1 and 2

Stage 1:

- Site enabling and preparation works

Stage 2:

- Stabilisation of the Lackagh Quarry western face (Section 1)
- Construction of the tunnel entry portal (Sections 1 and 2)
- Installation of a retaining wall from existing ground level in Section 3

Stage 3:

- Construction of the proposed tunnel (Section 2)
- Ongoing installation of retaining wall from existing ground level in Section 3 and commencement of the excavation works (Section 3)

Stage 4:

- Excavation ongoing for Section 3
- Stabilisation of the rock along the Section 2/Section 3 boundary (if/where required)
- Completion of the proposed tunnel (Section 2)
- Construction of the proposed road (Section 3)

A detailed report of the constructability of Lackagh Tunnel and the Western Approach and its potential direct and indirect impacts is included in **Appendix F**.

The pre-earthworks drainage (PED) at the western tunnel portal at Lackagh Tunnel can be constructed outside Annex I habitat in Lough Corrib cSAC. The PED can be constructed from within the proposed road corridor prior to the earthworks construction. To minimise the footprint within the Lough Corrib cSAC the PED side slopes, a short length (circa 20m at Ch. 10+920 to Ch. 10+940) of PED ditch will be piped to carry flows from the adjacent catchments. This construction will be undertaken using an excavator.

2.5.8 Material Sources and Transportation

2.5.8.1 Overview

The earthworks operations will be a major activity on site and will include excavation, stockpiling, processing, deposition, blasting, material reuse, import and transportation from site for recovery/disposal. The construction of the proposed road development will require considerable movements of materials to, from and around the site. Most of the materials leaving the site will consist of spoil from the excavation works. Stockpiling of surplus materials will not be permitted on lands within any European site to avoid any potential impacts as a result of stockpiling.

The current design of the proposed road development has an overall surplus of excavation material west of the River Corrib and an overall deficit of fill material east of the River Corrib. All excavated material deemed to meet the required standards will be reused as part of the fill sections subject to testing to ensure it is suitable for its proposed end use.

If the proposed road development is to be constructed in phases as per **Section 2.4.2** above, then there will an overall surplus of 597,000m^3 in Phase 1 and overall deficit of 258,000 m^3 in Phase 2. Therefore, there will be a requirement to store excavated acceptable material from Phase 1 to balance the deficit in Phase 2. This material will be stored within the proposed development boundary and outside of any European site. All wastes which are not suitable for reuse within the proposed road development will be collected only by contractors with valid waste collection permits, under the Waste Management (Facility Permit and Registration) Regulations 2007 and (Amendment) Regulations 2008, 2014, 2015. All facilities to which waste will be taken will have appropriate waste licences or permits, under the Waste Management Act 1996 - 2011, and the regulations thereunder, allowing them to accept the type of waste that is to be sent there. Hazardous waste generation will be minimised, and such waste will be recovered where feasible, and only disposed of if recovery is not feasible. Hazardous waste will be managed in accordance with the relevant legislation.

By only using facilities with the appropriate waste permits/licence/certificates, Galway County Council/TII will ensure that the Contractor will comply with the objectives of the Waste Management Act and that any environmental emissions (noise, dust, water) are managed at the destination site and therefore are legally the responsibility of the owner/operator of the destination site. Galway County Council can thereby be satisfied that the off-site spoil management aspect of the development is legally compliant with environmental and waste management legislation.

All traffic movements associated with the transportation of materials have been included in the assessment.

Materials required for the construction works will be sourced locally where possible.

A Construction and Demolition Waste Management Plan is included in the CEMP in **Appendix C**. This plan meets the requirements of the *Best Practice Guidelines*

for the Preparation of Waste Management Plans for Construction and Demolition Projects (Department of Environment, Heritage & Local Government. 2006) and *TII Guidelines for the Management of Waste from National Road Construction Projects.* The contractor will be obliged to implement the Construction and Demolition Waste Management Plan.

The western section of the proposed road development is in a granite area as far as the N59 Moycullen Road and a limestone area east of here. The overburden across the study area consists of glacial till derived from the underlying bedrock which have different chemical compositions. If limestone derived material is placed over granite bedrock, surface water run-off or groundwater movements through the material have the potential to impact local areas of peatland habitats by changing the pH of the groundwater. Therefore, the following fill limitations will be incorporated, to prevent impact due to the placement of non-native construction materials:

- The use of fill material is limited where sites have a pathway to a European site
- Only pavement and capping layers protected from surface water runoff and groundwater movements are permitted to be derived from non-native material at sensitive locations

All other acceptable fill material will be derived from native material or other pH compatible material.

Rock crushing may be undertaken on site in order to make the excavated rock suitable for reuse as general fill. Otherwise it will be necessary to import crushed stone to site. Materials required from quarries will only be sourced from quarries which are listed on the register maintained by the local authority. There are operational quarries located in close proximity to the proposed road development. There is potential to import bituminous material for paving from one of these quarries. Haul routes have been identified to these quarries and any potential impacts associated with these haul routes have been assessed in this NIS.

2.5.8.2 Potential Haul Routes

Potential haul routes have been identified across the proposed road development with aim of minimising interaction with the general public and creating as little disruption to the receiving environment as possible. Where possible haul routes will remain within the proposed development boundary with local road crossing points. However, there will be unavoidable periods where haul routes will require the use of public roads. A number of the potential haul routes will cross a European site both on existing roads and within construction footprint for the proposed road development. The Galway Bay Complex cSAC will be crossed by two proposed haul routes along the existing R336 between Bearna and Knocknacarra. The Lough Corrib cSAC will crossed by two proposed haul routes on the existing N6 Quincentenary Bridge and on the existing Coolough Road. The Lough Corrib cSAC will also be crossed by haul routes within the proposed development boundary on the proposed River Corrib Bridge and at the proposed Lackagh Tunnel. Refer **Figures 3.1** to **3.2** for haul route locations.

2.5.9 Construction Site Decommissioning

On completion of construction, all construction facilities and equipment such as plant, materials, signage, contractors' offices, site compounds and laydown areas, etc. will be removed from site. All ground will be reinstated to an appropriate standard.

2.6 Design measures

The proposed road development has been designed in accordance with TII Publications. A summary of the key design measures of relevance to avoiding or reducing impacts to European sites are as follows:

2.6.1 Drainage

To maintain the existing hydrological regime and reduce the risk of impacts to water quality in receiving watercourses:

- Flow control measures will be provided at all outfalls and discharge points along the length of the mainline of the proposed road development to ensure discharge does not cause any adverse effects on flow rates upstream or downstream of the receiving watercourse or sewer and to allow sufficient time for infiltration to discharge to the ground
- There will be 'no worsening' of flow rates outside of the site boundary up to the 1 in 100 year storm event
- Due to the karstic nature east of the N59 Moycullen Road, a sealed drainage system is provided to protect the underlying sensitive groundwater aquifers
- The drainage design takes into account the distribution of groundwater bodies so that rainfall remains within the groundwater body to which it would naturally recharge
- Pollution control measures will be provided on all networks on the mainline of the proposed road development prior to outfalling/discharging to ensure that receiving water bodies are not contaminated by runoff from the proposed road development during the operational phase

2.6.2 NUIG Pitches

- These pitches will include netting behind the goal posts and flood lighting. These pitches will be designed by specialist 3G pitch designers to meet the following performance criteria:
    - The pitch will
    - drain via gravity to a series of fin and filter drains constructed beneath the surface of the pitch. This mimics the existing greenfield scenario, where rainfall discharges to ground
    - The filter drains will also have a positive outfall which in larger rainfall events will discharge indirectly to the River Corrib via an existing drain

- Any loosed particles in the surfacing build up (e.g. sand and rubber) will be prevented from entering the watercourse via the drainage system
- Maintenance of the surfacing layer will be carried out by an experienced specialist pitch maintenance team

2.6.3 Lighting

- The road lighting design shall meet the requirements of BS5489-1, IS EN 13201 and the UK DMRB TD 34-07 and TII addendum. This will ensure that light pollution is kept to a minimum
- The proposed road lighting installation has been considered and designed with limiting light trespass as a key priority
- There is no lighting associated with the River Corrib Bridge
- The flood lighting proposed for the NUIG Pitches will be designed to limit the extents of the light spill outside of the pitches to the appropriate level not to impact on the receiving environment

2.6.4 Fencing

To avoid any direct impacts on QI Annex I habitat within any European site:

- Within or adjacent to any European site the permanent or temporary fencing will be erected prior to construction of the proposed road development and any necessary advanced works including utility diversions, archaeological testing, management of non-native invasive plant species and ground investigations. Fencing will be erected from the proposed road side of the fence. In areas where the proposed development boundary includes Annex I habitat within Lough Corrib cSAC the permanent fencing will be located between the proposed road and the Annex I habitat and will not be located within the habitat areas.

Mammal resistant fencing will also be included, where required, to ensure that species such as Otter do not gain access to the proposed road carriageway. Mammal-resistant fencing will be installed in accordance with the specification outlined in *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (National Roads Authority, 2008b) and TIIs mammal resistant fencing specification (currently CC-SCD-00320/00319).

2.6.5 Location of site compounds and storage areas

- Construction site compounds or site offices will not be located within any European site
- No stockpiles will be located within a European site. Note there are sufficient lands included with the proposed development boundary[9] for any necessary stockpiles
- No stockpiles will be located within an active floodplain area

[9] The proposed development boundary is the extents of the lands to be acquired for the proposed road development

- Material handling systems and site stockpiling of materials will be located at least 50m away from Annex I habitat within a European site

2.6.6 Hydrology

To maintain the existing hydrological regime and reduce the risk of impacts to water quality in receiving watercourses:

- The road drainage design provides a wetland system which promotes settlement of suspended particles followed by an attenuation/infiltration basin area upstream of all outfalls to prevent the accumulation of sediment picked up in road runoff. These ponds have been designed to provide primary settlement of sediments and to throttle storm flow runoff to greenfield flood runoff rates. All of these hybrid pond systems will be designed with silt traps and fitted with a hydrocarbon interceptor. Each pond will be fitted with a penstock system for isolation and containment of storm runoff waters in the event of a serious road spillage. The system of ponds will remove the more settleable sediment material with treatment performance of over 60% removal of sediment from the storm water discharge. This minimises the potential for local accumulation of sediment at the outfall locations with finer sediment being capable of wider dispersal in the receiving waters and avoiding any local impact
- There are no direct storm water discharges to the Coolagh Lakes
- The proposed road development has been designed so as to minimise the loss of flood zone area associated with the River Corrib and Coolagh Lakes. The deck of the proposed River Corrib Bridge is elevated above flood levels and the supporting piers are located outside of the flood risk area. Refer to Section 5.2.2 and 5.2.4 of **Appendix B** of the NIS for further details

2.6.7 Hydrogeology

To maintain the existing hydrogeological regime and reduce the risk of impacts to groundwater quality in receiving groundwater bodies:

- There will be no groundwater lowering within groundwater bodies that support groundwater dependant habitats within a European site
- All infiltration basins include pre-treatment by a hydrocarbon interceptor and a wetland. All infiltration basins include a containment area to provide an appropriate holding time to contain accidental spillages
- All infiltration basins will be over excavated by 2m to accommodate the provision of a minimum of 2m thickness of appropriate subsoil (as per TII definition in HD45/15). In combination with the wetlands the design of the infiltration basins, provides an appropriate level of protection to prevent contamination of groundwater from the infiltration basins
- Where required, dewatering will be discharged to ground within the same groundwater body so as to maintain the existing hydrogeological regime
- The design of the proposed road development does not allow dewatering of the bedrock aquifer to be undertaken in sensitive locations, namely Lackagh Tunnel

and its western approach and the Menlough Viaduct, where there is risk of affecting the extent of groundwater bodies linked to a European site and affecting the position of groundwater divides

2.6.8 Lackagh Tunnel

To avoid construction of the Lackagh Tunnel affecting QI Annex I habitats above in Lough Corrib cSAC or affecting the existing hydrogeological regime supporting wetland habitats in Lough Corrib cSAC:

- The Lackagh Tunnel is a mined (drill and blast) twin bored tunnel within rock located beneath the Lough Corrib cSAC
- The tunnel alignment and separation includes the following:
  - each bore maintains at least 8.0m clear rock above the crown of the tunnel to the top of the Lough Corrib cSAC ground surface
  - a 7m wide pillar separating the twin bores
- Stabilisation of the western quarry face will be completed in advance of tunnelling works including a composite support system of rock bolts, rock dowels, steel mesh and sprayed concrete
- Blast design and limitations are set out and include:
  - A conservative design approach vibration assessment determined that a maximum vibration limit of 25mm/sec at the ground level will pose no risk to habitats within Lough Corrib cSAC. A target construction blast vibration limit of 20mm/sec shall be implemented ensuring the maximum vibration limit is not exceeded and that blasting will pose no risk to habitats within Lough Corrib cSAC. A monitored trial blast shall be undertaken in the same bedrock formation by the blasting contractor in a controlled location that will pose no risk to sensitive receptors, including habitats within Lough Corrib cSAC. The trial blast will not exceed the vibration limitations of the local sensitive receptors and therefore pose no impact. The information obtained from the trial blast will calibrate and refine the blast design to a site specific design
- The infiltration basin in Lackagh Quarry has been designed to retain the natural recharge pattern by maintaining recharge to the groundwater body below
- In order to maintain recharge catchments, any inflows into the tunnel during construction will be managed by designing them to infiltrate to the floor of the tunnel until their inflow is sealed off
- All construction works will remain above the groundwater table for the duration of the works to ensure the groundwater table is not intercepted and dewatering of the bedrock aquifer is not required. The construction schedule will be tailored so that the excavation of the lower section will occur only during the groundwater low when the water table is below the construction level
- The tunnel will be fully lined with concrete

- On the western approach to Lackagh Tunnel a watertight seal will be installed on the underside of the road base and the cutting sides to protect against groundwater inflow and prevent contamination of groundwater
- Retaining systems are included at pinch point locations to prevent encroachment on Annex I habitats
- The retaining walls on the western approach will be watertight to a level of +17.7mOD to seal out any groundwater in the subsoil or bedrock and will prevent contamination of groundwater

2.6.9 River Corrib Bridge

- The River Corrib Bridge is a clear span across the river with no instream piers
- The bridge design consists of an elevated deck across the floodplain with a minimum clearance of 8.0m over the river
- The River Corrib Bridge will be constructed using a combination of two different construction methods as outlined in **Appendix D**

2.6.10 Retaining walls adjacent to Lough Corrib cSAC

To avoid any direct impacts on QI Annex I habitat within Lough Corrib cSAC:

- The construction of the retaining wall will be undertaken within the proposed development boundary and outside the areas of Annex I habitat and constructed as outlined in **Section 2.5.7.3** above

2.7 Maintenance during Operational Phase

The proposed road development will form part of the TII maintenance contracts and all elements including the drainage will be maintained on a regular basis to ensure all elements function as per their design and achieve the required standards.

3 Consultations

3.1 National Parks and Wildlife Service (NPWS)

Six meetings have been held by the project team with the National Parks & Wildlife Service (NPWS) section of the Department of Culture, Heritage and the Gaeltacht (formerly the Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, and previous to that, the Department of Arts, Heritage and the Gaeltacht): on 2 July 2014, 26 March 2015, 24 February 2016, 29 March 2017, 18 April 2017 and 3 August 2017. A formal consultation response related to the informal EIS Scoping Report was received from the Department of Arts, Heritage and the Gaeltacht on the 10 August 2016 and two documents related to the draft EIA Report and NIS on the 16 and 18 January 2018 (Ref. G Pre00241/2016).

In summary, discussions with the NPWS were broad ranging covering general requirements and process relating to scoping and preparation of the EIA Report and NIS, the ecological baseline surveys and findings, valuing ecological receptors, mitigation, impact assessment, conservation objectives, derogation licences, supporting land use plans and transportation strategies and the Lough Corrib cSAC boundary and QIs. The NPWS made the following comments/observations relevant to the preparation of the NIS and the appropriate assessment process, and also provided notes on a copy of the NIS:

- The NIS must include a full description of the proposed road development
- The relevant land use plans must be assessed for the potential in combination effects
- The ecological surveys should be scoped and designed to answer the questions posed by the Habitats Directive, and related case law, noting the tests and standards that apply
- The NIS assessment should focus on the QIs and SCIs of European sites (and supporting habitats) and the full scope of the conservation objectives; including, where available, site specific conservation objectives (site specific conservation objectives are not yet available for Lough Corrib SPA)
- Where site specific conservation objectives are not available, the current conservation objectives which are generic, as well as the attributes and targets from the conservation objectives from other sites should be used as a guide - using “restore” rather than “maintain” as a conservation aim as a precautionary approach
- Mitigation measures and strategies need to be fully developed and sufficiently detailed to meet the current legal requirements and standards
- The importance and scope of the plans and projects that are considered in the combination assessment
- The NPWS confirmed (at the meeting on 26 March 2015) the addition of the Annex I habitat Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* [3130] to the list

of QIs of Lough Corrib cSAC. There are no proposals to add any additional QIs to this cSAC

- The NPWS are in the process of updating the digital mapping datasets into the ITM projection on modern OSI mapping. For European sites where this has not yet been completed, presenting the boundary of European sites on mapping included in the NIS should be based upon an interpretation of its location relative to its intended location on the official 6" mapping (relative to the topographical features it follows on that mapping dataset)
- The appeals process to formally finalise designated status and the boundary of Lough Corrib cSAC is ongoing and the NPWS are not aware of any plans to modify or extend the boundary of Lough Corrib cSAC in the vicinity of the proposed road development
- Confirmed that the QI population for the Lesser horseshoe bat in Lough Corrib cSAC was the maternity roost at Eborhall House (roost 217 in the NPWS database), on the northern shore of Lough Corrib, near Cong, Co. Mayo
- The requirements and procedures to be followed if compensatory measures are required as part of any planning application under the provision of Article 6(4) of the Habitats Directive
- If monitoring/supervision of mitigation measures is required it must be included in the NIS

As evident throughout the NIS, these recommendations have been taken on board and implemented throughout the examination and analysis of this NIS.

3.2 Inland Fisheries Ireland (IFI)

Two meetings were held with IFI to discuss the value of watercourses crossed by the proposed road development for fish species: the first on 14 August 2014 at the Route Selection phase of the project, and the second on 15 September 2016 to discuss the design of the proposed road development.

During these meetings, and in correspondence related to same, IFI made the following observations in relation to the value of the River Corrib catchment for fish and the QIs Atlantic salmon, Sea lamprey and Brook lamprey:

- The River Corrib is a nationally important river system for Atlantic salmon
- IFI have observed Sea lamprey scaling the Salmon Weir and spawning in the upper catchment at Cong – this contradicts some published sources which stated that the species was thought to be restricted below the Salmon Weir in Galway City
- IFI had no records of spawning grounds at the proposed watercourse crossing points along the proposed road development

4 Methodology

4.1 Guidance

This report has been prepared with regard to the following guidance documents on Appropriate Assessment, where relevant:

- *Appropriate Assessment of Plans and Projects in Ireland - Guidance for Planning Authorities* (Department of Environment, Heritage and Local Government, 2010 revision)
- *Appropriate Assessment under Article 6 of the Habitats Directive: Guidance for Planning Authorities.* Circular NPWS 1/10 & PSSP 2/10
- *Assessment of Plans and Projects Significantly Affecting Natura 2000 sites: Methodological Guidance on the Provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC* (European Commission Environment Directorate-General, 2001 and draft update April 2015). The guidance within this document provides a non-mandatory methodology for carrying out assessments required under Article 6(3) and (4) of the Habitats Directive
- *Managing Natura 2000 Sites: The Provisions of Article 6 of the Habitat's Directive 92/43/EEC* (EC Environment Directorate-General, 2000) and
- *Communication from the Commission on the precautionary principle*. European Commission (2000)

Other general guidance on ecological impact assessment which has informed the assessment in this report, includes:

- *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition* (CIEEM, 2016)
- *Guidelines on the information to be contained in Environmental Impact Assessment Reports* (Environmental Protection Agency, Draft August 2017)
- *Guidelines on the Information to be contained in Environmental Impact Statements* (Environmental Protection Agency, 2002)
- *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements* (Environmental Protection Agency, 2003)
- *Advice notes for Preparing Environmental Impact Statements* (Environmental Protection Agency, Draft September 2015)
- *Environmental Guidelines Series for Planning and Construction of National Roads* (National Roads Authority, 2005-2009), and
- *Environmental Impact Assessment of National Road Schemes – A Practical Guide* (National Road Authority, 2008a)
- *Guidelines for Assessment of Ecological Impacts of National Roads Schemes* (National Road Authority, 2009)
- *Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment* (European Union, 2013)

- *Environmental Impact Assessment of Projects Guidance on the preparation of the Environmental Impact Assessment Report* (European Union, 2017)

4.2 Desk Study

The desktop data sources are listed below:

- The results of ecological surveys undertaken as part of the route selection study (*N6 Galway City Transport Project: Route Selection Report* (Arup, 2016)[10]) and EIA studies for the N6 Galway City Ring Road (see **Section 4.4** and **Section 9** below for details)
- The results of bird surveys carried out for the 2006 N6 Galway City Outer Bypass EIS (RPS, 2006)
- Ordnance Survey of Ireland mapping and aerial photography available from www.osi.ie
- Online data available on European sites, including habitat and species GIS datasets, and conservation objectives (and supporting) documents, as held by the National Parks and Wildlife Service (NPWS) from www.npws.ie
- Online protected species datasets held by the National Biodiversity Data Centre from http://maps.biodiversityireland.ie
- Environmental information/data for the area available from www.epa.ie (Envision Online Environmental Map Viewer - http://gis.epa.ie)
- Information on the status of EU protected habitats and species in Ireland (National Parks & Wildlife Service, 2013a, 2013b and 2013c)
- Water Framework Directive Fish Stock Survey of Lough Corrib, June 2014 (Kelly *et al.* 2014)
- Corrib Estuary: Sampling Fish for the Water Framework Directive – Transitional Waters 2008 (The Central and regional Fisheries Board, 2009)

4.3 Assessment Methodology

The proposed road development (including the proposed design, construction methodologies and operational effects) was analysed and assessed to identify the potential impacts associated with the proposed road development that could affect the ecological environment. From this, the Zone of Influence (ZoI) of the proposed road development was defined. Based on the identified impacts, and their ZoI, the European sites potentially at risk of any direct or indirect impacts were identified. This assessment was undertaken in consideration of all potential impact sources and pathways connecting the proposed road development to European sites, in view of the conservation objectives supporting the conservation condition of the sites' QIs/SCIs.

[10] The Route Selection Report is available from http://www.n6galwaycity.ie

The conservation objectives relating to each European site and its QIs/SCIs are expressed generally for cSACs as "to maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the cSAC has been selected", and for SPAs "to maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA".

Following on from this, and as defined in the Habitats Directive, favourable conservation status (or condition, at a site level) of a habitat is achieved when:

- *its natural range, and area it covers within that range, are stable or increasing, and*
- *the specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future, and*
- *the conservation status of its typical species is favourable*

The favourable conservation status (or condition, at a site level) 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, and*
- *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*

Where site-specific conservation objectives have been prepared for a given European site, these include a series of specific attributes and targets against which effects on conservation condition, or integrity, can be measured, i.e. an impact which affects the achievement of favourable conservation condition, as measured by the attributes and targets, is an impact on site integrity. In the case of many SACs/SPAs, site-specific conservation objectives are not available, or have not been published. Where that is the case, and as recommended by the NPWS (see **Section 3.1**) sample site specific attributes and targets for a given QI/SCI have been compiled, based on those from other relevant European sites, as a guide in assessing how conservation condition could potentially be affected by the proposed road development.

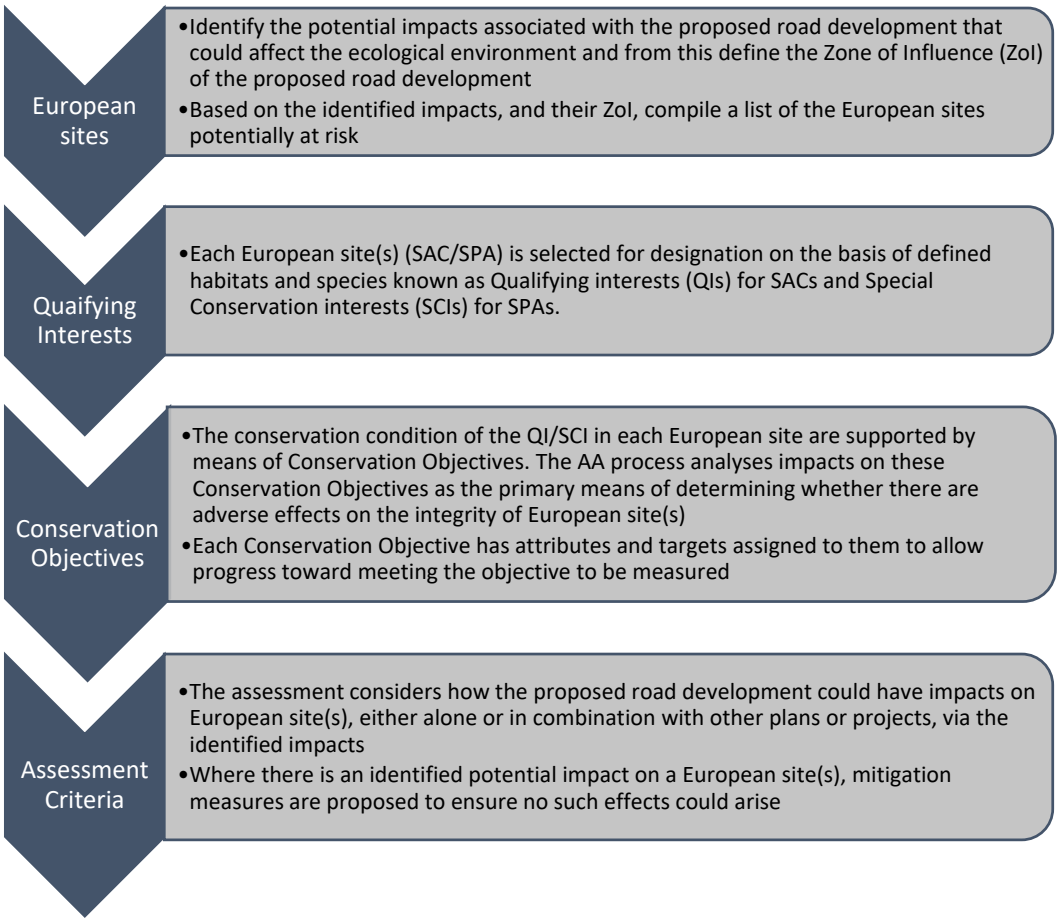
In the case of some QIs/SCIs in certain European sites, the conservation objective is to restore rather than maintain conservation condition and this distinction is taken into account in the assessment; as is any legacy damage to European sites that has occurred since their designation, insofar as possible.

Having ascertained during the screening that the proposed road development is either likely to have a significant effect on a European site(s), or that any such likelihood is uncertain or cannot be ruled out, this NIS has been prepared to inform and assist the competent authority, An Bord Pleanála, in carrying out its Appropriate Assessment as to whether or not the proposed road development will

adversely affect the integrity of European sites either alone or in combination with other plans and projects, taking into account the conservation objectives of the European sites.

To the extent that the assessment carried out as part of the preparation of this NIS found that the proposed road development has the potential to impact on four European sites, avoidance and mitigation measures have been included as part of the proposed road development to ensure that, in view of the European sites' conservation objectives and beyond reasonable scientific doubt, the proposed road development will not adversely affect the integrity of the sites concerned.

This process is summarised in the diagram below.



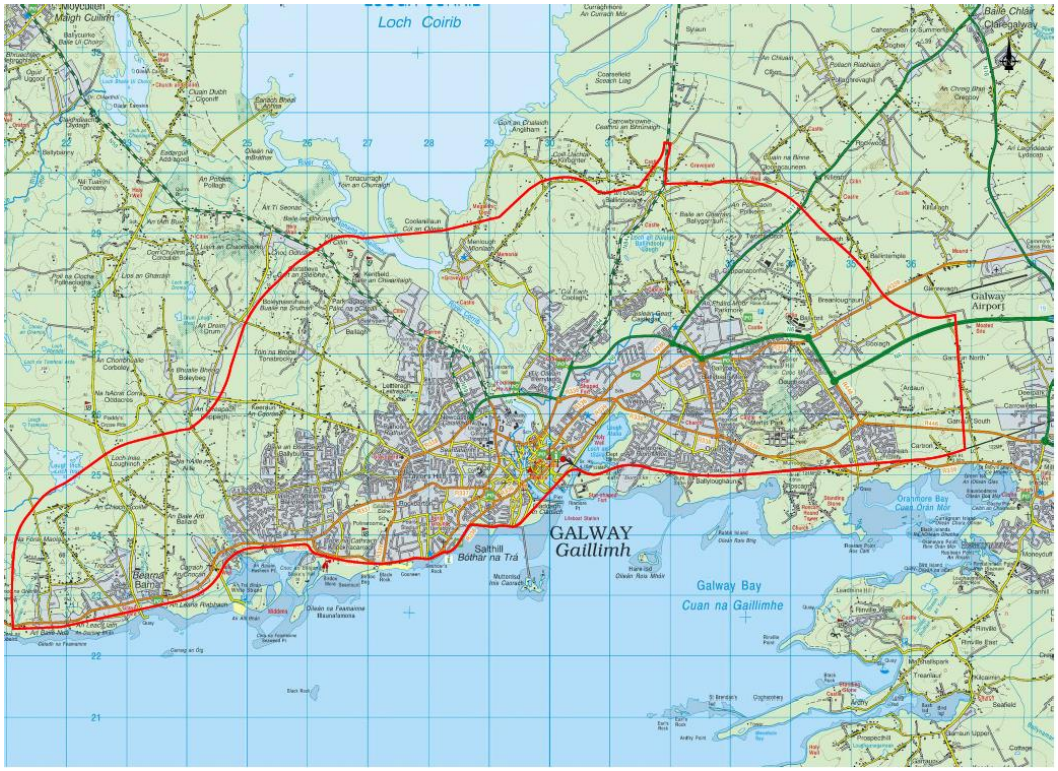
4.4 Baseline Surveys

The following section describes the various surveys that were carried out to inform this assessment. The results of these surveys are presented in **Section 5** and **Section 9** of this NIS, with further detail provided where necessary in **Appendices A** to **G**.

The term "scheme study area", when used, refers to the wider study area at which ecological constraints were initially identified during the constraints and route selection studies for the proposed road development (see **Plate 4.1** below for the extents of the scheme study area with further details of coverage for the various survey types shown on **Figures 4.1** and **4.2**). This is the study area across which

many of the ecological surveys undertaken to inform this project were initially carried out. For some ecological receptors, the surveys extended beyond the area defined by the "scheme study area", where necessary. For many of the ecological receptors, surveys were also carried out within a more restricted study area; focussed on assessing potential direct and indirect impacts within the Zone of Influence (ZoI) of the proposed road development, as set out in **Section 7** of this NIS.

Plate 4.1: Scheme Study Area



4.4.1 Ecological Surveys

This section provides an outline of the various ecological survey methodologies used to collate baseline ecological information in the preparation of this report.

The scoping exercise undertaken for the constraints and route selection studies for the proposed road development identified numerous sensitive ecological receptors within the scheme study area (See **Plate 4.1**) that could potentially be impacted by a road development. As a result, EIA level surveys for many of these ecological receptors were undertaken, during the constraints and route selection studies for the proposed road development. However, many of these surveys were carried out over a larger survey area (within the scheme study area) and at a resolution appropriate to gathering information to inform route selection. Therefore, additional surveys for the EIA/NIS stage of the project were undertaken in subsequent seasons/years at a resolution appropriate to gathering information to inform EIA and NIS, as well as to supplement the information already gathered and to fill any gaps, spatially, in the ecological baseline datasets. Where multiple surveys were carried out for a particular ecological receptor, over a number of survey seasons or covering different geographic locations, they are described below in chronological order.

Preparation for the NIS assessment involved a review of the ecological baseline information gathered for the constraints and route selection studies for the proposed road development to identify any ecological data gaps to fully assess the effects of the proposed road development on European sites. The approach and scope of the ecological surveys were developed with the questions and test posed by the Habitats Directive, the supporting national legislation and relevant case law, and the conservation objectives of European sites potentially affected by the proposed road development in mind. Extensive field surveys were designed and carried out over a number of years by teams of experts with the specific intention of identifying ecological constraints and avoiding impacts with regard to the surrounding European sites.

A summary of the ecological surveys which informed the preparation of this NIS are provided in **Table 4.1**.

Table 4.1: Ecological Surveys and Survey Dates between 2013 and 2017

Survey	Survey Date(s)	Surveyor(s)
Habitat surveys:		Botanical, Environmental & Conservation (BEC) Consultants Ltd., Scott Cawley Ltd. and various independent botanists including Dr Joanne Denyer, Dr John Conaghan, Dr Janice Fuller, Katharine Duff, Eamon O'Sullivan, Roger Goodwillie, Dr Cilian Roden, Michelle O'Neill and Mary O'Connor.
• Lough Corrib cSAC – Selected Locations	July to September, 2013	
• Petrifying springs survey	March to June, 2014	
• Lough Corrib candidate Special Area of Conservation (cSAC) Study Area	May to September, 2014	
• Ecological Sites [11]	June to October, 2014	
• Aquatic habitats	June to September, 2014	
• Lackagh Quarry Petrifying spring survey	June 2015	
• EIA Habitat surveys	September to December, 2015 July to October 2016 May 2017 to January 2018	
Protected plant species:		
• Slender naiad *Najas flexilis*	June to September, 2014	Dr Cilian Roden
• Varnished hook-moss *Hamatocaulis vernicosus*	September 2014	Dr Rory Hodd
Otter survey (River Corrib and Coolagh Lakes)	April and May, 2014	Scott Cawley Ltd.

[11] Ecological Sites, in this case, are sites of potential ecological value for the habitats present: i.e. determined to be at least of a Local Importance (higher value) (*Guidelines for Assessment of Ecological Impacts of National Roads Schemes* (National Roads Authority, 2009). The boundaries of the Ecological Sites were initially defined based on interpretation of orthophotography and collation of available existing habitat information, in conjunction with a ground truthing exercise to verify the orthophotography interpretation. These boundaries were then refined, where appropriate, based on the findings of the various habitat surveys undertaken.

Survey	Survey Date(s)	Surveyor(s)
Mammal survey (excluding bats)	April to June and October/November, 2015 October 2016 October/November 2017	Scott Cawley Ltd. and Dr Chris Peppiatt
White-clawed crayfish survey	September, 2014	Scott Cawley Ltd. and Dr Julian Reynolds
Molluscan surveys (includes Freshwater pearl mussel and *Vertigo* snail species surveys)	August, 2014 October, 2017 (two additional molluscan sites)	Dr Evelyn Moorkens and Dr Ian Killeen
Breeding bird surveys	May and June, 2015 June 2016	Dr Chris Peppiatt, Gerry Murphy, John Small
Wintering bird survey	September, 2014 to March, 2015	Scott Cawley Ltd., Dr Chris Peppiatt, Gerry Murphy, John Small and Tom Cuffe.
Fish surveys (including assessment of biological water quality status)	September 2015	Triturus Environmental Services Ltd.

4.4.1.1 Habitat Surveys

Habitat surveys for the proposed road development were carried out between 2013 and 2017: from initial surveys which targeted specific areas, to a full habitat survey of all areas of Lough Corrib cSAC and Lough Corrib SPA within the potential zone of influence of the proposed road development.

The initial phase, carried out between July and September 2013, included a habitat mapping survey focussed on a few key sites in the Ballygarraun area (outside of any European sites and therefore, the results are not directly relevant to this assessment) along with a survey of the wider area for the priority Annex I habitat Petrifying springs with tufa formation (*Cratoneurion*) [*7220].

The full terrestrial extent of Lough Corrib cSAC, from Coolanillaun to the Nuns Island/Waterside area in Galway City, was surveyed between March and September 2014 in tandem with wider scale surveys of aquatic habitats (which included all freshwater areas in Lough Corrib cSAC within this zone) and defined ecological sites across Galway City and its environs. The River Corrib and Coolanillaun upstream of the pier in Menlough also lie within Lough Corrib SPA. Follow up surveys were carried out in 2015, 2016 and in 2017 to verify the baseline information gathered in 2014 and to fill in any gaps in the habitat data. A dedicated survey of Lackagh Quarry for the priority Annex I Petrifying springs habitat was carried out in June 2015 (an area not covered during the 2013 survey).

Habitat Surveys (2013)

Lough Corrib cSAC – Selected Locations

A habitat survey was carried out by BEC in 2013 to classify the habitats present at areas of Limestone pavement at Ballygarraun (to the east of the currently defined

Lough Corrib cSAC study area – see **Figure 4.2**). The habitat map and data from this survey was incorporated into the results from the 2014 surveys (see below).

The full survey report was published in 2015 as part of the route selection report for the scheme (see Appendix A.4.2 Ecological Constraints Report – Appendix B of Arup, 2016(Perrin, 2014)). Some revisions to the habitat boundaries were made in 2017 following further walkover surveys and the report was updated accordingly and is presented in **Appendix G**.

Habitat Surveys (2014)

Petrifying Springs Survey

A dedicated survey for this priority Annex I habitat type – Petrifying springs with tufa formation (Cratoneurion) – was carried out by Botanical, Environmental & Conservation Consultants Ltd. (BEC) in 2014. A combination of desktop review and Geographic Information System (GIS) analysis was used to define the survey sites, which were then visited to establish the presence/absence of a petrifying spring feature. This was supplemented by the additional habitat survey work carried out in 2014 and 2015, as described below. Surveys in 2014 did not include Lackagh Quarry; an area that was subsequently surveyed in 2015 – see 2015 Habitat Surveys section below for details. The full survey report was published in 2015 as part of the N6 Galway City Transport Route Selection Report (Arup, 2016) (see **Appendix A.4.2** Ecological Constraints Report.

Lough Corrib cSAC Survey Area

Habitat surveys were carried out by BEC and Wetland Surveys Ireland Ltd. from May to September 2014 within the Lough Corrib cSAC habitat survey area (the full report is included in **Appendix G**). The extent of the Lough Corrib cSAC habitat survey area is shown on **Figures 4.1** to **4.2**. The survey methodology comprised two stages: Stage 1 comprised mapping to level 3 of the Heritage Council habitat codes (Fossitt, 2000) with areas of Annex I habitat also being identified; for Stage 2, all polygons were revisited and indicator species recorded, a rapid quality-assessment score was attributed to each polygon which contained an Annex I habitat type, and relevé data was collected across the survey area to support the habitat classification given during the mapping exercise and to provide additional data on the conservation value of habitats. All habitat polygons were also attributed with an ecological valuation as per the criteria set out in Guidelines for Assessment of Ecological Impacts of National Roads Schemes: Revision 2 (National Roads Authority, 2009).

The conservation condition of each Annex I habitat within this survey area was assessed. The assessment was based on publications available from the National Parks and Wildlife Service (NPWS) (see *Annex I Habitat Classification* section below for references) and on the approach used for the national conservation assessment of Annex I habitats, which is carried out according to guidelines published by the EU (Evans & Arvela, 2011).

Assessment criteria were available from NPWS for the majority of the Annex I habitats recorded but where not available, the criteria relating to similar habitats were used. Annex I habitats were defined with reference to recent national studies

co-ordinated by NPWS and the Interpretation manual of European Union Habitats EUR28 (CEC, 2013). Vegetation communities were assigned to Annex I habitat areas based on the relevé data gathered and on published definitions. In cases where published vegetation community definitions were not available, novel classifications were assigned.

The full details of the survey and assessment methodologies used - including the assessment criteria, Annex I habitat definitions, and vegetation community classifications – are described in the survey report included in **Appendix G**.

Ecological Sites

The aim of the ecological sites habitat survey was to describe, classify and map the habitats of the Ecological Sites based on the Heritage Council classification (Fossitt 2000), with particular emphasis on habitats conforming to Annex I habitats (as listed in the EU Habitats Directive), and to assess their ecological importance. Any plant species of restricted distribution and ecological importance were noted.

Ecological Sites, in this case, were sites of potential ecological value; the boundaries of which were initially defined based on interpretation of orthophotography and collation of available existing habitat information, in conjunction with a ground truthing exercise to verify the orthophotography interpretation. These boundaries were then refined, where appropriate, based on the findings of the various habitat surveys undertaken.

The surveys were carried out by Dr Joanne Denyer, Dr John Conaghan, Dr Janice Fuller, Katharine Duff and Eamon O'Sullivan from the 15 June to the 15 October 2014. The locations of the Ecological Sites surveyed are shown on **Figures 4.1** to **4.2**.

Annex I Habitat Classification

Reference was made to the Interpretation manual of European Union Habitats EUR28 (CEC, 2013), and the National and Regional habitat survey reports, in terms of the criteria for classifying the different Annex I habitats and assessing their conservation condition:

- *Turloughs over 10 ha: vegetation survey and evaluation* (Goodwillie, R., 1992)
- *Turlough Hydrology, Ecology and Conservation* (Waldren, S. 2015, Ed.)
- *Summary of findings from the Survey of Potential Turloughs 2015* (O'Neill, F.H. & Martin, J.R., 2015)
- *The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78* (O'Neill et al., 2013)
- *Results of monitoring survey of old sessile oak woods and alluvial forests. Irish Wildlife Manuals, No. 71* (O'Neill, F.H. & Barron, S.J., 2013)
- *National Survey of Native Woodlands 2003-2008 - Volumes I and II* (Perrin et al., 2008).
- *National survey of limestone pavement and associated habitats in Ireland. Irish Wildlife Manuals, No. 73* (Wilson, S. and Fernández, F., 2013)

- *Coolagh Lakes, Lough Corrib SAC, Co. Galway: Wetland Survey and Conservation Assessment* (Crushell, P. & Foss, P., 2014a: unpublished report)
- *Coolanillaun Bog, Lough Corrib SAC, Co. Galway: Wetland Survey and Conservation Assessment* (Crushell, P. & Foss, P., 2014b: unpublished report)
- *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. Irish Wildlife Manuals, No. 79* (Perrin et al., 2014)
- *Monitoring Guidelines for the Assessment of Petrifying Springs in Ireland* (Lyons & Kelly, 2016)

Assessment criteria for *Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae [7210] which were developed during the Constraints Study (by Crushell and Foss 2014a and 2014b) were used. The Annex I habitats surveyed are listed in **Table 4.2**.

Table 4.2: Annex I habitats recorded across the scheme study area, the reference for assessment criteria used, and size of the assessment relevé

Annex I Habitat Code	Habitat Name [1]	Reference	Relevé size (metres)
1220	Perennial vegetation of stony banks	n/a	n/a
1330	Atlantic salt meadows	McCorry & Ryle (2009)	2x2
4010	Wet heath	Perrin et al. (2014)	2x2
4030	Dry heaths	Perrin et al. (2014)	2x2
6210 *6210	Orchid-rich calcareous grassland (* important orchid sites)	O'Neill et al. (2013) O'Neill et al. (2013)	2x2 2x2
*6230	Species-rich *Nardus* upland grassland	O'Neill et al. (2013)	2x2
6410	Molinia meadows	O'Neill et al. (2013)	2x2
6430	Hydrophilous tall herb	O'Neill et al. (2013)	2x2
6510	Lowland hay meadows	O'Neill et al. (2013)	2x2
*7130	Blanket bog (active)*	Perrin et al. (2014	2x2
7140	Transition mires	Perrin et al. (2014)	2x2
7150	Rhynchosporion depressions	Perrin et al. (2014)	2x2
*7210	Cladium fen*	Crushell & Foss (2014a & 2014b); criteria developed for GCTP project	2x2
*7220	Petrifying springs*	Lyons & Kelly (2016)	n/a
7230	Alkaline fens	Perrin et al. (2014, 2010)	2x2
*8240	Limestone pavement*	Wilson & Fernández (2013)	5x5
*91E0	Residual alluvial forests	O'Neill & Barron (2013)	

Annex I Habitat Code	Habitat Name [1]	Reference	Relevé size (metres)
*3180	Turloughs*	Goodwillie (1992) Waldren, (2015, Ed.)	2x2

[1]Abbreviated Annex I habitat names are after NPWS (2013a & 2013b), full Annex I habitat titles are available in *Interpretation manual of European Union Habitats EUR28 (*CEC**,** 2013)

Field sheets were prepared in advance for recording site notes and habitat descriptions, which included conservation condition assessment criteria. Vascular plant nomenclature follows that of the New Flora of the British Isles 3rd Edition (Stace, 2010); bryophyte nomenclature follows the Checklist of British and Irish bryophytes (BBS, 2009).

Ecological Evaluation

The ecological importance of habitats was assessed using the criteria listed in the Guidelines for Assessment of Ecological Impacts of National Roads Schemes (NRA, 2009). For Annex I habitats recorded, a further rapid quality assessment of the Annex I habitat (scale 1, 2, or 3) was made, based on the following criteria, whereby:

1 = the habitat was a poor example of the Annex I habitat.

2 = the habitat was a good example of the Annex I habitat

3 = the habitat was an excellent example of the Annex I habitat

Field Survey

Field survey maps were prepared from aerial photographs of the Ecological Sites (1:5,000 scale minimum). The Ecological Sites were subject to a walkover survey by experienced botanists. Each habitat present was described and classified (after Fossitt for non-Annex habitats or for Annex I habitats, as per NPWS guidance from the relevant national Annex I habitat monitoring reports) and the main plant species were listed on the habitat recording form. The habitat extent was mapped onto the aerial photograph, with GPS points taken where a habitat extent could not clearly be identified from the aerial photograph. For each Annex I habitat type encountered, a relevé(s) was (were) taken using a prepared form. The relevé size was $2m^2$ for all Annex I habitats except for woodland, which was $5m^2$. The relevé form included a habitat condition assessment based on criteria which were drawn from the relevant national habitat surveys for the National Parks and Wildlife Service (NPWS). Where applicable, the Annex I habitat was assigned to a vegetation community.

A photographic record of the habitats and relevé(s) for each ecological site was taken; two photos per relevé – one for the relevé and one for a view from the relevé. Notes on management, threats and habitat condition were also taken.

For each Ecological Site, the following were completed:

a) Site form: summary description of the Ecological Site, list of habitats and notable features

b) Habitat map: hand drawn polygons (attributed with the corresponding habitat codes) on aerial photograph

c) Field survey notes: hand written on habitat recording forms

d) Relevé forms: hand written and completed for Annex I habitats

e) Photographs: photographic record (digital) of habitats and relevé(s)

f) Habitat table: tabulated summary of all habitats, including habitat description, classification (Fossitt and Annex I), plant species list, habitat condition and ecological evaluation/importance

Other Areas

Within the scheme study area, those areas not covered by the surveys described above were subject to a walkover survey; the purpose of which was to determine the nature of the habitats present and establish whether any areas corresponded with Annex I habitat types. In some instances, the survey excluded residential properties and associated gardens, and commercial and industrial complexes.

Notes were taken on the habitat types present (according to the habitat categories described in Fossitt, 2000) and where habitat plots were assessed to be of a high ecological value, with the potential to correspond to an Annex I habitat type, these were subject to more detailed survey as described above under Ecological Sites. If appropriate, these were then incorporated into Ecological Sites for consideration as part of the route selection process.

Aquatic Habitats

Aquatic habitats were surveyed for the presence of Annex I habitat types by Dr. Cillian Roden, from the 16 June 2014 to the 8 September 2014.

The survey sites included the River Corrib corridor, Coolagh Lakes, Lough Inch, Ballindooley Lough, and the Terryland River. The locations of the survey sites are shown on **Figures 4.1** to **4.2**.

Sites were accessed either from the shore or by boat. Sub-littoral vegetation was examined by snorkelling. Smaller sites (such as the Terryland River) were examined by wading or by shore-based sampling. A list of species present, the depth of the sub-littoral vegetation and the exact position of each site was determined. Depths were measured using a SCUBAPRO depth gauge accurate to 0.1m and position determined using a hand-held GPS recorder. GPS position shows approximate area surveyed by snorkel. Species present were recorded on an underwater writing slate. Samples for later examination were stored in plastic bags and identified within one day of collection. Underwater photographs were taken with a Panasonic Lumix DMC-FT3 underwater camera.

Habitat Surveys (2015/2016)

Petrifying Spring Survey

A dedicated survey of seepage lines in Lackagh Quarry to record the presence of petrifying spring habitat was carried out by Dr Rory Hodd on the 03 June 2015.

The aim of the survey was to determine whether or not any of these features corresponded with the priority Annex I habitat type **Petrifying springs with tufa formation (Cratoneurion)* [*7220]. Plant species associated with each of the seepage lines were recorded and compared with the current definitions of the plant communities associated with this Annex I habitat type (CEC, 2013; NPWS, 2013b; and Lyons & Kelly, 2016).

EIA Habitat Survey

The additional habitat surveys that were undertaken to supplement the baseline data already collected for the purposes of the NIS and EIA level of assessment for the proposed road development, consisted of the following elements:

- Habitats that had been surveyed in detail in 2013/2014 (i.e. Lough Corrib cSAC Study Area and the Ecological Sites) were rechecked in 2015, 2016 and 2017. Where habitats had changed from the 2013/14 baseline they were resurveyed as per the methodology described above under *Habitat Surveys 2014 – Ecological Sites*
- Areas that had not been surveyed in 2013/14 were subject to a full habitat survey as per the methodology described above under *Habitat Surveys 2014 – Ecological Sites*. This was carried out in 2015 with additional areas included in 2016 and 2017 as a result of changes to the proposed development boundary as a result of the on-going iterative design process.

The locations of these survey areas are shown on **Figures 4.1** to **4.2**.

4.4.1.2 Qualifying Interest Plant Species Surveys

Aside from the botanical survey work carried out to record and classify habitats (during which any rare/protected plant species present were recorded), dedicated surveys for the following legally protected plant species were carried out: Varnished hook-moss *Hamatocaulis vernicosus* and the Slender naiad *Najas flexilis*. Both of these plant species are listed on Annex II of the Habitats Directive and listed as QI species of Lough Corrib cSAC (with Slender naiad also listed on Annex IV of the Habitats Directive), and are protected under the Flora (Protection) Order, 2015.

Varnished hook-moss

The Varnished hook-moss survey was carried out by Dr Rory Hodd from 2 to 7 September 2014.

Potential sites for survey were selected in consultation with ecologists carrying out habitat mapping within the scheme study area. Potential sites were identified as those where fen occurred, and where brown moss species (i.e. a suite of moss species indicative of, and generally restricted to, fen habitats) had been noted. Sites

where fen transitions into bog, or where transition mire or intermediate fen had been noted, were prioritised as they had the most potentially suitable habitat for the species.

Nine potential sites were surveyed for the presence of Varnished hook-moss (**Figure 5**). The nearest known site for Varnished hook-moss, at Gortachalla Lough, north of Moycullen, was also visited to establish the species' habitat preferences in this specific area. Each site was extensively searched for areas where conditions were suitable for the growth of this species, and areas where plant species with similar requirements were found. Any areas which were deemed potentially suitable were thoroughly searched and the moss flora of these areas was examined in detail.

Slender naiad

The Slender naiad survey was carried out by Dr Cillian Roden over the period June to September 2014, as part of the aquatic Annex I habitat survey, as described above in the Aquatic Habitats section.

As a submerged aquatic plant species of clear, low-nutrient lakes, potential survey sites within the scheme study area were Lough Inch, the Coolagh Lakes and Ballindooley Lough – see **Figures 4.1** to **4.2**. As described above for aquatic habitats, sub-littoral vegetation was examined by snorkelling.

4.4.1.3 Otter Survey

An Otter survey of Lough Corrib cSAC was carried out in April/May 2014; covering the area from Lough Corrib to the Nuns Island/Waterside area in Galway City. Additional Otter surveys were carried out as part of the mammal survey between April and November 2015 and October 2016, to resurvey that part of Lough Corrib cSAC within c. 250m of the proposed road development. A re-survey of areas of potential impact was carried out in October 2017, to check that there had been no change since the original survey results.

River Corrib Otter Survey (2014)

An Otter survey of the River Corrib, from Coolanillaun to the Waterside area in Galway City, was carried out by Scott Cawley Ltd. from the 15 April to 7 May 2014.

The survey included all area of Otter Habitat (defined as being a 10m width of riverbank each side of the river in the Threat Response Plan: Otter (2009-2011) (NPWS, 2009)) within the boundary of the Lough Corrib cSAC. The Otter survey study area is shown on **Figure 6**. The status and activity of any Otter holts was recorded along with any evidence of activity, including paths, tracks, feeding signs, sprainting sites or couches (Otter resting places).

Mammal Survey (2015 and 2016)

A mammal survey was carried out by Scott Cawley Ltd. and Dr Chris Peppiatt over four survey periods: 30 April to 5 June 2015, 28 October to 8 November 2015, 25 to 28 October 2016 and 9 to 20 October 2017.

A corridor of approximately 500m was surveyed for mammal species, including Otter, as part of the multi-disciplinary walkover survey. This included lands with Lough Corrib cSAC in the vicinity of the proposed road development – **Figure 6**. The status and activity of Otter holts was recorded along with any evidence of activity, including paths, tracks, feeding signs, latrines or couches.

As part of the survey, two infra-red motion-activated cameras were installed between 9 July and 4 August 2015 (under NPWS Licence No. 024/2015) to monitor a number of small burrows along a stream bank located adjacent to playing fields at National University of Galway (NUIG) to confirm the presence/absence of Otter.

4.4.1.4 White-clawed Crayfish Surveys

The White-clawed crayfish survey was carried out by Scott Cawley Ltd. and Dr. Julian Reynolds, under licence from the NPWS (Licence No. C120/2014), from the 23 August 2014 to 6 September 2014.

The watercourses surveyed are shown on **Figure 7**. Depending on the size of the waterbody, it was either surveyed using sweep-netting with hand nets (following Reynolds *et al*. 2010) or trapped using crayfish traps of appropriate mesh size. Where trapping was undertaken, traps were checked for crayfish and baited each morning and were left out over two or three nights.

4.4.1.5 Freshwater Pearl Mussel Survey

Surveys for the Freshwater pearl mussel *Margaritifera margaritifera* were carried out by Dr Evelyn Moorkens and Dr Ian Killeen within the scheme study area in August 2014 (*N6 Galway City Transport Project: Route Selection Report* (Arup, 2016)).

This survey did not include the River Corrib as this section of the river does not have the appropriate geology to support *Margaritifera*. Furthermore, the river downstream of the proposed River Corrib Bridge does not support suitable Freshwater pearl mussel habitat; i.e. there is an absence of clean gravel/sand substrate, a riffle flow regime and the river is tidally influenced below the Salmon Weir in Galway City.

4.4.1.6 Breeding Bird Surveys

Breeding bird surveys were conducted by Dr. Chris Peppiatt, Gerry Murphy and John Small over three visits in May/June 2015 using a methodology adapted from the Breeding Bird Survey (Gilbert et al., 1998). Additional areas were covered, over two visits, in June of 2016 as a result of changes to the proposed development boundary. Lands within, and adjacent to, the proposed development boundary were slowly walked in a manner allowing the surveyor to come within 50m of all habitat features – see **Figures 8.1** to **8.2** for survey corridor. Birds were identified by sight and song, and general location and activity were recorded using the British Trust for Ornithology (BTO) species and activity codes. The conservation status of the bird species recorded is as per:

- SCI species of SPAs within the ZoI of the proposed road development

- Birds of Conservation Concern in Ireland (BoCCI) lists which classify bird species into three categories: Red List – birds of high conservation concern; Amber List – birds of medium conservation concern; and Green List – birds not considered threatened (Colhoun & Cummins, 2013)
- Bird species listed on Annex I of the EU Birds Directive (2008/144/EC)

The full breeding bird survey results are provided in **Appendix H**.

4.4.1.7 Wintering Bird Surveys

Winter bird field surveys were conducted by Dr. Chris Peppiatt, Gerry Murphy, John Small, Tom Cuffe and Scott Cawley Ltd., once a month during daylight hours from September 2014 to March 2015. Due to the diverse nature of the sites surveyed, surveys were conducted using a combination of methodologies. In general, the approach was a 'look-see' methodology (based on Gilbert et al. 2011). The survey sites are shown on **Figure 9**.

Wetland and Peatland Sites

Where possible, sites were surveyed from vantage points (e.g. Ballindooley Lough and Coolagh Lakes) and any species utilising the area, and their activity, were recorded. Larger sites were surveyed using a hybrid methodology of thorough walks through the site with point counts and/or vantage points undertaken along the route of the proposed road development, where possible. The sites covered included:

- River Corrib
- Terryland River
- Ballindooley Lough
- Coolagh Lakes
- Moycullen Bogs NHA at Ballagh and Tonabrocky
- Cappagh Road Peatland
- Lough Inch north-eastern peatland
- Lough Inch southern peatland
- Lough Inch south western peatland

Hen harrier Winter Roost Surveys

Hen harrier Roost Surveys were undertaken at Ballindooley Lough and the Coolagh Lakes. This involved vantage point surveys of the area from 1.5 hours before sunset to 0.5 hours after sunset to record any Hen harriers in the area.

Quarries, Agricultural Areas, and Amenity Areas

Three quarries were surveyed using a hybrid methodology of walks and/or vehicle-based transects through the site with point counts and/or vantage points undertaken along the transect.

Agricultural and amenity areas were surveyed using a combination of vehicle-based surveys and roadside views where possible, with some areas requiring a walk-through to determine usage by wintering birds.

The full winter bird survey results are provided in **Appendix I**.

4.4.1.8 Fish Surveys

The fish surveys were carried out by Triturus Environmental Services Ltd. in September 2015. As the only waterbody surveyed which lies within a European site (Lough Corrib cSAC), only surveys carried out at the Coolagh Lakes (i.e. a fyke netting survey) are relevant with regard to this NIS and AA and are described here. The location of the Coolagh Lakes relative to the proposed road development is shown on **Figure 4.2** – features AH06 and AH07.

All equipment and PPE used was disinfected with Virkon® prior to and post-survey completion, and best practice precautions were employed to prevent the potential spread of invasive species and water-borne pathogens, according to standard Inland Fisheries Ireland (IFI) biosecurity protocols (available at http://www.fisheriesireland.ie/fisheries-research-1/73-biosecurity-protocol-for-field-survey-work-1).

Fyke Netting Survey

Boat based fyke netting surveys were undertaken at Ballindooley Lough and the Coolagh Lakes. In advance of setting the nets a high-resolution transducer was used to locate fish markings and establish a depth profile of the lake basins. This facilitated the positioning of the fyke nets near shelf drop offs and helped establish distributional patterns of fish. Five 1.5m diameter (D shaped) fyke nets, with multi panel mesh, were placed in the margins of the lakes in the littoral zones (windward bank) and in shallow bay areas overnight, and retrieved within 24 hours. The fish captured were measured by two personnel and length frequency graphs and species composition graphs were constructed. All fish were processed quickly and returned alive to the lakes.

The full fish survey report is provided in **Appendix J** of the NIS.

4.4.2 Hydrological Surveys and Monitoring

Hydrological surveys including water quantity and quality monitoring were undertaken to inform the NIS assessment as the proposed road development crosses catchments/subcatchments that drain to European sites. These catchments/subcatchments include the River Corrib (the location where the proposed road development crosses the River Corrib lies within Lough Corrib cSAC) and four other watercourse catchments/subcatchments (Sruthán na Líbeirtí, the Trusky Stream, the Bearna Stream, the Tonabrocky Stream and the Knocknacarragh Stream), all of which flow into Galway Bay; some directly into that part of Galway Bay designated as Galway Bay Complex cSAC and Inner Galway Bay SPA with the remainder entering the bay to the west of the European sites' boundaries.

The hydrological study included both a desk review and field surveys. The desk study included consultation with relevant regulatory bodies, a review of published hydrological literature, aerial photography, and topographical and hydrometric information related to waterbodies within the zone of influence of the proposed road development. Field surveys undertaken included walkover assessment, stream and river surveys and water quality monitoring which along with the findings and data collated during the desk review informed the hydrological modelling.

The full hydrological survey methodology is provided in **Appendix B**.

4.4.3 Hydrogeological Surveys and Monitoring

A hydrogeological study was undertaken to inform the NIS assessment as the proposed road development traverses several groundwater bodies that support groundwater dependant wetland habitats within European sites (e.g. the Coolagh Lakes which form part of the qualifying interests of Lough Corrib cSAC).

The hydrogeological study included both a desk review and field surveys/ground investigations. The hydrogeological field surveys and ground investigation works were designed, planned and carried out so as to avoid any impacts on European sites and were subject to screening for appropriate assessment by Galway County Council – which determined that ground investigation works were not likely to have a significant effect on any European site.

The field surveys included a survey of pre-existing monitoring wells, a survey of karst features and ground investigation including groundwater monitoring installations. The ground investigations included boreholes, trial pits, window sampling[12] and geophysical surveys, hydrogeological monitoring and testing. In summary, these investigations comprised:

- 32 No. groundwater monitoring wells
- 16 No. groundwater level monitoring rounds
- 12 No. groundwater quality monitoring rounds
- 15 No. infiltration test
- 19 No. variable head permeability tests
- 1 No. step pumping test

The full hydrogeological survey methodology used to gather hydrogeological data for the full extent of the proposed road development (including the locations of ground investigation works) is provided in the supporting Hydrogeology Assessment Report in **Appendix A** and the Lackagh Tunnel Geotechnical and Hydrogeology Appraisal Report in **Appendix F**.

[12] A window sample is used to bore shallow boreholes, usually up to 5mbgl depending on the soil type, to obtain soil samples for assessment.

4.4.4 Geotechnical Baseline – Lackagh Tunnel

Site specific ground investigation (GI) works were undertaken in 2015 and 2016 to identify the existing geological environment and ground conditions at Lackagh Quarry comprising:

- Desk study and site walkover
- One horizontal borehole
- Four vertical boreholes
- Geophysical Survey (surface and downhole)

The locations of the GI relevant to investigating the geological baseline and ground condition at Lackagh Quarry, are shown on Figure 3.12 of the Lackagh Tunnel Report (**Appendix F**).

5 Existing Ecological Baseline

The local ecological baseline, including European sites, is described in this section of the NIS. The hydrological and hydrogeological baseline data is also outlined here. The hydrological and hydrogeological baseline data is related to the assessment of the ecological impacts as they include potential pathways for impacts from the proposed road development to affect European sites locally.

5.1 Underlying Geology and Habitats

The western part of the study area is underlain by granite and the eastern by limestone and, as a consequence, the nature of the habitats present across the study area are generally acidic in nature west of the N59 Moycullen Road and calcareous to the east.

West of the N59 Moycullen Road, the habitats generally consist of a mosaic of agricultural fields, peatland/heath habitats and scrub, separated into distinct habitat blocks of varying sizes by the local road network and the associated linear residential development. The character of the agricultural fields varies from intensively managed farmland through to abandoned fields overgrown with scrub and bracken. The peatland habitat blocks consist of predominantly wet heath, dry heath and bog mosaics. These peatland habitat blocks vary in size and include some smaller, more isolated, remnant patches of heath. Small areas of fen and transition mire are also present. Given the close proximity of Galway City there are also large expanses of urban and residential development adjacent to the proposed road development, particularly around Ballyburke/Rahoon area and where the proposed road development crosses the N59 Moycullen Road at Dangan.

East of the N59 Moycullen Road, there are two distinct habitat zones; the area from the River Corrib to the N84 Headford Road is comprised of a patchwork of semi-natural woodland, limestone pavement, scrub and calcareous grassland fields. East of the N84 Headford Road is predominantly improved agricultural grasslands, set amongst isolated patches of scrub, semi-natural woodland and limestone pavement of varying sizes, surrounded by residential and industrial development in Parkmore, Ballybrit, Briarhill and Doughiska. There are also two wetland complexes of note in this section, namely the Coolagh Lakes and Ballindooley Lough. There are also some isolated patches of semi-natural habitats, calcareous grassland and limestone pavement, in the Coolagh/Doughiska area.

The habitat types recorded along the proposed road development, are as follows:

- Flower beds and borders (BC4)
- Buildings and artificial surfaces (BL3)
- Spoil and bare ground (ED2)
- Recolonising bare ground (ED3)
- Active quarries and mines (ED4)
- Exposed siliceous rock (ER1)

- Exposed calcareous rock (ER2), including the priority Annex I habitat *8240
- Limestone/marl lakes (FL3), including the Annex I habitat 3140
- Mesotrophic lakes (FL4)
- Eutrophic lakes (FL5)
- Turloughs (FL6), which corresponds with the priority Annex I habitat *3180
- Other artificial lakes and ponds (FL8)
- Calcareous springs (FP1), including the priority Annex I habitat *7220
- Reed and large sedge swamps (FS1), including the priority Annex I habitats *7210 and the Annex I habitat 6430
- Tall-herb swamps (FS2), including the Annex I habitats 6430/*7210
- Eroding/upland rivers (FW1)
- Depositing/lowland rivers (FW2)
- Drainage ditches (FW4)
- Improved agricultural grassland (GA1)
- Amenity grassland (improved) (GA2)
- Marsh (GM1)
- Dry calcareous and neutral grassland (GS1), including the priority Annex I habitat *6210/Annex I habitat 6210
- Dry meadows and grassy verges (GS2), including the Annex I habitat 6510
- Dry-humid acid grassland (GS3), including the priority Annex I habitat *6230
- Wet grassland (GS4), including the Annex I habitat 6410
- Dense bracken (HD1)
- Dry siliceous heath (HH1), which corresponds with the Annex I habitat 4030
- Dry calcareous heath (HH2), which corresponds with the Annex I habitat 4030
- Wet heath (HH3), which corresponds with the Annex I habitat 4010
- Rich fen and flush (PF1), including the Annex I habitats 7230/*7210
- Poor fen and flush (PF2)
- (Mixed) broadleaved woodland (WD1)
- Mixed broadleaved/conifer woodland (WD2)
- (Mixed) conifer woodland (WD3)
- Scattered trees and parkland (WD5)
- Hedgerows (WL1)
- Treelines (WL2)
- Oak-ash-hazel woodland (WN2), including the priority Annex I habitat *8240

- Wet willow-alder-ash woodland (WN6), including the priority Annex I habitat *91E0
- Scrub (WS1), including the priority Annex I habitat *8240
- Immature woodland (WS2)
- Ornamental/non-native shrub (WS3)
- Recently-felled woodland (WS5)

Habitat mapping of the local area is provided showing both the Fossitt (2000) habitat classifications (refer to **Figures 13.1** to **13.5**) and, where applicable, the priority Annex I or Annex I habitat types (refer to **Figures 14.1** to **14.5**).

5.2 Hydrogeological Baseline

The proposed road development traverses the following groundwater bodies (GWB) – refer to **Figures 10.1.1** and **10.1.2** for locations relative to the proposed road development:

- Spiddal GWB
- Maam – Clonbur GWB
- Ross Lake GWB
- GWDTE Lough Corrib Fen 1 (Menlough)
- GWDTE Lough Corrib Fen 2
- Clare-Corrib GWB
- Clarinbridge GWB

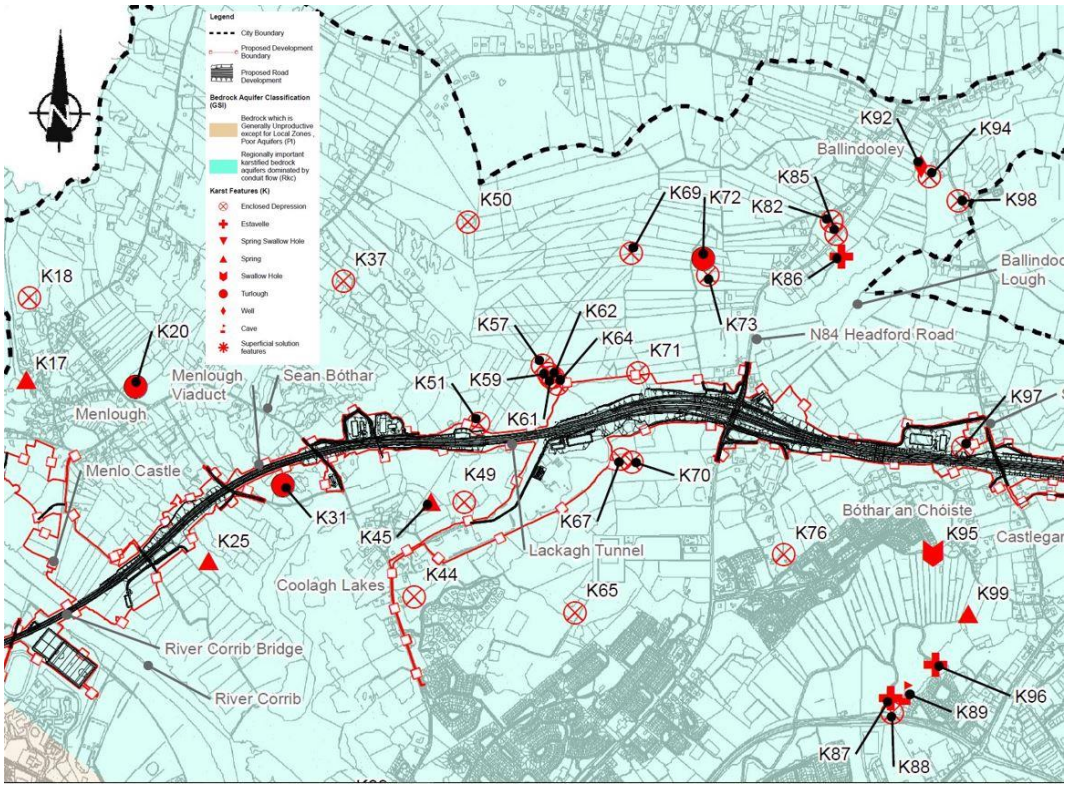
The western part of the study area, from the R336 Coast Road west of Bearna Village to the N59 Moycullen Road, is underlain by granite. The Spiddal GWB and the Maam – Clonbur GWB lie within this area and both aquifers contribute groundwater to Galway Bay Complex cSAC and Inner Galway Bay SPA (see **Figures 10.1.1**). However, both are considered poor aquifers and most rainfall would run off to streams and rivers, with a small component of groundwater discharging to Galway Bay.

The eastern part of the study area, from the N59 Moycullen Road to the N6 Junction at Coolough, is underlain by limestone. This area lies within the Visean Limestone Undifferentiated aquifer that has karst conduit groundwater flow. This aquifer is subdivided into the Ross lake GWB, the GWDTE Lough Corrib Fen 1 (Menlough), the GWDTE Lough Corrib Fen 2, the Clare-Corrib GWB and the Clarinbridge GWB. The Clare-Corrib GWB includes the Clare-Corrib (Ballindooley West) GWB, the Clare-Corrib (Ballindooley East) GWB and the Clare-Corrib (Terryland) GWB.

The Ross Lake GWB contributes groundwater to the River Corrib, which in this area lies within Lough Corrib cSAC and Lough Corrib SPA (see **Figures 10.1.1** and **10.1.2**).

The GWDTE Lough Corrib Fen 1 (Menlough) extends east from the River Corrib to the townland of Coolough. This GWB has been divided into two areas, namely Lough Corrib Fen 1 (Menlough) and Lough Corrib Fen 1 (Lackagh). Lough Corrib Fen 1 (Menlough) lies north of Coolagh Lakes and Lough Corrib Fen 1 (Lackagh) forms a small GWB (<0.04km^2) between Lough Corrib and Lackagh Quarry. Groundwater flows westwards within the Lough Corrib Fen 1 (Menlough) GWB from the groundwater divide with the Clare-Corrib GWB to the Coolagh Lakes and the River Corrib. Western Coolagh Spring (K25) is a karst spring and forms part of the Lough Corrib Fen 1 (Menlough) GWB - see Figure 1.02 in **Appendix A,** of which an extract is shown in **Plate 5.1** below. Western Coolagh Spring (K25) provides groundwater flow to the upper lake of Coolagh Lakes. Due to the compartmentalisation of the aquifer by buried valleys/palaeokarst, the groundwater in Lough Corrib Fen 1 (Lackagh) GWB is largely contained. Due to the thick clay subsoil there are no observed discharges from the limestone bedrock to the Eastern Coolagh Spring and the compartmentalisation prevents discharge to Western Coolagh Spring. Instead, groundwater flow from Lough Corrib Fen 1 (Lackagh) is likely to flow eastwards to Lackagh Quarry during peak groundwater levels. There is a potential for seepage from the limestone aquifer through the clayey subsoil to the Eastern Coolagh Spring but due to the low permeability and thickness of the clayey subsoil, these potential seepages are of a very low flow rate. If present, seepages from the subsoil to the Eastern Coolagh Spring would represent a very small fraction of the groundwater contribution to Coolagh Lakes compared to the karst inflow at Western Coolagh Spring (K25), which provides the main groundwater contribution flow to Coolagh Lakes. This interaction is explained further in Section 4.2.2 of **Appendix A**.

Plate 5.1: Extract from Figure 1.02 of Appendix A showing locations of Western Coolagh Spring (K25) and the Eastern Coolagh Spring (K45)



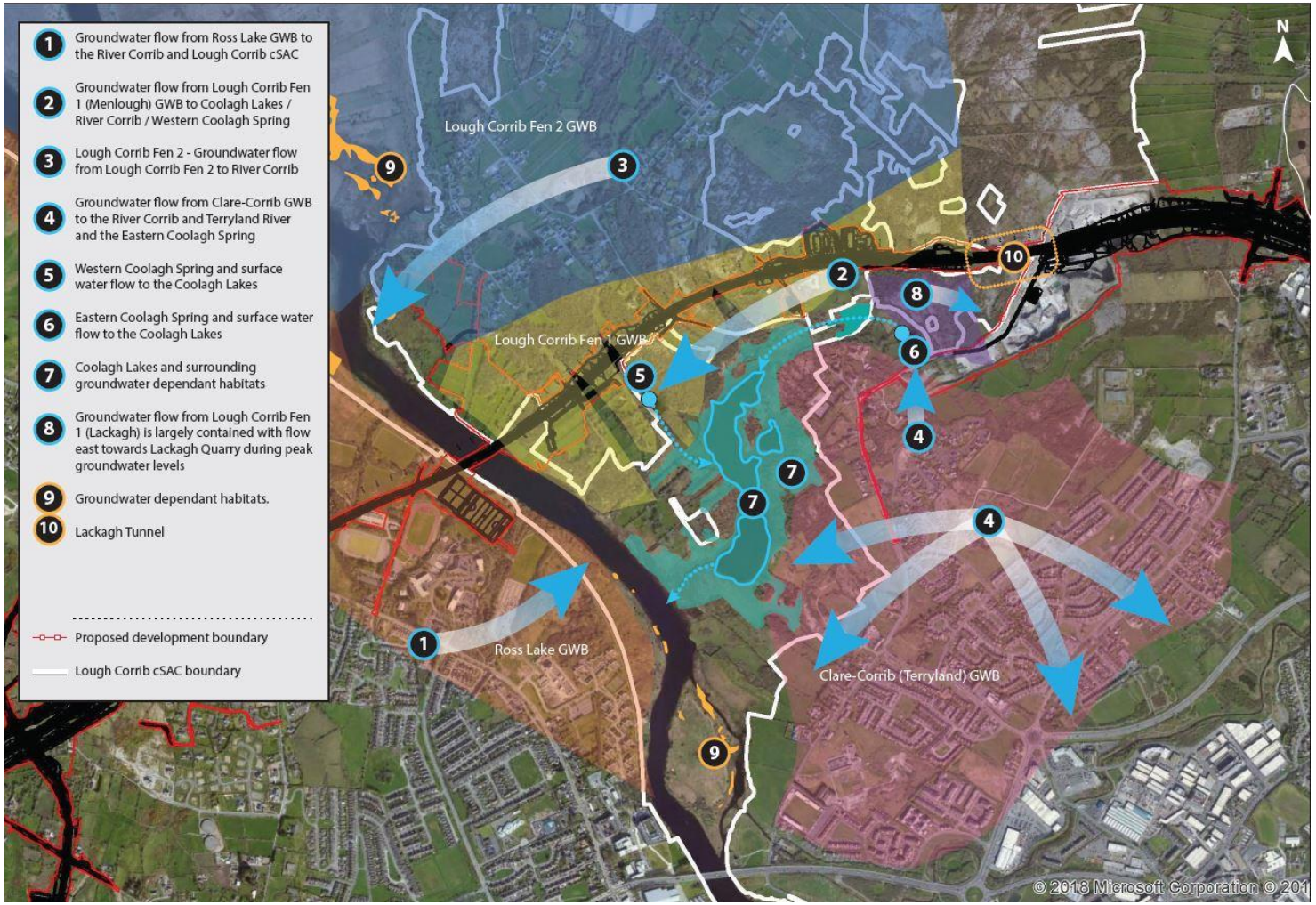
The GWDTE Lough Corrib Fen 2 lies within the unmitigated hydrogeological ZoI (refer to **Figure 10.3.5** and **Figure 10.3.6**). This GWB contributes groundwater to the River Corrib which is part of Lough Corrib cSAC and Lough Corrib SPA and flows downstream to Galway Bay which is part of Galway Bay Complex cSAC and Inner Galway Bay SPA.

The Clare-Corrib GWB is divided up into three sections: Ballindooley West, Ballindooley East and Terryland. These groundwater bodies contribute to the River Corrib (Lough Corrib cSAC) and Terryland River catchments which ultimately drain to Galway Bay and Galway Bay Complex cSAC and Inner Galway Bay SPA (see **Figure 10.1.2** and **Figure 10.2.2**). Clare-Corrib GWB includes Ballindooley Lough and the surrounding wetlands but Ballindooley Lough lies up gradient of the proposed road development and therefore, beyond the ZoI.

The Clarinbridge GWB also contributes groundwater to Galway Bay and hence Galway Bay Complex cSAC and Inner Galway Bay SPA (see **Figure 10.1.2** and **Figure 10.2.2**).

This is illustrated on **Plate 5.2** below. The full results of the hydrogeology study, including groundwater level measurements, are presented in **Appendix A**.

Plate 5.2: Generalised hydrogeology interactions with European sites



5.3 Hydrological Baseline

The proposed road development crosses the catchments/sub-catchments of eight watercourses, as listed below in **Table 5.1**. The River Corrib channel lies within Lough Corrib cSAC. All other watercourses flow into Galway Bay; some directly into that part of Galway Bay designated as Galway Bay Complex cSAC and Inner Galway Bay SPA with the remainder entering the bay to the west of the European sites' boundaries. The full results of the hydrology study are presented in **Appendix B** with the drainage catchment crossed by the proposed road development shown on **Figures 11.1** and **11.2**.

Table 5.1: Watercourses/waterbodies crossed by, or within the ZoI of, the proposed road development and links to European sites

Watercourse	Biological Water Quality[13]	Link to European site(s)
Sruthán na Líbeirtí	Q3	Galway Bay c.3.6km west of Galway Bay Complex cSAC and Inner Galway Bay SPA
Trusky Stream	Q3	Galway Bay at Bearna Village c.1.4km west of Galway Bay Complex cSAC and Inner Galway Bay SPA
Bearna Stream and tributary	Q4/Q3	Rusheen Bay – within Galway Bay Complex cSAC and Inner Galway Bay SPA
Tonabrocky Stream	Q4	Rusheen Bay – within Galway Bay Complex cSAC and Inner Galway Bay SPA
Knocknacarra Stream	Q3	Rusheen Bay – within Galway Bay Complex cSAC and Inner Galway Bay SPA
River Corrib	Q4	Galway Bay Complex cSAC and Inner Galway Bay SPA (Galway City)
Coolagh Lakes	n/a	Within Lough Corrib cSAC
Ballindooley Lough	n/a	Supports wintering bird species listed as SCIs of Lough Corrib SPA and/or Inner Galway Bay SPA

The water quality sampling results are presented in the Hydrology Assessment Report in **Appendix B** (see Annex A of that report). The results showed consistently good quality water at all of the sites with nutrient, Biochemical Oxygen Demand (BOD), sediments and heavy metal concentrations well within acceptable limits based on the surface water regulations. Bacterial faecal contamination was identified at all locations, possibly associated with the presence of agricultural activities and point septic tank and slurry pit sources within the respective catchments.

The western watercourses (Bearna, Trusky and Sruthán na Líbeirtí Streams) associated with the granite bedrock and peatland areas showed slightly lower pH,

[13] After Toner *et al.*, 2005: Q5, Q4-5 and Q4 = Unpolluted, Class A; Q3-4 = Slightly polluted, Class B; Q3 or Q2/3 = Moderately polluted Class C; and, Q2, Q1/2 or Q1 = Seriously polluted Class D.
Biological water quality classification does not apply to surface water lakes (e.g. Coolagh Lakes and Ballindooley Lough)

lower alkalinity and hardness, and elevated iron concentrations in comparison to the eastern limestone watercourses. The most alkaline and highest hardness waters were found within Ballindooley Lough followed by the Coolagh Lakes.

Full descriptions of these river catchments, and both the Coolagh Lakes and Ballindooley Lough, are provided in Section 3.2 of **Appendix B** Hydrology Assessment Report).

5.4 Flora and Fauna Species

The diverse range of habitats present across the scheme study area supports an equally diverse species assemblage.

The scheme study area supports populations of the following bat species: the Lesser horseshoe bat *Rhinolophus hipposideros*, Leisler's bat *Nyctalus leisleri*, the Common pipistrelle bat *Pipistrellus pipistrellus*, Soprano pipistrelle bat *Pipistrellus pygmaeus*, Nathusius' pipistrelle bat *Pipistrellus nathusii*, Brown long-eared bat *Plecotus auritus*, Daubenton's Bat *Myotis daubentonii*, Natterer's bat *Myotis nattereri* and the Whiskered bat *Myotis mystacinus*.

Otter *Lutra lutra* populations are associated with the River Corrib, the Bearna Stream catchment and Galway Bay.

Other mammal species present include Badger *Meles meles*, Pine marten *Martes martes*, Wood mouse *Apodemus sylvaticus*, Red squirrel *Sciurus vulgaris*, Irish stoat *Mustela erminea hibernica*, Irish hare *Lepus timidus hibernicus*, Hedgehog *Erinaceus europaeus* and the Pygmy shrew *Sorex minutus*, Fox *Vulpes vulpes*, Rabbit *Orytolagus cuniculus*, Mink *Mustela vison* and the Bank vole *Myodes glareolus*.

Galway Bay supports a diverse range of marine mammal species, including: Harbour seal *Phoca vitulina*, Grey seal *Halichoerus grypus*, Common dolphin *Delphinus delphis* and Harbour porpoise *Phocoena phocoena*. All cetacean species are also protected under the Habitats Directive (Annex IV).

Although not present in the River Corrib, there are populations of the White-clawed crayfish *Austropotamobius pallipes* and the Freshwater pearl mussel *Margaritifera margaritifera* upstream of the proposed road development within the River Corrib catchment. A Marsh fritillary butterfly *Euphydryas aurinia* population is present in the western part of the study area, associated with the mosaic of rough grassland, heath and bog habitats there.

Wetland habitats associated with the River Corrib, the Coolagh Lakes and Ballindooley Lough also support a rich mollusc assemblage, including the Marsh whorl snail *Vertigo antivertigo* which is listed as vulnerable in the Irish Red Data List of molluscs (Byrne *et al*., 2009).

A diverse range of both breeding and wintering bird species are known from the scheme study area or were recorded during the surveys carried out in the preparation of this NIS. This includes many bird species which are listed as SCIs for the surrounding SPA sites.

The winter bird surveys carried out in 2014/15 recorded the following bird species, which are listed as SCIs for SPA sites locally for their wintering populations, across the scheme study area: Bar-tailed godwit, Light-bellied brent goose, Black-headed gull, Cormorant, Common gull, Coot, Curlew, Golden plover, Grey heron, Hen harrier, Lapwing, Great northern diver, Redshank, Shoveler, Teal, Turnstone, Tufted duck and Wigeon. Many of these were recorded along the River Corrib corridor, which is consistent with the findings of the 2006 surveys (RPS, 2006). See **Appendix I** for the wintering bird survey results and **Table 5.3** below for which European sites these species are listed as SCIs for their wintering populations.

The breeding bird surveys carried out in the preparation of this NIS recorded the following bird species, which are listed as SCIs for SPA sites locally for their breeding populations, across the scheme study area: Black-headed gull, Common tern and Cormorant. See **Appendix H** for the results of the breeding bird surveys and **Table 5.3** below for which European sites these species are listed as SCIs for their breeding populations.

In the western part of the study area, with the exception of the Bearna Stream which supports Atlantic salmon, Sea trout, Brown trout and European eel, the watercourses are generally of a limited value for fish species. The River Corrib supports species such as Atlantic salmon *Salmo salar*, Sea lamprey *Petromyzon marinus*, Brook lamprey *Lampetra planeri* and the European eel *Anguilla anguilla*. The Coolagh Lakes support coarse fish species such as Perch *Perca fluviatilis* and Roach *Rutilus rutilus* with Pike *Esox lucius*, Rudd *Scardinius erythropthalmus* and Tench *Tinca tinca* also present in Ballindooley Lough. The Corrib Estuary and Galway Bay are important transitional and marine fisheries habitat, supporting a range of fish species (The Central and Regional Fisheries Boards, 2009).

The Common frog *Rana temporaria* and the Smooth newt *Triturus vulgaris* are widespread in wetland habitats locally. The Common lizard *Zootoca (Lacerta) vivipara* were recorded across the western part of the study area.

Slender cottongrass *Eriophorum gracile*, a species protected under the Flora (Protection) Order, 2015, was recorded from the Tonabrocky and Coolanillaun areas. Although the Small white orchid *Pseudorchis albida* (also an FPO protected species) is known from the locality, it was not recorded during any of the surveys carried out in relation to the proposed road development.

5.5 Non-native Invasive Species

There are three non-native invasive plant species listed on the Third Schedule of the Birds and Habitats Regulations present within, or in close proximity to, the proposed road development. The locations of these invasive species are summarised below in **Table 5.2**. None of these infestations are in the vicinity of a European site, with the exception of number 10 below (Japanese knotweed located in NUIG lands) which is located approximately 25m from the proposed development boundary. The location of number 10 is shown in **Figure 13.1**.

Table 5.2: Summary of Non-native Invasive Species Listed in the Third Schedule of the Birds and Habitats Regulations Recorded within the study area of the Proposed Road Development

No	Common Name	Chainage (approximate)	Details
1	Japanese knotweed	Ch. 0+010 (mainline)	Along farm track, south of proposed Bearna West Roundabout, adjacent to the proposed development boundary (approximately 14m outside proposed development boundary)
2	Rhododendron	Ch. 1+580 (mainline)	Recorded in woodland along the eastern side of the Troscaigh Road (L5387), north of the proposed road development. Directly adjacent to proposed development boundary (within 3m)
3	Rhododendron	Ch. 1+600 (mainline)	Recorded in woodland along the eastern side of the Troscaigh Road (L5387), north of the proposed road development. Directly adjacent to proposed development boundary (within 1m)
4	Japanese knotweed	South-east of Ch. 5+275 (mainline)	In rough grassland field with scrub outside of Sli Geal residential estate, near Ballyburke, approximately 45m outside of the proposed development boundary
5	Japanese knotweed	Ch. 6+840 (mainline)	South of the mainline for the proposed road development. Located along minor watercourse. This watercourse is downstream of the mainline for the proposed road development but is crossed further downstream by the N59 South Link Road. Adjacent to residential property located east of the proposed drainage outfall at Rahoon. Approximately 85m outside of the proposed development boundary
6	Rhododendron	Ch. 6+800 (mainline)	South of mainline. Located along minor watercourse. This watercourse is downstream of the mainline for the proposed road development but is crossed further downstream by the N59 South Link Road. Adjacent to residential property located east of the proposed drainage outfall at Rahoon. Approximately 85m outside of the proposed development boundary
7	Japanese knotweed	Ch. 8+370 (mainline)	In area of recolonising bare ground within the proposed development boundary

No	Common Name	Chainage (approximate)	Details
8	Himalayan knotweed	Ch. 8+330 (mainline)	South of the proposed road development. 41m from the proposed development boundary
9	Himalayan knotweed	Ch. 8+200 (mainline)	North of the proposed road development. In excess of 100m from proposed development boundary
10	Japanese knotweed	Ch. 8+930 (mainline)	In woodland/scrub, between Ch. 8+900 and Ch. 8+950 at the NUIG Sporting Campus, approximately 25m from the proposed development boundary
11	Japanese knotweed	Ch. 12+225 (mainline)	In residential garden, within the proposed development boundary the N84 Headford Road Junction
12	Japanese knotweed	Ch. 1+800 (N59 Link Road South)	Field west of Rosán Glas road. In area of recolonising bare ground, north of Bóthar Diarmuida Junction, along the N59 Link Road South. Within proposed development boundary
13	Japanese knotweed	Ch. 1+890 (N59 Link Road South) Link Road)	Field west of Rosán Glas road. In area of recolonising bare ground, north of Bóthar Diarmuida Junction, along the N59 Link Road South. Within proposed development boundary

5.6 European sites

There are 19 European sites (cSACs or SPAs) located in the vicinity of the proposed development boundary (see **Figure 12**). **Table 5.3** below lists these sites, their distance from the proposed development boundary, and the sites Qualifying Interests/Special Conservation Interests. As discussed in **Section 2.2**, the proposed road development crosses only one of these, namely Lough Corrib cSAC.

Table 5.3: European Sites (cSACs and SPAs) in the vicinity of the proposed development boundary

Site Name	Distance[14]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
Candidate Special Areas of Conservation		
Lough Corrib cSAC [000297]	crossed by the proposed road develop-ment	[1029] Freshwater pearl mussel *Margaritifera margaritifera* [1092] White-clawed crayfish *Austropotamobius pallipes* [1095] Sea lamprey *Petromyzon marinus* [1096] Brook lamprey *Lampetra planeri* [1106] Atlantic salmon *Salmo salar* (only in fresh water) [1303] Lesser horseshoe bat *Rhinolophus hipposideros* [1355] Otter *Lutra lutra*

[14] Distance in km/m from the proposed road development

Site Name	Distance[14]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[1393] Varnished hook-moss *Drepanocladus (Hamatocaulis) vernicosus* [1833] Slender naiad *Najas flexilis* [3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3130] Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea* [3140] Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) [6410] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [7110] * Active raised bogs [7120] Degraded raised bogs still capable of natural regeneration [7150] Depressions on peat substrates of the *Rhynchosporion* [7210] * Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* [7220] * Petrifying springs with tufa formation (*Cratoneurion*) [7230] Alkaline fens [8240] * Limestone pavements [91A0] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles [91D0] * Bog woodland
Galway Bay Complex cSAC [000268][15]	160m	[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 [1310] *Salicornia* and other annuals colonising mud and sand [1330] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) [1355] Otter *Lutra lutra* [1365] Harbour seal *Phoca vitulina*

[15] Inner Galway Bay is also a Ramsar site, under the Ramsar Convention (Ramsar site No. 838) and is a marine protected site under the OSPAR Convention - Galway Bay Complex MPA (O-IE-0002969)

Site Name	Distance[14]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[1410] Mediterranean salt meadows (*Juncetalia maritimi*) [3180] Turloughs* [5130] *Juniperus communis* formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) [7210] Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae* [7230] Alkaline fens
Connemara Bog Complex cSAC [002034]	6km	[1065] Marsh fritillary butterfly *Euphydryas* (*Eurodryas*, *Hypodryas*) *aurinia* [1106] Atlantic salmon *Salmo salar* (only in fresh water) [1150] * Coastal lagoons [1170] Reefs [1355] Otter *Lutra lutra* [1833] Slender naiad *Najas flexilis* [3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*) [3160] Natural dystrophic lakes and ponds [3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [4010] Northern Atlantic wet heaths with *Erica tetralix* [4030] European dry heaths [6410] *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) [7130] Blanket bogs (* if active only) [7140] Transition mires and Quaking bogs [7150] Depressions on peat substrates of the *Rhynchosporion* [7230] Alkaline fens [91A0] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles
Ross Lake and Woods cSAC [001312]	10.2km	[1303] Lesser horseshoe bat *Rhinolophus hipposideros* [3140] Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.
Black Head-Poulsallagh Complex cSAC [000020]	10.6km	[1170] Reefs [1220] Perennial vegetation of stony banks [1395] Petalwort *Petalophyllum ralfsii* [3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [4060] Alpine and Boreal heaths [5130] *Juniperus communis* formations on heaths or calcareous grasslands

Site Name	Distance[14]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) [6510] Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [7220] Petrifying springs with tufa formation (*Cratoneurion*) [8240] Limestone pavements [8330] Submerged or partially submerged sea caves
Lough Fingall Complex cSAC [000606]	11.1km	[1303] Lesser horseshoe bat *Rhinolophus hipposideros* [3180] * Turloughs [4060] Alpine and Boreal heaths [5130] *Juniperus communis* formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (* important orchid sites) [7210] * Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* [8240] * Limestone pavements
Rahasane Turlough SAC [000322]	13.2km	[3180] * Turloughs
Gortnandarragh Limestone Pavement cSAC [001271]	13.4km	[8240] * Limestone pavements
Moneen Mountain cSAC [000054]	13.2km	[1065] Marsh fritillary butterfly *Euphydryas* (*Eurodryas, Hypodryas*) *aurinia* [1303] Lesser horseshoe bat *Rhinolophus hipposideros* [3180] * Turloughs [4060] Alpine and Boreal heaths [5130] *Juniperus communis* formations on heaths or calcareous grasslands [6130] Calaminarian grasslands of the *Violetalia calaminariae* [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) [7220] * Petrifying springs with tufa formation (*Cratoneurion*) [8240] * Limestone pavements
East Burren Complex cSAC [001926]	13.5km	[1065] Marsh fritillary butterfly *Euphydryas* (*Eurodryas, Hypodryas*) *aurinia* [1303] Lesser horseshoe bat *Rhinolophus hipposideros* [1355] Otter *Lutra lutra*

Site Name	Distance[14]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
		[3140] Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. [3180] * Turloughs [3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [4060] Alpine and Boreal heaths [5130] *Juniperus communis* formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) [6510] Lowland hay meadows (*Alopecurus pratensis, Sanguisorba officinalis*) [7210] * Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* [7220] * Petrifying springs with tufa formation (*Cratoneurion*) [7230] Alkaline fens [8240] * Limestone pavements [8310] Caves not open to the public [91E0] * Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion, Alnion incanae, Salicion albae*)
Kiltiernan Turlough cSAC [001285]	13.8km	[3180] * Turloughs
Castletaylor Complex cSAC [000242]	14km	[3180] * Turloughs [4060] Alpine and Boreal heaths [5130] *Juniperus communis* formations on heaths or calcareous grasslands [6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) [8240] * Limestone pavements
Ardrahan Grassland cSAC [002244]	15km	[4060] Alpine and Boreal heaths [5130] *Juniperus communis* formations on heaths or calcareous grasslands [8240] * Limestone pavements
Ballyvaughan Turlough cSAC [000996]	15km	[3180] * Turloughs

Site Name	Distance[14]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
Special Protection Areas		
Lough Corrib SPA [004042]	203m	Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] - wintering Gadwall (*Anas strepera*) [A051] - wintering Shoveler (*Anas clypeata*) [A056] - wintering Pochard (*Aythya ferina*) [A059] - wintering Tufted Duck (*Aythya fuligula*) [A061] - wintering Common Scoter (*Melanitta nigra*) [A065] - breeding Hen Harrier (*Circus cyaneus*) [A082] – post-breeding/roost Coot (*Fulica atra*) [A125] - wintering Golden Plover (*Pluvialis apricaria*) [A140] - wintering Black-headed Gull (*Chroicocephalus ridibundus*) [A179] - breeding Common Gull (*Larus canus*) [A182] - breeding Common Tern (*Sterna hirundo*) [A193] - breeding Arctic Tern (*Sterna paradisaea*) [A194] – breeding Wetlands & Waterbirds [A999]
Inner Galway Bay SPA [004031]	1.1km at Oranmore Bay and Rusheen Bay	Great Northern Diver (*Gavia immer*) [A003] - wintering Cormorant (*Phalacrocorax carbo*) [A017] - breeding Grey Heron (*Ardea cinerea*) [A028] - wintering Light-bellied Brent Goose (*Branta bernicla hrota*) [A046] - wintering Wigeon (*Anas penelope*) [A050] - wintering Teal (*Anas crecca*) [A052] - wintering Shoveler (*Anas clypeata*) [A056] - wintering Red-breasted Merganser (*Mergus serrator*) [A069] - wintering Ringed Plover (*Charadrius hiaticula*) [A137] - wintering Golden Plover (*Pluvialis apricaria*) [A140] - wintering Lapwing (*Vanellus vanellus*) [A142] - wintering Dunlin (*Calidris alpina*) [A149] - wintering Bar-tailed Godwit (*Limosa lapponica*) [A157] - wintering Curlew (*Numenius arquata*) [A160] - wintering Redshank (*Tringa totanus*) [A162] - wintering Turnstone (*Arenaria interpres*) [A169] - wintering Black-headed Gull (*Chroicocephalus ridibundus*) [A179] - wintering Common Gull (*Larus canus*) [A182] - wintering Sandwich Tern (*Sterna sandvicensis*) [A191] - breeding Common Tern (*Sterna hirundo*) [A193] - breeding Wetlands & Waterbirds [A999]
Cregganna Marsh SPA [004142]	4km	Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] - wintering

Site Name	Distance[14]	Reasons for Designation – Qualifying Interests (QIs) or Special Conservation Interests (SCIs)
Connemara Bog Complex SPA [004181]	9.2km	Cormorant (*Phalacrocorax carbo*) [A017] - breeding Merlin (*Falco columbarius*) [A098] - breeding Golden Plover (*Pluvialis apricaria*) [A140] - breeding Common Gull (*Larus canus*) [A182] - breeding
Rahasane Turlough SPA [004089]	13.2km	Whooper Swan (*Cygnus cygnus*) [A038] - wintering Wigeon (*Anas penelope*) [A050] - wintering Golden Plover (*Pluvialis apricaria*) [A140] - wintering Black-tailed Godwit (*Limosa limosa*) [A156] - wintering Greenland White-fronted Goose (*Anser albifrons flavirostris*) [A395] - wintering Wetlands & Waterbirds [A999]

More detailed ecological baseline information is provided below in **Section 9** to further inform the detailed examination and assessment of the potential impacts of the proposed road development on individual European sites that lie within its ZoI. The process of identifying the potential impacts of the proposed road development, defining the ZoI, and determining which European sites are potentially at risk of impacts is set out below in **Sections 6** to **8**.

6 Potential Impacts of the Proposed Road Development

Through the evolution of the proposed road development, elements were included in the design to address some of the potential impacts discussed below. The design progressed in tandem with environmental studies which were undertaken to both inform the baseline environmental data and inform the design to minimise impacts to the receiving environment. Therefore, the identification and avoidance of potential impacts followed an iterative process between the design and environmental teams as follows:

- Potential impacts were identified by the environmental team
- Data on the potential impact was assessed by the design team to establish design solutions to eliminate a potential impact, and the design was updated to include these advanced solutions
- The updated design was reassessed by the environmental team
- The final design has addressed identified potential direct and indirect impacts and where potential direct and indirect impacts were not designed out, mitigation measures were incorporated

The design measures are presented in **Section 2.6** above and how these measures avoid or minimise the potential for the proposed road development to impact on European sites is discussed further below.

The proposed road development has the potential to have the following types of impacts on the receiving ecological environment:

- Direct loss of habitat area
- Fragment habitat areas and/or the territories of fauna species
- Tunnelling and deep excavations affecting the structural integrity[16] of the rock mass supporting the surface-level habitats
- Tunnelling and excavations affecting the existing hydrogeological regime and/or construction works affecting groundwater quality from contaminated surface water runoff and/or an accidental spillage or pollution
- Affect water quality in receiving watercourses during construction from contaminated surface water runoff and/or an accidental spillage or pollution event affecting habitats and/or species
- Affect air quality which in turn can affect the vegetation composition and structure of nearby habitats
- Introduce or spread non-native invasive species

[16] Structural Integrity of the rockmass that supports the mosaic of Limestone pavement and Calcareous grassland is the physical and mechanical geotechnical properties that control the behaviour of the geotechnical Limestone pavement environment

- Disturb fauna species (e.g. through noise, vibration, artificial lighting or increased human presence) resulting in the displacement of affected species from breeding/resting places or supporting habitat, potentially at key life-cycle stages
- Create a barrier to species movements as a consequence of constructing/introducing a new road carriageway into the natural environment
- Pose a mortality risk to aquatic species through accidentally dropping construction materials into watercourses when constructing new structures over watercourses
- Shade habitats beneath elevated structures, or next to high embankment or retaining walls, causing a reduction in sunlight and direct precipitation affecting the vegetation composition and structure
- Pose a mortality risk to fauna species from road traffic collisions or collisions with bridge structures

6.1 Habitat Loss & Fragmentation

The proposed road development will cause a direct loss or fragmentation of habitat areas within the receiving ecological environment by traversing or cutting through habitat areas. Across the study area this includes habitat types such as grasslands (both semi-natural and those improved/managed for amenity or agricultural purposes), scrub, woodland, wetlands, limestone pavement and watercourses, and as outlined in **Section 5.1**, many of these habitats also correspond with Annex I habitat types.

As noted in **Section 2.2**, the proposed road development and its boundary overlaps with, i.e. traverses through or adjacent to one European site, namely Lough Corrib cSAC, at four locations: at the termination of the proposed drainage outfall from the N59 Link Road North at Kentfield; at the site of the proposed River Corrib Bridge between Dangan and Menlough; to the west of the Coolagh Lakes; and, to the west and north of Lackagh Quarry where the proposed road development will consist of a tunnel (Lackagh Tunnel) and approach road infrastructure (Ch. 10+620 to Ch. 11+800). This will result in the loss of habitat area (and in places some level of habitat fragmentation) from that part of Lough Corrib cSAC through which the proposed road development traverses, between the River Corrib (Ch. 9+250) and Lackagh Quarry (Ch. 11+800). In total, c.4ha of Lough Corrib cSAC lie within the proposed development boundary. Habitat loss has the potential to affect the conservation objectives of Lough Corrib cSAC through the loss of QI habitat or the loss of habitat supporting the QI habitats or species (e.g. Otter habitat and/or breeding or resting sites). Habitat fragmentation is the process by which habitat loss divides habitat blocks into smaller more isolated patches and can happen at both a landscape scale or to discrete habitat areas. Habitat fragmentation can affect how ecosystems function, their resilience to change and, with regard to species, affect interactions within or between populations, population density or species richness.

Tunnelling and deep excavations associated with the proposed Lackagh Tunnel have the potential to result in habitat losses, potentially beyond the immediate

footprint of the proposed road carriageway, and this is discussed separately below in **Section 6.2** and **Section 6.3**.

Although the proposed road development does not directly impact upon any SPA sites, and will not result in any habitat loss or habitat fragmentation within any SPA sites, it does pass through, and will result in habitat loss in, potential "ex-situ" sites[17] where SCI listed bird species were recorded. This impact could result in the loss of important supporting habitat areas outside of the SPA boundary affecting the conservation objectives to maintain the distribution of areas used by SCI birds and those relating to population trends. This is discussed below in relation to SCI bird species listed for either their breeding or wintering populations for surrounding SPA sites.

There are four SPA sites locally which have bird species listed as SCIs for their wintering populations: Lough Corrib SPA, Inner Galway Bay SPA, Connemara Bog Complex SPA and Cregganna Marsh SPA.

The proposed road development will result in varying degrees of habitat loss in nine of the winter bird sites where bird species listed as SCIs of the surrounding SPAs, for their wintering populations, were recorded (Lough Corrib SPA and Inner Galway Bay SPA[18]): WB01, WB02, WB03, WB07, WB08, WB10, WB16, WB23 and WB45.

Overall, the areas of habitat loss are small relative to the extent of each affected winter bird survey site. The habitat types being lost are also common and widespread in the wider locality, in particular the peat/heathland habitats between Bearna and the N59 Moycullen Road, which extend to the north-west into Connemara. Similarly, for birds (as highly mobile species), habitat fragmentation is only likely to be an issue where it would result in the fragmented habitat patches being unviable in the long-term due to their reduced size, and consequently limit the availability of large areas of a given habitat type locally. In most cases the proposed road development clips these winter bird sites along their southern boundary (WB01, WB02, WB03, WB07, WB08, WB10 and WB23) and the effects of habitat fragmentation are minimal, particularly given that for some winter bird sites (e.g. WB01) the habitats represented are only a small proportion of those same habitats in the locality.

[17] The need to consider use of habitat areas outside of an SPA by SCI bird species is set out in Section 3.1 and 5.2 of the *Inner Galway Bay Special Protection Area (Site Code 4031), Conservation Objectives Supporting Document, Version 1* (National Parks & Wildlife Service, 2013d). These areas are termed 'ex-situ' sites and are defined as areas of habitat situated within the immediate hinterland of the SPA, or in areas ecologically connected to it, which support SCI bird species. There is no information or evidence to confirm whether any of the bird species recorded in habitats outside of European sites, which are within the ZoI of the proposed road development, are birds from either Lough Corrib SPA and/or Inner Galway Bay SPA, or are not part of the population from either European site. Therefore, a precautionary approach is being taken in assuming that any habitat areas supporting SCI bird species are potentially 'ex-situ' sites under that definition, and are assessed accordingly.

[18] Connemara Bog Complex cSAC is designated for breeding bird populations only (see **Table 5.3** above). Cregganna Marsh SPA lies c.4km south-east of the proposed road development. There were no records of Greenland white-fronted geese (the sole SCI species for this SPA site) from any of the winter bird sites surveyed for the proposed road development. Therefore, habitat loss associated with the proposed road development poses no risk to the wintering Greenland white-fronted geese population at Cregganna Marsh SPA.

Summary

The proposed road development will result in the loss/fragmentation of habitat area, with some of this habitat loss/fragmentation occurring within and adjacent to Lough Corrib cSAC. The proposed road development will also result in the loss/fragmentation of habitat area from local sites that support wintering bird species listed as SCIs for their wintering populations at local SPA sites (Lough Corrib SPA and Inner Galway Bay SPA).

6.2 Habitat Degradation as a result of Tunnelling/Excavations

The proposed road development includes elements of tunnelling and excavations, both of which have the potential to cause habitat degradation within the receiving ecological environment. Where tunnelling or deep excavations will be required to construct the proposed road development, they pose a risk of structural fracturing or collapse of rock masses/faces which support habitats either above (in the case of underground tunnelling) or adjacent to (in the case of deep cuttings/excavations) the works area. This could result in the loss of habitat area or, in the case of Limestone pavement [*8240] where the surface structure of the habitat is a critical component of that habitat type, structural degradation of the habitat. Tunnelling or deep excavations could also have hydrogeological effects, and these are discussed in **Section 6.3** below.

The proposed Lackagh Tunnel and its approaches are the only tunnelling/excavation elements of the proposed road development that lie within, or in close proximity to, a European site (Lough Corrib cSAC) and have the potential to give rise to these types of impacts. The proposed Galway Racecourse Tunnel lies more than 2.5km from the nearest European sites and poses no risk of affecting bedrock structure. As with the proposed Lackagh Tunnel, there is the potential for hydrogeological effects which are discussed in **Section 6.3** below.

Summary

The proposed road development will involve tunnelling under Lough Corrib cSAC and excavating deep cuttings within and immediately adjacent to the Lough Corrib cSAC boundary. This has the potential to result in the loss, or degradation, of QI Annex I habitat area in Lough Corrib cSAC which has the potential to affect the sites conservation objectives and adversely affect the integrity of this European site.

6.3 Habitat Degradation as a result of Hydrogeological Impacts

Construction activities, and operation of the proposed road development, have the potential to interact with the hydrogeology of receptors by changing the groundwater regime upon which the receptor is dependent. The potential direct or indirect impacts of the proposed road development on the existing hydrogeological regime are discussed in this section.

The following are groundwater bodies (GWB) traversed by or potentially impacted by the proposed road development. The locations of these GWB relative to the proposed road development and European sites are shown on **Figure 10.1.1** and **Figure 10.1.2** and discussed further below:

- Spiddal GWB
- Maam – Clonbur GWB
- Ross Lake GWB
- GWDTE Lough Corrib Fen 1 (Menlough)[19]
- GWDTE Lough Corrib Fen 2
- Clare-Corrib GWB
- Clarinbridge GWB

The characteristics which determine the potential for hydrogeological impacts on European sites are:

- The proximity to the European site (i.e. is the European site within the drawdown zone of influence or areas of potential pollution?)
- The level of aquifer connectivity between the European site and the proposed road development (i.e. is the feature in the same groundwater body as the proposed road development, or is there a hydraulic divide between the feature and the proposed road development?)
- The groundwater flow direction in the vicinity of the European site
- The requirement for dewatering, which depends on the excavation depth (whether in a road cutting or tunnel) of the proposed road development relative to the seasonal fluctuation in groundwater level
- The water quality of the feature and the groundwater from which it receives its base flow

19 As described above in Section 5.2, and in more detail in Section 4.2.2 of **Appendix A**, the GWDTE Lough Corrib Fen 1 (Menlough) was divided into two distinct groundwater bodies, based on the findings of the hydrogeological investigations: Lough Corrib Fen 1 (Menlough) GWB and the Lough Corrib Fen 1 (Lackagh) GWB

6.3.1 Potential Hydrogeological Impacts during Construction

Groundwater levels

The proposed road development has the potential to cause an impact on groundwater levels in the receiving environment as it will require the lowering of groundwater levels by dewatering of the bedrock aquifer during construction within those excavations deeper than the seasonal groundwater fluctuation. Dewatering will be undertaken using passive dewatering (gravity) where possible otherwise active dewatering (pumping) will be required. Dewatering of the bedrock aquifer will lower water levels locally (the extent of which depends on the properties of the aquifer), which can impact on groundwater by modifying the quantity of water carried by aquifer pathways.

In addition to the drawdown, groundwater levels are also at risk if karst flow paths are encountered. If karst pathways are present, then there is a risk of the groundwater carried by the flow paths being modified in volume. This may occur if pathways receive increased runoff from the proposed road development or if increased water erosion of sediment along the pathways occurs. Pathways may also be modified from poured concrete at structures migrating into the aquifer potentially restricting flow paths to receptors.

A number of requirements have been incorporated into the design in order to protect the existing hydrogeological regime, these include:

- No dewatering of the bedrock aquifer will occur during construction at Menlough Viaduct or Lackagh Tunnel (or its approaches). Furthermore, the construction sequence will take into account the seasonal groundwater fluctuation. During the winter groundwater high it may be necessary to limit the depth of works so that dewatering is not required
- Any groundwater intercepted will be collected and piped to either the surface water receptor it would naturally have drained to within the Galway Granite Batholith (i.e. the western part of the proposed road development between the Bearna West Roundabout and the N59 Moycullen Road) or, in the Visean Undifferentiated Limestone aquifer (i.e. east of the N59 Moycullen Road), intercepted groundwater will be controlled and infiltrated back to the same groundwater body
- Construction dewatering of the bedrock aquifer may seasonally be required in the limestone cutting between Castlegar and the N83 Tuam Road (Ch. 13+050 to Ch. 13+650) during peak groundwater levels. Any groundwater intercepted will be discharged back to the same GWB

Groundwater pollution

During construction, there is a risk of groundwater pollution from accidental spillages on site as well as from fines being transported during storm events and recharging to ground. Spillages and runoff has a high risk to groundwater where karst pathways are present. If karst is present then pollutants can travel significant distances relatively quickly, without natural attenuation or dilution that would occur in non-karst pathways (such as fracture or matrix flow). Similarly, if karst pathways

are present then there is a risk of poured concrete migrating into the aquifer, which could potentially contaminate flow paths to receptors.

In terms of design requirements, for the Ross Lake GWB, Lough Corrib Fen 1 (Menlough) GWB, Lough Corrib Fen 1 (Lackagh) GWB, GWDTE Lough Corrib Fen 2 and Clare-Corrib GWB the runoff from the construction will be managed on site, collected and treated prior to disposal by infiltration basins.

Groundwater recharge

Vegetation removal during construction will lead to an increase in the quantity of effective rainfall. Generally, where vegetation is removed then there is an increase of run off rather than recharge, as most effective rainfall becomes overland flow to surface water. If karst is present, then runoff may rapidly drain to ground at point recharge locations where flow paths are encountered.

All groundwater intercepted during construction will be managed and discharged within the same GWB. Groundwater intercepted during construction will remain within the surface water catchment that they would naturally have been received by. The recharge rate will not change in the Galway Granite Batholith. A temporary minor increase in the recharge rate (between 0.1m and 0.4m) is estimated in the Visean Undifferentiated Limestone aquifer from increased recharge below the footprint of the proposed road development.

Loss of aquifer area

The proposed road development will have an imperceptible impact on the Galway Granite Batholith aquifer or the Visean Undifferentiated Limestone aquifer from loss of aquifer area as in both cases the volumes lost are very small (refer to **Appendix A**). The loss of aquifer area does not have any long-term effects on any groundwater dependant habitats in European sites.

6.3.2 Potential Hydrogeological Impacts during Operation

Groundwater levels and recharge

There will be no active dewatering required during the operation phase but passive dewatering of the bedrock aquifer will occur at a number of cutting locations and the drainage associated with the proposed road development will cause the groundwater levels to adjust locally.

All groundwater intercepted by the proposed road drainage will be discharged to the same GWB thereby, maintaining the overall recharge rate to the aquifers and resulting in an imperceptible impact on groundwater levels.

Point discharges to groundwater from the infiltration basins will lead to local increases in the groundwater table. However, overall there will not be any net change to groundwater levels or recharge rate arising from this.

Groundwater pollution

The drainage design, including the design of the infiltration basins, minimises the risk of a pollution event during operation affecting groundwater quality. Risk of spillage is low (<0.5%) and any impacts that do accidentally occur will be temporary.

All infiltration basins are designed to include the following features as standard design: a containment area, a hydrocarbon interceptor and a wetland treatment component.

Infiltration to ground will diffuse and provide slow pathways to the groundwater table that will naturally promote settlement of fines. In the groundwater there will be significant dilution of any pollutants that enter that system and also some attenuation of any fines.

The overburden across the study area consists of glacial till derived from the underlying bedrock. The bedrock changes at the N59 Moycullen Road, from a granite (in the west) to a limestone bedrock (in the east) which have different chemical compositions. If limestone derived material is placed over granite bedrock, surface water run-off or groundwater movements through the material have the potential to impact local areas of peatland habitats by changing the pH of the local groundwater. Although, the magnitude of such an impact on groundwater pH is likely to be imperceptible. Due to the chemically inert nature of granite, if it is transported and used on embankments on limestone then there are no water quality concerns in terms of hydrogeology.

Summary

The proposed road development has the potential to affect the existing hydrogeological regime supporting groundwater dependant habitats within any European sites (or potential ex-situ bird sites) within the hydrogeological ZoI.

The proposed road development will not have any perceptible effect on the aquifers or groundwater bodies through changing recharge rates or loss of aquifer volume Groundwater effects could arise through groundwater drawdown and/or impacts on groundwater quality during construction and/or operation. This has the potential to result in the loss, or degradation, of habitat area supporting the QIs/SCIs of a European site which has the potential to affect the sites' conservation objectives and adversely affect the integrity of those European sites.

6.4 Habitat Degradation as a result of Hydrological Impacts

Types of hydrological impact fall into two broad categories of quantitative and qualitative impacts.

Quantitative hydrological impacts represent changes to the natural flow regime in the aquatic system in terms of changes to the water balance, flow depth, velocities, temperature and density leading to changes in the hydrodynamics of the aquatic system. These changes can be brought about by direct encroachment of the waterbody or by altering the recharge to a waterbody generally by the presence of

the proposed road development and its associated road drainage system within the catchment area.

Hydraulic structures such as bridges, culverts, channel diversions and outfalls can, if not appropriately designed, impact negatively on upstream and downstream water levels and on flow velocities. If a bridge or culvert opening is too narrow or a diversion channel undersized it may impede flow during times of floods thus causing water levels upstream of the structure to be raised above what would occur in the absence of the structure. If in-stream culvert structures and associated channel diversions and transitions are too wide or steep this can significantly affect the mean and low flow regime of the stream in terms of velocity and water depth changes resulting in low velocities and low water depths which can alter the local sedimentology and flow regime resulting in benthic impacts and potential fishery impacts.

Hard paved areas and local changes in the topography by the formation of the proposed road development can alter the groundwater and surface water recharge regime. The footprint of the proposed road development and its associated drainage system can capture surface runoff, unsaturated soil interflow and groundwater flows from up gradient and divert them to point surface and groundwater discharge points. Surface water drainage from the carriageway, grassed margins and embankment slopes can lead to localised increased flows and flooding in the receiving watercourses. The road formation can act as a large stone drain causing a diversion of recharge flows and in deep cuttings into the water table, a dewatering effect on the groundwater system which impacts both surface and groundwater systems.

Constructional activities such as temporary encroachments of watercourses for construction purposes of a bridge, culvert, outfall, temporary access road and temporary diversion can give rise to changes in the local flow regime which may alter velocities and depths and potentially give rise to changes to the hydrological flow regime and changes to channel morphology (channel deposition and erosion).

Qualitative hydrological impacts represent changes to the chemistry of the receiving waterbodies generally arising from road drainage discharges. Water quality impacts include those on receiving watercourses at storm outfalls from routine road runoff (generally sediment associated contaminants, heavy metals, hydrocarbons and suspended solids, de-icing agents (salt and grit) and to a lesser extent nutrients, organics, and coliforms). A wide range of heavy metals are known to occur in road drainage waters, the primary metals of concern are Cadmium (Cd), Lead (Pb), Copper (Cu) and Zinc (ZU). Salt and grit applications to road surfaces to mitigate icy conditions, will result in an increased salinity, pH, conductivity and total dissolved solids concentrations to receiving aquatic system. Increased salinity of watercourses can alter the ecological balance of the aquatic system and increase the bioavailability of chemical contaminants.

The proposed road drainage and associated storm outfalls provide a potential direct pathway for contaminant from accidental spillages associated with HGV’s (agricultural, oil/chemical spillages, bulk liquid, cement, etc.) to gain access to receiving watercourses.

6.4.1 Potential Hydrological Impacts during Construction

Construction activities pose a significant risk to watercourses, particularly contaminated surface water runoff from construction activities entering nearby watercourses. Construction activities within and alongside surface waters associated with bridge and culvert construction, outfalls and channel diversions can contribute to the deterioration of water quality and can physically alter the stream/river bed and bank morphology with the potential to alter erosion and deposition rates locally and downstream. Activities within or close to the watercourse channels can lead to increased turbidity through re-suspension of bed sediments and release of new sediments from earthworks. Consequently, in-stream works can potentially represent a severe disruption to aquatic ecology.

The main contaminants arising from construction runoff include:

- Elevated silt/sediment loading in construction site runoff

  Elevated silt loading can lead to long-term damage to aquatic ecosystems by smothering spawning grounds and gravel beds and clogging the gills of fish. Increased silt load in receiving watercourses stunts aquatic plant growth, limits dissolved oxygen capacity and overall reduces the ecological quality with the most critical period associated with low flow conditions. Chemical contaminants in the watercourse can bind to silt which can lead to increased bioavailability of these contaminants

- Spillage of concrete, grout and other cement based products

  These cement based products are highly alkaline (releasing fine highly alkaline silt) and extremely corrosive and can result in significant impact to watercourses altering the pH, smothering the stream bed and physically damaging fish through burning and clogging by the fine silt of gills

- Accidental spillage of hydrocarbons from construction plant and at storage depots/construction compounds
- Faecal contamination arising from inadequate treatment of on-site toilets and washing facilities

Hydrological Regime

As the proposed River Corrib Bridge structure is clear span and does not require any in-stream works to construct the supporting piers, construction works will not affect the flow or flooding regime of the River Corrib.

Any effects on the existing hydrological regime of any watercourses draining to Galway Bay (Sruthán na Líbeirtí (Liberty Stream), the Trusky Stream, the Bearna Stream and tributaries, the Tonabrocky Stream, and the Knocknacarragh Stream) would be temporary and would not have long-term hydrological effects on the receiving environment downstream in Galway Bay Complex cSAC or Inner Galway Bay SPA.

Surface Water Quality

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any of the watercourses crossed by the proposed road development has the potential to have a significant negative impact on water quality, and consequently downstream in Galway Bay. The effects of frequent and/or prolonged pollution events in a river system can be extensive and far-reaching and can have significant long-term effects. In an extreme scenario, with a pollution event of sufficient magnitude, it could result in the mortality of aquatic species. Water quality impacts could affect freshwater aquatic species in the receiving environment, any wetland habitats downstream connected to the receiving watercourses, and potentially the receiving estuarine, coastal and marine environment.

Potential Hydrological Impacts during Operation

As discussed in **Section 2.4**, there are 16 proposed mainline surface water outfalls discharging directly to surface watercourses, located primarily in the western section of the study area (over the western 10.15km of the 17.5km long mainline for the proposed road development). The remaining 7.35km, to the east of the River Corrib will be discharged to groundwater or to existing public storm and foul sewer systems in the absence of surface water drainage features. The realigned N84 Headford Road and slip roads for the N84 Headford Road Junction will discharge to a small ditch that inflows to Ballindooley Lough. The two short sections of tunnel in the eastern section will discharge to the public foul sewer via pumping.

Hydrological Regime

The proposed drainage outfalls have the potential to affect the general flow and morphological regime of a receiving watercourse during operation by increasing the volume and rate of runoff during storm events. However, the design includes the provision of attenuation ponds and flow control to restrict the outfall discharge to a more natural greenfield flood runoff rate, thereby avoiding potential significant impacts to channel morphology and flow regime.

The presence of new structures on watercourses has the potential to affect the existing flooding regime of the river/stream concerned. However, the assessment for the OPW Section 50 applications showed that all culverts provided are suitably sized to prevent any potential flood impacts both under present day statistics and in the short to medium term climate change conditions.

The only major watercourse bridge structure is the proposed River Corrib Bridge. The morphology of the River Corrib is significantly influenced by ambient flow and flooding conditions in the river, which in the case of the River Corrib are controlled through the Salmon Weir in Galway City. The potential increase in flow volume to the river arises from increased impervious area by the road pavement area, the provision of road and embankment drainage with a direct pathway via the road drainage system to the receiving watercourse and potential interception of groundwater and diversion of drainage waters that would not otherwise have reached the outfall point. The hard-paved areas and the road drainage system reduces the time of concentration for rainwater to arrive at the outfall and thus increase the rate of runoff over the natural greenfield condition.

In terms of the flooding regime, a detailed hydraulic assessment of the River Corrib and the proposed bridge structure was carried out as part of the Section 50 of the Arterial Drainage Act 1945 (as amended) application for the River Corrib Bridge. This assessment involved development of a detailed 2-dimensional hydraulic model of the River Corrib reach from Menlough to the Salmon Weirs Barrage and included the Jordan Island channel and the Coolagh Lakes to predict flood levels and allow testing of various bridge configurations as part of the design and optioneering studies for the bridge.

The modelling of return period flood flows with inclusion for statistical error provided flood levels at the proposed bridge site and these predicted flood levels clearly demonstrate that the proposed bridge structure will have no discernible impact on water levels and the flow regime either upstream or downstream nor is there any flood risk issues for the proposed road development with the proposed bridge deck and the storm drainage system sufficiently elevated above extreme flood levels.

Hydraulic analysis shows no discernible impact on flood levels at the design flood event which is the 100 year with inclusion of a climate change (CC) allowance of 20%. The predicted flood level for this design flood condition (100yr +CC) is 7.59m OD. At such a flood level, both river bank piers will be located just outside of the flood risk area. At the estimated 1000 year flood level of 7.67m OD associated with a peak flood flow of 648 cumec, the proposed bridge piers remain outside floodplain area in the flood zone (refer to Figure 8 in **Appendix B**) and, therefore, no encroachment of the floodplain area will occur at the bridge crossing. The water quality/attenuation ponds are also shown to remain outside the flood risk zones.

In order to avoid any potential scour risk associated with the construction of the bridge structure, the abutments will be sufficiently set back from the channel bank edge with foundations located at depth. This will protect the river channel from changes in morphology whereby the channel over time would naturally migrate towards one of the abutments. However, there is little potential for bank erosion at the proposed River Corrib crossing location as the river channel is straight, regular and cut into bedrock.

Surface Water Quality

As discussed in **Section 2.5.7.1**, there are three drainage networks which discharge directly to the Lough Corrib cSAC, namely S15, which drains the proposed N59 Link Road North and outfalls to an existing drainage ditch which ultimately outfalls to the River Corrib (part of both Lough Corrib cSAC and Lough Corrib SPA at this location), S18A and S18B which both directly discharge to the River Corrib. Additionally, there are two road drainage networks (S14A and S14B) which outfall indirectly to the Lough Corrib cSAC via an existing stream[20] which flows to the west of Aughnacurra residential estate. The outfall from the proposed NUIG pitches (S44) will also outfall indirectly to the Lough Corrib cSAC via an existing stream which flows south of the existing pitches.

[20] It should be noted that a section of this stream is partially culverted through Ard na Locha and is referenced as a sewer on **Figure 2.6**.

All drainage outfalls within the catchments of the Bearna Stream and the Knocknacarragh Stream will ultimately discharge to Galway Bay within Galway Bay Complex cSAC and Inner Galway Bay SPA. The remaining surface water catchments to which the road drainage outfalls (Sruthán na Líbeirtí (Liberty Stream) and the Trusky Stream) also discharge to Galway Bay but to the west of Galway Bay Complex cSAC and Inner Galway Bay SPA.

The drainage network and discharge points across the proposed road development, including those in the River Corrib catchment, are shown on **Figures 2.1** to **2.15**.

These outfalls have a potential to affect water quality in the receiving watercourses from routine contaminants that are contained in road drainage waters and also potentially by contamination arising from large liquid spillages as a result of an accident on the proposed road development.

All road drainage outfall discharges will undergo first flush water quality treatment in a wetland and pond system and will be fitted with an oil and petrol interceptor to capture hydrocarbons. Assessment of the potential impact both at individual outfalls and the cumulative load from the five surface outfalls on the water quality of the River Corrib was assessed using 2-dimensional hydrodynamic and transport dispersion modelling and using the TII HAWRAT package. The findings from this assessment (Section 4.2.2 of **Appendix B**) clearly show that the proposed routine discharge and first flush events will be sufficiently diluted by the River Corrib flow, even during low flow conditions, as not to have any perceptible water quality impact either locally or downstream. The assessment shows that water quality treatment of the first flush event through detention and slow-release over a 24 hour period is an important measure as it reduces localised impacts near the outfall point such that predicted heavy metal and suspended sediment concentrations do not exceed any environmental threshold levels and easily satisfy the surface water regulations.

To assess the localised impacts of the outfall drainage discharges to the River Corrib after treatment the 2-dimensional hydrodynamic model of the River Corrib developed for assessing the proposed river bridge crossing was run for first flush events of 15mm rainfall on the hard-paved area discharging at the various River Corrib outfalls (see Section 4.2.3 of **Appendix B**). The plume migrates with the flowing river downstream towards Galway City and therefore exposure duration is limited to the discharge period of approximately 12 hours. The maximum predicted concentrations throughout the model domain show that the plume hugs the near bank side of the river for quite a distance downstream before fully mixing across the river channel and has an imperceptible impact on water quality in the River Corrib (Figures 1 to 6 of **Appendix B**).

There is significant buffering between the proposed road development and the Galway Bay Complex cSAC and Inner Galway Bay SPA which minimises the potential impact of pollution runoff on these sites. The overall scale of the Galway Bay Complex cSAC and Inner Galway Bay SPA and the large flushing by tidal waters over spring and neap tides eliminates any potential impact that the proposed road development could have on the water quality of the Galway Bay Complex cSAC and Inner Galway Bay SPA.

It is anticipated that the proposed road development (which will take traffic from existing roads) will provide some benefit to water quality in receiving watercourses

as most of the existing road network does not have sustainable urban drainage systems to protect surface and groundwater alike.

The risk of pollution to both surface and groundwater resulting from accidental spillage has been considered. The risk is influenced by the type of roadway, length of road, the traffic volume, and proportion and type of heavy goods vehicles (HGV's). A spillage risk assessment of the proposed road development has been carried out in accordance with the TII Publications DN-DNG-03065 (HD45/15) (formerly NRA Design Manual for Roads and Bridges DMRB) – presented in Tables 4 and 5 of **Appendix B**. The spillage assessment shows the proposed road development will have very low magnitude of risk for individual outfalls or grouped catchment outfalls. The overall combined probability of a serious HGV spillage entering a watercourse from the proposed road development is low at 0.09%. A similar assessment was carried out for the proposed outfalls to groundwater via an infiltration basin and is presented in Table 5 of **Appendix B** and similarly show very low probabilities.

Notwithstanding the very low spillage risk for this proposed road development all storm outfalls will include pollution control facilities at their outfalls. All outflows will generally pass through large detention ponds that will be fitted with a penstock or similar restriction at the outfall to the receiving channel. In the event of a serious spill, these controls can be put in place to block the outflow of contaminants allowing time for clean up to take place.

Summary

The proposed road development has the potential to affect water quality in the receiving environment during construction. This has the potential to impact on aquatic, estuarine and marine QI habitats and species downstream of the proposed road development in Lough Corrib cSAC and Galway Bay Complex cSAC, habitats and SCI bird species downstream in Lough Corrib SPA and Inner Galway Bay SPA, and wetland habitats at potential "ex-situ" sites where SCI bird species of Lough Corrib SPA and Inner Galway Bay SPA were recorded. This has the potential to result in the degradation of QI/SCI habitats and habitat area supporting the QI/SCI species of these European sites which has the potential to affect the sites' conservation objectives and adversely affect the integrity of these European sites.

6.5 Habitat Degradation as a result of Air Quality Impacts

Emissions from car exhausts, and the deposition of particulate matter and heavy metals produced by engine, brake and tyre wear, can contribute to increased deposition of pollutants such as oxides of nitrogen (NO_x, NO_s), volatile organic compounds (VOCs), particulate matter (PM), heavy metals (HM) and ammonia (NH_4) in the vicinity of a road carriageway. This can affect the ecosystems and vegetation present, influencing plant growth rates and species composition, diversity, and abundance. Dust emissions associated with construction works could, in extreme circumstances, affect adjoining habitats (potentially burying sensitive habitats or plant species).

The current understanding of air quality impacts from roads and their interaction/effects on ecology are set out in the TII guidance document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (National Roads Authority, 2011) and two UK reports: *The Ecological Effects of Diffuse Air Pollution from Road Transport* (Bignal et al., 2004) and *The Ecological Effects of Air Pollution from Road Transport: An Updated Review* (Natural England, 2016). The effects of air pollution on vegetation and habitats are generally greatest within 50-100m of the road carriageway but effects can extend up to 200m. The only European site in the vicinity which could be affected is Lough Corrib cSAC.

Summary

The proposed road development has the potential to affect vegetation and habitats in Lough Corrib cSAC through air quality impacts during construction and/or operation which has the potential to affect the conservation objectives and adversely affect the integrity of this European site.

6.6 Habitat Degradation as a result of Shading Impacts

Elevated structures, sections of high embankment or high retaining walls have the potential to have shading effects on habitats beneath or in the vicinity of these features. Shading effects on the vegetation composition and structure of impacted habitats arise through a reduction in sunlight and/or direct precipitation affecting plant growth and species composition/abundance. Shading impacts on vegetation can only affect habitat areas beneath or in close proximity to the proposed road development.

The proposed River Corrib Bridge and the elevated embankment on its eastern approach (Ch. 9+250 – Ch. 9+600) and the section of embankment, retaining structure and bridge over Bóthar Nua (Ch. 9+850 – Ch. 10+150 occur within, or adjacent to, Lough Corrib cSAC and this is the only European site at risk from shading effects. Although the proposed road development also passes through or lies adjacent to Lough Corrib cSAC for Lackagh Tunnel and its approaches between Ch. 10+600 and Ch. 11+800, shading impacts will not arise in this area as the

proposed road carriageway is either at grade, in cutting, underground, or passing through Lackagh Quarry which lies below the level of the surrounding lands.

Summary

The proposed road development has the potential to affect habitats in Lough Corrib cSAC as a consequence of shading impacts during operation which has the potential to affect the conservation objectives and adversely affect the integrity of this European site.

6.7 Habitat Degradation as a result of Introducing or Spreading Non-native Invasive Plant Species

Non-native invasive plant species have been recorded along, or in close proximity to the proposed road development[21] (see **Section 5.5** and **Figures 13.1** to **13.5**). Therefore, construction works have the potential to accidentally cause their introduction/spread to habitat areas within European sites crossed by, or downstream of, the proposed road development. This includes along the haul routes shown on **Figures 3.1** and **3.2**. This has the potential to have long-term effects on plant species composition, diversity and abundance in affected habitats.

Given the presence of non-native invasive plant species cover in the immediate vicinity of the proposed road development, there is the potential that these species will recolonize vegetated areas within the proposed development boundary post-construction. As such, there is also a risk that routine maintenance works may inadvertently spread contaminated vegetation cuttings.

Summary

The proposed road development has the potential to affect habitats along the proposed road development during construction and/or operation as a result of introducing or spreading non-native invasive plant species, which has the potential to affect the conservation objectives and adversely affect the integrity of nearby European sites.

6.8 Disturbance/Displacement

In conjunction with any displacement effects associated with habitat loss, increased human presence and/or noise and vibration associated with construction works, has the potential to displace any fauna species from both breeding/resting places and from foraging habitat. This section discusses those species that are relevant to the assessment of effects on European sites.

Disturbance/displacement effects from the proposed road development could only affect the QI species of a cSAC/SAC site that is crossed by, or in close proximity to, it. The same applies in relation to SPA sites with the additional requirement to consider ex-situ sites, beyond the SPA boundary, that are important in supporting the SPAs SCI population(s). With regard to cSAC/SAC sites, only Lough Corrib

[21] Non-native invasive aquatic plant species (or fauna species) were not recorded in aquatic habitats impacted by construction works.

cSAC, and its QI species Otter, Atlantic salmon, Sea lamprey and Brook lamprey, is likely to be subject to some level of disturbance during construction and/or operation[22].

Otter

As there were no Otter breeding or resting places, holts or couches, within the construction disturbance ZoI (150m), the proposed road development will not result in any disturbance or displacement effects in that regard. However, Otter were recorded widely along the River Corrib corridor. Therefore, increased human presence and/or noise and vibration associated with construction works, particularly associated with the construction of the proposed River Corrib Bridge, has the potential to (at least temporarily) displace commuting or foraging Otter.

Otter are known to tolerate human disturbance, including road traffic, under certain circumstances (Bailey & Rochford, 2006; The Environment Agency, 2010; Irish Wildlife Trust, 2012; and, Reid et al. 2013). This is also evidenced by the presence of Otter signs along the River Corrib through the NUIG Campus (see **Figure 6**), the presence of an active Otter couch site within 50m of the Quincentenary Bridge, and the presence of Otter (including holt sites) in the urban centre of Galway City. Otter are also nocturnal in habitat, and this greatly reduces the risk of displacement given that the majority of construction works likely to take place during normal daylight working hours. There will be blasting at Ballagh for approximately 9 months which will cause some level of disturbance to Otter using the Bearna Stream (the lower reaches of which are within Galway Bay Complex cSAC) and the Tonabrocky Stream. However, this will only affect Otter temporarily, will not affect any Otter holts, and with Otter known to tolerate certain levels of disturbance and habituate to it, this will not have long-term effects on Otter usage of the Bearna Stream catchment. Considering the above, disturbance due to increased human presence, noise and vibration associated with construction works in the vicinity of the River Corrib, Coolagh Lakes, and Bearna Woods, does not pose a risk of resulting in long-term disturbance/displacement of Otter from these river/lake systems.

Similarly, Otter would not be adversely affected by disturbance during operation given that, based on the findings of the Otter surveys carried out in 2014/15, they are currently using habitat in the vicinity of the NUIG Campus and the existing Quincentenary Bridge (an existing busy road). There is no artificial lighting associated with the proposed River Corrib Bridge and light spill from the proposed NUIG pitches will not affect use of the River Corrib corridor by Otter and therefore, there is no risk of displacement effects from this impact source.

The proposed road development will not result in any long-term disturbance or displacement of Otter, during construction or operation.

[22] The other QI species of Lough Corrib cSAC are not at risk of disturbance effects as they are either not present in the River Corrib (White-clawed crayfish or the Freshwater pearl mussel – see **Section 9.1.2.3** and **Section 9.1.2.6**, respectively) or the QI populations are remote from the study area as is the case for the Lesser horseshoe bat (**Section 9.1.2.5**).

Atlantic salmon, Brook lamprey and Sea lamprey

Increased human presence, and noise and vibration associated with the construction works (including the installation of any temporary piles required to construct bridge abutments) could result in the displacement of fish species from the area. Given the temporary nature of any vibration associated with pile driving, and the short-term nature of general construction works (which if carried out during normal working hours, would be of a limited duration each day), disturbance levels will not permanently displace fish species from the River Corrib in the vicinity of the proposed road development.

Given that the existing Quincentenary Bridge does not result in any disturbance or displacement effects to fish species in the River Corrib, operation of the proposed road development does not pose any disturbance displacement risk. There will be no artificial lighting associated with the proposed River Corrib Bridge and light spill from the proposed NUIG pitches will not affect use of the River Corrib corridor by these species and therefore, there is no risk of displacement effects from this impact source.

The proposed road development will not result in any long-term disturbance or displacement of Atlantic salmon, Brook lamprey or Sea lamprey, during construction or operation, will not affect the conservation objective attributes and targets supporting the conservation condition of these species in Lough Corrib cSAC (see **Table 9.17**).

SCI Bird Species

Increased human presence, and noise and vibration associated with general construction works (and also including any impulse noise disturbance, such as blasting, that might be required to facilitate construction works) has the potential to disturb, and potentially displace, birds from important habitat areas. This could apply to areas both within SPA sites, or at associated ex-situ supporting habitat area remote from the SPA site itself.

Summary

The proposed road development has the potential to affect habitat usage by SCI bird species during construction and/or operation, both within SPA sites and at important ex-situ habitat areas which have the potential to affect the conservation objectives and adversely affect the integrity of SPA sites.

6.9 Barrier Effect

The proposed road development could potentially pose a physical barrier to aquatic species movement either as a result of physical construction or during operation where the design of watercourse crossing structures restricts the movement of aquatic species along river/stream corridors, particularly during periods of high water or flood. The proposed road development traverses the following watercourses: Sruthán na Líbeirtí, the Trusky Stream, the Bearna Stream, the Tonabrocky Stream, the Knocknacarragh Stream and the River Corrib.

The River Corrib is the only watercourse crossed by the proposed road development within a European site, namely Lough Corrib cSAC.

However, given the construction methodology (as outlined in **Appendix D**), the proposed River Corrib Bridge does not require the provision of a temporary crossing structure to facilitate construction works and neither are any in-stream works required. Bankside works will be required to install the drainage outfalls to the River Corrib on both banks of the river (**Figures 2.1** to **2.15**); and this will result in the severance of the bankside habitat used by Otter, at least temporarily, during construction. Nevertheless, considering all of the above, the River Corrib channel will remain unobstructed by construction works and therefore construction works will not pose any physical barrier to aquatic species movement along the river corridor.

As the proposed River Corrib Bridge is a clear span structure (elevated c.10m over the river), and will not have any in-stream supporting structures, it poses no risk of a barrier to aquatic species' movement along the River Corrib during operation.

The proposed road development crosses the Bearna Stream and the Tonabrocky Stream. Otter were also recorded in the Bearna Stream catchment. Two culvert structures are proposed on these watercourses which have the potential to present a barrier to Otter movement during construction (as in-stream works are required) and during operation. Although where the proposed road development crosses these watercourses they are not within Galway Bay Complex cSAC, the lower portion of the Bearna Stream does lie within this European site. Otter using these watercourses are likely to form part of that European site's Otter population.

Disturbance/displacement of aquatic species from sections of river/stream channel during construction could also potentially act as a "barrier" to species movement. This is assessed above under *Disturbance/Displacement*, the conclusion of which was that neither construction or operational disturbance poses any risk of affecting the conservation objectives of Lough Corrib cSAC's QI species.

Summary

The proposed road development will not result in a barrier to aquatic species movement during construction or operation. However, it may present a barrier effect to Otter within the Bearna Stream catchment.

6.10 Mortality Risk from Construction works and Road Traffic

The introduction of the proposed road development into a rural landscape will permanently increase the risk of road traffic collisions with terrestrial fauna species. This section discusses those species that are relevant to the assessment of effects on European sites.

During construction of the proposed River Corrib Bridge, there is a risk of construction materials accidentally falling into the River Corrib and killing/injuring aquatic species such Otter, Atlantic salmon, Brook lamprey and Sea lamprey. At this location, the River Corrib lies with Lough Corrib cSAC and these species are

listed as QIs for this European site. As the proposed road development is remote from all other European sites, this potential impact only poses a risk to the conservation objectives of Lough Corrib cSAC.

Evidence of Otter activity was widespread along the River Corrib and at the Coolagh Lakes, both of which form part of Lough Corrib cSAC. Otter were also recorded in the Bearna Stream catchment and, although where the proposed road development crosses the catchment is not part of the Galway Complex cSAC, Otter using these watercourses are likely to form part of that European site's Otter population. The introduction of a new road, including a new bridge structure, across the River Corrib floodplain and in close proximity to the wetland complex at the Coolagh Lakes introduces a risk of road traffic collisions with Otter as do the new crossings of the proposed road development over watercourses in the catchment of the Bearna Stream. This has the potential to affect the conservation objectives of Otter in both Lough Corrib cSAC and Galway Bay Complex cSAC.

Summary

The proposed road development has the potential to result in the mortality of the QI aquatic species of Lough Corrib cSAC during construction of the River Corrib Bridge, It also has the potential to result in the mortality of Otter through the increased risk of road traffic collisions which could affect the Otter populations of Lough Corrib cSAC and Galway Bay Complex cSAC. These impacts have the potential to affect the sites conservation objectives and adversely affect the integrity of these European sites.

6.11 Collision Risk with Bridge Structures

Avian mortality caused by collision with man-made structures is well-documented (Banks 1979). Buildings and windows (Kelm, 2008), power lines (Jenkins et al., 2010), wind turbines (Lucas et al., 2008) and communication towers (Longcore et al., 2012) are all documented as the primary structures causing bird collisions leading to mortality (Erickson et al., 2001). Less widely documented is avian collisions with bridges.

The Fehmarnbelt Fixed Link EIA (FEBI, 2013) details results of a bird collision study carried out at the Oresund Bridge by Nilsson et al. (2009). The bridge connects Denmark and Sweden, includes cable-stay sections and is approximately 8km in length. In 2000, shortly after the bridge opened, 344 bird carcasses were recovered following one collision event. The incident was assumed to be an effect of low visibility in combination with high pylons. After opening of the bridge in 2000, a collision of estimated thousands of birds occurred on the night of the 8 October 2000 (Bengtsson 2000). Subsequent studies on bird movements around the bridge recorded collision events in autumn of 2001 (291 birds), 2002 (103 birds), 2003 (65 birds) and 2008 (21 birds) as reported in FEBI, 2013. A review of the 2001 data showed that passerine species comprised 94% of collision victims, a finding that has similarly been reported at lighted towers and associated guy wires in the US and Canada (Longcore *et al.*, 2013), 96% of victims were migrating birds and 73% were nocturnal migrants (Nilsson and Green 2002 as reported in FEBI 2013). The composition of collision victims in later studies (Nilsson and Green 2003, 2004, Nilsson *et al.* 2009 as reported in FEBI 2013) changed with a marked

reduction in the number of passerine carcasses recovered and an increase in gull species carcasses. The data indicated that lighting changes in 2002, turning bridge lights off at high pylons during foggy conditions, may have reduced passerine collision numbers, and that scavenging species (e.g. gulls) may have a greater collision risk with traffic due to their behaviour. The studies have also inferred that bird collisions with the bridge mainly occur during adverse weather conditions (Nilsson *et al.* 2009 as report in FEBI 2013). To put this study into context it has been estimated 100 million individuals pass over the Oresund area every autumn (Nilsson and Green 2011), with 10 million migrants passing the Oresund Bridge during autumn migration, and that numbers of collision victims reported in the above studies did not represent more than a minor effect on species considered (Nilsson *et al.* 2009 as report in FEBI 2013).

As part of the Hong Kong-Shenzhen Western Corridor EIA for a 5.5km bridge (Ove Arup & Partners Hong Kong Ltd., 2002) a short study was carried out during the migration period (November 2001 to March 2002) to assess flight behaviour and altitudes over three selected bridges, all approximately 15m in height. The study found that birds tended to flyover the structure in the evening and below the structure during the midday, and that birds actively avoided the structure by changing their altitude on approach. No collisions with the studied bridges were observed. However, it should be noted that nocturnal surveys were not carried out. A short-term study at the Golden Gate Bridge, California, showed birds actively avoided the bridge structure with most flying over or around the cable-stay structures rather than through them. No collisions were recorded and similarly these surveys were carried out during the diurnal period (Golden Gate Bridge EIA, 2009).

The findings of these studies support an argument that bridge structures, although they may result in some degree of bird mortality through collision, do not pose a collision risk of a magnitude that would kill large numbers of birds or result in any population level effects as a consequence.

The risk of birds colliding with a bridge structure is dependent on factors such as the location and attributes of the man-made structures (Lucas *et al.* 2008), visibility and detectability of the structure (bridge strikes are more likely during poor weather conditions or at night), the structure of the surrounding habitat, their frequency of occurrence within the impact zone (and flight height relative to the bridge structure), and the bird species present and their species-specific characteristics such as morphology and behaviour which influence their relative susceptibility to colliding with structures (Janss, 2000). The effects of collision risk at night can be magnified by disorientation caused by artificial lighting (Molenaar et al., 2006). It has also been inferred that a bird's individual experience or inexperience can influence collision risk (Barrios and Rodriguez, 2004).

Larger, less agile species such as geese, swans, and Cormorant would be expected to be more susceptible to colliding with a bridge structure; particularly in relation to the risk of colliding with supporting cables. In terms of design criteria, bridges lit at night and with a dense and/or expansive network of supporting cables and towers across the river valley pose the highest risk.

The only structure associated with the proposed road development which is of a scale as to pose a collision risk to birds is the proposed River Corrib bridge. It is

elevated above ground across the entire River Corrib floodplain (c.620m) which is a prominent natural corridor used by birds for foraging and commuting between Lough Corrib and Galway Bay. Along with more local daily bird movements, the River Corrib corridor is also likely to be used during the seasonal movement of birds to and from Galway Bay. With the exception of the proposed Menlough Viaduct, all of the other structures associated with the proposed road development are either tunnels or (relatively) small river/stream culverts and pose no risk to birds at a population level. The Menlough Viaduct spans an area of limestone pavement and woodland across the top of a low hill but given that it is only slightly elevated above the surrounding land (generally the deck is between 0.75m and 2.5m above ground), is mostly flanked by woodland on both sides (minimising the collision potential by directing birds over the structure), it poses a minimal collision risk to birds.

The design for the proposed River Corrib Bridge consists of prefabricated, precast box girders supporting a cast concrete bridge deck. Refer to **Section 2.3** above and **Appendix D** for more detail. In terms of design, this poses a minimal risk to birds when compared with bridge structures which present a network of supporting cable structures across the river corridor. The structural depth of the main span of the bridge deck that crosses the River Corrib ranges from 3-7m, which is generally thicker (and therefore likely to be more visible to birds) than the existing Quincentenary Bridge c.1.7km downstream. It will also not be lit, which further reduces the risk of bird collision.

In terms of bird species known to use the River Corrib corridor for commuting or foraging, the surveys carried out in 2005/2006 as part of the 2006 Galway City Outer Bypass Scheme (RPS, 2006) recorded the following SCI species flying through the proposed bridge site for that scheme over the survey period (52 surveys encompassing 104 hours of observations): Black-headed gull, Common gull, Common tern, Cormorant, Coot, Curlew, Grey heron, Hen harrier, Lapwing and Merlin. The most frequently recorded of these were Black-headed gull, Common gull and Cormorant. Black-headed gull were recorded passing the observation point 409 times (with 810 individuals counted in total); Common gull passed the observation point 93 times (130 individuals in total); and, Cormorant passed the observation point 177 times (248 individuals in total). Hen harrier and Coot were only recorded once, Curlew twice and Lapwing on four occasions over the survey period. Grey heron were recorded passing the observation point on 20 occasions. Common tern were observed passing the observation point on only 43 occasions and generally low over the water (<5m). Many of these species, Black-headed gull, Common gull, Cormorant, Coot, Curlew, Grey heron along with Redshank, were also recorded along the River Corrib over the course of the surveys carried out in the preparation of this NIS.

It is worth noting in terms of collision risk and population level effects locally, that the Quincentenary Bridge (an elevated structure above the River Corrib with supporting piers in the river channel) has been in operation since 1984 and population trends for the SCI bird species of Inner Galway Bay SPA recorded along the River Corrib corridor are currently assessed as stable or increasing (NPWS 2013d) – similar population trends were not available for Lough Corrib SPA at the time of writing.

Given the low risk posed by bridges to bird populations, the design of the proposed River Corrib Bridge, the low number of individual SCI bird species (and individuals) recorded passing along the River Corrib corridor (particularly in the context of the SPA populations for those species), and the low crossing frequencies observed, a bridge such as that proposed over the River Corrib for the proposed road development is not predicted to pose a collision risk of a magnitude that would have any long-term effects on the numbers, distribution, or the existing population trend for any SPA.

Summary

The proposed road development has the potential to cause a collision risk to bird species, however, this risk will not result in any population level effects.

6.12 Summary

Table 6.1 below summarises the potential impacts associated with the proposed road development, and their ZoI.

Table 6.1: Potential Impacts of the Proposed Road Development

Impact
Construction Impacts
Habitat loss Loss/fragmentation of habitat area, within and adjacent to Lough Corrib cSAC, and the loss/fragmentation of habitat area from local sites that support wintering bird species listed as SCIs of Lough Corrib SPA and Inner Galway Bay SPA
Habitat degradation as a result of tunnelling/excavations Tunnelling under Lough Corrib cSAC and excavating deep cuttings within and immediately adjacent to the Lough Corrib cSAC boundary has the potential to result in the loss, or degradation, of QI Annex I habitat area in Lough Corrib cSAC
Habitat degradation as a result of hydrogeological impacts Potential to affect the existing hydrogeological regime supporting groundwater dependant habitats within the hydrogeological ZoI
Habitat degradation as a result of hydrological impacts Potential to affect water quality in the receiving environment during construction
Habitat degradation as a result of air quality impacts Potential to affect vegetation and habitats in Lough Corrib cSAC through dust deposition impacts during construction
Habitat degradation as a result of introducing/spreading non-native invasive plant species during construction
Disturbance/displacement Potential to affect habitat usage by SCI bird species during construction and/or operation, both within SPA sites and at important ex-situ habitat areas
Mortality risk from construction works Potential to result in the mortality of the QI aquatic species of Lough Corrib cSAC during construction of the River Corrib Bridge

Impact
Operational Impacts
Habitat degradation as a result of hydrogeological impacts Potential to affect the existing hydrogeological regime supporting groundwater dependant habitats within the hydrogeological ZoI.
Habitat degradation as a result of shading impacts Potential to affect habitats in Lough Corrib cSAC as a consequence of shading impacts during operation
Habitat degradation as a result of air quality impacts Potential to affect vegetation and habitats in Lough Corrib cSAC through air quality impacts during operation
Habitat degradation as a result of introducing/spreading non-native invasive plant species during operation
Barrier effect Potential to present a barrier to Otter within the Bearna Stream catchment
Mortality risk from road traffic Potential to result in the mortality of Otter through the increased risk of road traffic collisions which could affect the Otter populations of Lough Corrib cSAC and Galway Bay Complex cSAC

7 Zone of Influence of the Proposed Road Development

The Zone of Influence (ZoI) is the area within which the proposed road development could affect the receiving environment such that it could potentially have significant effects on the QI habitats or QI/SCI species of a European site (as defined in CIEEM, 2016).

The mechanism to define the ZoI is summarised as follows:

- Consider the nature, size and location of the proposed road development (see **Section 2** for a description of the proposed road development)
- Consider the sensitivities of the relevant ecological receptors (see **Section 5** for a description of the baseline environment)
- Identify potential impact sources and pathways (see **Section 6** for the potential impacts associated with the proposed road development)
- Determine the ZoI based on the potential extent of the impact

In consideration of the identified impact sources and pathways presented in **Section 6** and summarised below, the ZoI of each is explained further below and summarised in **Table 7.2**, with the combined ZoI shown on **Plate 7.1** below and on **Figure 16**.

7.1 Habitat Loss & Fragmentation

As discussed in **Section 6.1**, habitat loss refers to any habitat areas lost within European sites and also within the proposed development boundary. Habitat fragmentation refers to any habitat block which is split by the proposed road development.

As outlined in **Section 2.2** and **6.1**, the proposed road development traverses Lough Corrib cSAC and some potential ex-situ sites supporting bird species listed as SCIs of Lough Corrib SPA and/or Inner Galway Bay SPA – on both instances this will result in some level of habitat loss and fragmentation.

Loss of habitat, and any associated habitat fragmentation, at the winter bird sites will not result in a decline in the number and range of habitat areas available locally to bird species listed as SCIs of any of the surrounding SPAs for their wintering populations and will not therefore, affect the ability of these SCI populations to maintain themselves in the long-term.

There are three SPA sites locally which have bird species listed as SCIs for their breeding populations: Lough Corrib SPA, Inner Galway Bay SPA and Connemara Bog Complex SPA.

Black-headed gull, Common gull and Common tern are listed as SCIs for their breeding populations in Lough Corrib SPA[23]. The nearest Black-headed gull

[23] The breeding sites of these species in Lough Corrib are described in Hunt & Heffernan (2007)

breeding site is at Angliham Quarry; c.1.3km to the north of the proposed road development, where 11 of 431 nest sites recorded during the 2007 survey were located. There are many islands in Lough Corrib traditionally used as Common gull breeding sites, and many bays, islands and sections of shoreline in the lake traditionally used as Common tern nest sites. The nearest of these sites was at Walsh's Island, more than 8.5km to the north of the proposed road development. Both Black-headed gull and Common gull are opportunistic feeders and any habitat loss/fragmentation associated with the proposed road development will not affect their breeding success. Common tern feed on fish and as the proposed road development will not result in the loss of any coastal or inland waterways (e.g. Lough Corrib, the River Corrib, Galway Bay) any habitat loss/fragmentation will not affect their breeding success.

Cormorant, Sandwich tern and Common tern are listed as SCIs for their breeding populations in Inner Galway Bay SPA. All are fish eating birds and as the proposed road development will not result in the loss of any coastal or inland waterways (e.g. Lough Corrib, the River Corrib, Galway Bay) any habitat loss/fragmentation will not affect their breeding success.

Connemara Bog Complex SPA lies c.9km to the north-west of the proposed road development. At this distance the proposed road development poses no risk of affecting breeding success at the nesting sites within the SPA: the lakes for Cormorant and Common gull, and upland habitats for Merlin and Golden plover.

All other SPAs are located more than 10km from the proposed road development. That distance is considered to be beyond the normal commuting range of wintering or breeding SCI species. The exception is birds wintering in Ireland migrating to/from their breeding grounds; for example, Whooper swans returning to winter in Ireland from their Icelandic breeding grounds. Current best scientific knowledge is that roads do not pose any risk of population level effects to wintering birds during these migratory movements (once habitat loss is considered in the context of staging areas; which does not arise in the context of the proposed road development), and breeding sites or supporting home ranges will not be affected beyond a distance of 10km. Accordingly, the proposed road development poses no risk to the conservation objectives of any other SPA sites.

The ZoI of this impact is potentially any habitat area within or traversed by the proposed development boundary that lies either within Lough Corrib cSAC or those potential ex-situ sites supporting SCI listed bird species of Lough Corrib SPA and/or Inner Galway Bay SPA.

7.2 Habitat Degradation as a result of Tunnelling/Excavations

As discussed in **Section 2.2**, the proposed road development traverses adjacent to and beneath the Lough Corrib cSAC for Lackagh Tunnel and its approaches. The proposed road development has the potential to affect the structural integrity[24] of the rock mass, and the structure and function of the habitats supported by it, above and adjacent to the proposed Lackagh Tunnel and associated construction works.

The ZoI of this impact is habitat areas immediately above the Lackagh Tunnel and along the western and eastern approaches to the tunnel within Lough Corrib cSAC.

7.3 Habitat Degradation as a result of Hydrogeological Impacts

The proposed road development will interact with groundwater during construction and operation and there are groundwater dependant habitats locally that could be negatively affected as a consequence of groundwater drawdown or groundwater quality impacts, where they occur within the hydrogeological ZoI.

The extent of drawdown, referred to as drawdown zone of influence (ZoI), is the area within which groundwater levels are lowered and outside of this area groundwater levels will remain at their natural level. The drawdown ZoI is presented as a radius on either side of the proposed road development that takes into account the aquifer properties and the hydraulic gradient and it is calculated using the upper range of properties determined for each aquifer.

The area where groundwater is at risk from accidental pollution or runoff is limited in extent to the footprint of the proposed road development for the Galway Granite Batholith due to the poor aquifer properties that will prevent groundwater migrating downgradient of the site. If localised zones of permeability are encountered in the Galway Granite Batholith, then these will be managed by sealing them from the proposed road drainage. The area where groundwater is at risk from accidental pollution or runoff for the Visean Undifferentiated Limestone aquifer encompasses the footprint of the proposed road development but is extended where karst is present to accommodate groundwater down gradient.

The hydrogeological ZoI for groundwater drawdown and groundwater quality impacts during construction and operation is shown on **Figures 10.2.1** to **10.3.8**.

The unmitigated ZoI of the proposed road development within the Spiddal GWB, the Maam-Clonbur GWB, the Clare-Corrib (Ballindooley West) GWB, the Clare-Corrib (Ballindooley East) GWB, and the Clarinbridge GWB does not extend to include any European sites (refer to **Figures 10.2.1** to **10.2.2**). Therefore, the proposed road development will not have any impacts on groundwater dependent

[24] Structural Integrity of the rock mass that supports the mosaic of Limestone pavement and Calcareous grassland is the physical and mechanical geotechnical properties that control the behaviour of the geotechnical Limestone pavement environment

habitats in any European sites supported by these groundwater bodies, during construction or operation, as a consequence of the proposed road development traversing these groundwater bodies.

During construction or operation, the proposed road development only has the potential to interact with groundwater dependant habitats that are within the unmitigated hydrogeological ZoI of the proposed road development, and supported by groundwater contributions from Ross Lake GWB, Lough Corrib Fen 1 (Menlough) GWB, Lough Corrib Fen 1 (Lackagh) GWB, GWDTE Lough Corrib Fen 2 or the Clare-Corrib GWB. The only European site within this zone that contains groundwater dependent habitats is Lough Corrib cSAC.

Within these groundwater bodies, the following elements of the proposed road development have the potential to interact with groundwater during construction, based upon the design of the proposed road development and the groundwater monitoring data presented in **Appendix A** and **Appendix F**: excavating and installing the N59 Link Road North drainage outfall, excavating and installing the support piers for the River Corrib Bridge, excavating and installing the support piers for the Menlough Viaduct, the western approach to the Lackagh Tunnel and the Lackagh Tunnel itself.

Although the potential hydrogeological impacts do not extend to any SPA sites, and will not result in any habitat loss or habitat degradation within any SPA sites, it does have the potential to affect wetland habitats at the Coolagh Lakes, and potentially peatland habitats in the western part of the study area. These habitats support wintering bird species which are listed as SCIs of Lough Corrib SPA and/or Inner Galway Bay SPA. Therefore, impacts upon the existing hydrogeological regime could potentially affect habitat quality and usage of the site by SCI species, which in turn would could affect the conservation objective to maintain the distribution of areas used by SCI waterbirds.

The hydrogeological ZoI for groundwater drawdown and groundwater quality impacts during construction and operation is shown on Figures 10.2.1 to 10.3.8 and includes habitat areas within Lough Corrib cSAC, and wetland sites supporting SCIs of Lough Corrib SPA and Inner Galway Bay SPA.

7.4 Habitat Degradation as a result of Hydrological Impacts

The proposed road development traverses the catchments of the following streams/rivers: Sruthán na Líbeirtí (Liberty Stream), the Trusky Stream, the Bearna Stream, the Tonabrocky Stream, the Knocknacarragh Stream, the River Corrib (and the Coolagh Lakes), and Ballindooley Lough. There is therefore the potential for the proposed road development to affect water quality in the receiving environment during construction which has the potential to impact on any aquatic, estuarine and marine habitats and/or species downstream of the proposed road development in those watercourses and in Galway Bay.

The ZoI of this impact is any wetland, coastal or marine habitat downstream of any watercourse crossings or drainage outfalls, and any aquatic/marine species therein and includes Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA.

7.5 Habitat Degradation as a result of Air Quality Impacts

Construction works will generate dust and road traffic will generate air pollutants during operation. The effects of air pollution on vegetation and habitats may extend for up to 200m from the proposed road carriageway.

The ZoI of this impact is the immediate vicinity of the construction works for dust deposition and within 200m of the proposed road edge during operation, and includes Lough Corrib cSAC.

7.6 Habitat Degradation as a result of Shading Impacts

Habitats beneath, or immediately adjacent to, viaduct structures, embankments or retaining walls where habitat will not be permanently lost are at risk of some level of shading from the proposed road development – i.e. the proposed River Corrib Bridge, the proposed Menlough Viaduct, and sections of embankment and retaining walls between these structures.

The ZoI of this impact is habitat areas within Lough Corrib cSAC that lie beneath, or immediately adjacent to, viaduct structures, embankments or retaining walls where habitat will not be permanently lost – i.e. the proposed River Corrib Bridge, the proposed Menlough Viaduct, and sections of embankment and retaining walls between these structures.

7.7 Habitat Degradation as a result of Introducing/Spreading Non-native Invasive Plant Species

There are local populations of non-native invasive plant species present within, or in close proximity to, the proposed development boundary. The proposed road development has the potential to accidentally cause the introduction/spread of non-native invasive plant species to any habitat areas crossed by, immediately adjacent to, or downstream of the proposed road development during construction and/or operation. During construction, the haul routes also pose a potential source and pathway for soil contaminated by non-native invasive plant species (**Figures 3.1** and **3.2**).

The ZoI of this impact is potentially any habitats crossed by, immediately adjacent to, or downstream of the proposed road development or along any of the proposed haul routes are at risk from contaminated soil/material and includes Lough Corrib cSAC and Galway Bay Complex cSAC.

7.8 Disturbance/Displacement of Bird Species from SPAs and/or Ex-situ Sites

In relation to defining the disturbance ZoI for wintering bird species there are three components to consider: general construction activity disturbance (e.g. increased human presence, vehicle movements and earthworks), construction impulse noise disturbance (e.g. pile driving and blasting), and operation traffic noise.

General Construction Activity Disturbance

Based on the findings of the study prepared for Humber INCA, Cutts *et al.* (2009) investigating the effects of disturbance on foraging and roosting waterbirds, in terms of a response to third party disturbance (e.g. human presence), minimal effects would be expected beyond 300m. In terms of construction noise, levels below 50dB would not be expected to result in any response from foraging or roosting birds. Noise levels between 50dB and 70dB would provoke a moderate effect/level of response from birds—i.e. birds becoming alert and some behavioural changes (e.g. reduced feeding activity)—but birds would be expected to habituate to noise levels within this range. Noise levels above 70dB would likely result in birds moving out of the affected zone, or leaving the site altogether. This is supported by the findings of Wright et al. (2010) which found that noise levels above 60dB resulted in behavioural responses, with birds abandoning the site in response to noise levels above 70dB.

Noise levels associated with typical construction activity have been calculated in accordance with the methodology set out in BS 5228: Part 1. This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels. A variety of items of plant will be in use during the construction works. These will include breakers, excavators, dump trucks, and generators in addition to general road surfacing and levelling

equipment. The key phases of works will involve ground breaking, excavation works, fill works, piling of structures, and general road works.

The following tables present calculations of indicative noise levels for typical noise sources associated with road construction works, at set distances from the construction activity, using the source data from BS 5228:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise.

Calculations of indicative noise levels for typical noise sources associated with road construction works at set distances from the construction activity were calculated using the source data from BS 5228:2009 Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise. The calculations assume that plant items are operating for 66% of the time to obtain an LAeq, 1 hour value. Noise levels are presented in **Table 7.1** for the individual items of plant at specific distances in addition to a cumulative level assuming all plant items associated with the individual phases are operating simultaneously, and at the same distance, for any one scenario. The calculations do not take account of any screening afforded by intervening structures, construction site hoarding etc. and therefore represent a "worst case" scenario.

Table 7.1: Calculated Equivalent Continuous Noise Levels (LAeq, T) for Various Construction Activities and Predicted Sound Level Attenuation by Distance

Site Clearance & Preparation	**Calculated $L_{Aeq, T}$ (dB) at distance from works (m)**							
	50m	100m	150m	200m	250m	300m	350m	400m
Pneumatic breaker C.1.6	67	61	58	55	53	52	50	49
Wheeled loader C2-26	63	57	54	51	49	48	46	45
Tracked excavator (loading dump truck) C1-10	69	63	60	57	55	54	52	51
Dozer C.2.10	64	58	55	52	50	49	47	46
Dump Truck (C2.30)	63	57	54	51	49	48	46	45
Combined L_{Aeq} from all works	**73**	**67**	**64**	**61**	**59**	**58**	**56**	**55**
Fill Works	**Calculated $L_{Aeq, T}$ (dB) at distance from works (m)**							
	50m	100m	150m	200m	250m	300m	350m	400m
Tracked excavator (loading dump truck) C1-10	69	63	60	57	55	54	52	51
Articulated dump truck (dumping rubble) C1-11	64	58	55	52	50	49	47	46
Wheeled loader C2-26	63	57	54	51	49	48	46	45
Dozer C.2.10	64	58	55	52	50	49	47	46
Dump Truck Tipping fill (C2.30)	63	57	54	51	49	48	46	45
Combined L_{Aeq} from all works	**73**	**66**	**63**	**60**	**59**	**57**	**56**	**54**
Piling Works	**Calculated $L_{Aeq, T}$ at distance from works (m)**							
	50m	100m	150m	200m	250m	300m	350m	400m
Crawler Mounted Rig (C3.22)	64	58	55	52	50	49	47	46
Tracked Excavator inserting metal cage, (C3.24)	58	52	49	46	44	43	41	40
Concrete Pump & Cement Mixer Truck (C4.24)	51	45	42	39	37	36	34	33
Diesel Generator (C4.76)	45	39	36	33	31	30	28	27
Angle Grinder (C4.93)	64	58	55	52	50	49	47	46
Combined L_{Aeq} from all works	**68**	**62**	**58**	**56**	**54**	**52**	**51**	**50**
Road Works	**Calculated $L_{Aeq, T}$ at distance from works (m)**							
	50m	100m	150m	200m	250m	300m	350m	400m
Tracked excavator (C2.21)	55	49	46	43	41	40	38	37
Dump Truck (C2.30)	63	57	54	51	49	48	46	45
vibration rollers (C5.20)	59	53	50	47	45	44	42	41
Asphalt Paver & Tipping Lorry (C.5.31)	61	55	52	49	47	46	44	43
Diesel Generator (C4.76)	45	39	36	33	31	30	28	27
Road Rollers (C5.19)	64	58	55	52	50	49	47	46
Combined L_{Aeq} from all works	**69**	**63**	**59**	**57**	**55**	**53**	**52**	**51**

None of the construction activities listed above would be expected to result in any more than a moderate level of disturbance effect on waterbirds at distances beyond 150m. At 300m, noise levels are below 60dB or, in most cases, are approaching the 50dB threshold. Low, or no, effects would be expected for those noise levels. Any landscape features, vegetation cover or buildings between the construction site and winter bird sites would contribute to further reducing the ambient noise at any given distance. Therefore, 300m is considered to be a precautionary buffer in defining the ZoI of disturbance effects associated with general construction activities.

The disturbance distances at which third party human disturbance would result in behavioural changes or displacement would be expected to be less than that associated with noise sources (Cutts *et al.*, 2009). For the purposes of the assessment, a precautionary approach is taken and the greater buffer distance of 300m is used to define the potential disturbance zone. This 300m buffer is referred hereafter as the "general construction disturbance ZoI".

Impulse Noise Disturbance

In terms of noise levels associated with blasting, behavioural response thresholds would be expected to be similar to those described above for general construction related disturbance—i.e. greater than 60dB. However, calculating a distance whereby blasting would attenuate to below 60dB is less certain given the large number of variables that would influence that calculation (e.g. size of charge used, air pressure, depth of blasting and relationship to the surrounding topography).

Rees et al. (2005) found that impulsive noise disturbance (e.g. airport bird scaring) alerted Whooper swans at distances of up to c.800m. However, it is worth noting that in that study, airport scaring only alerted the birds on eight occasions over three years, the proportion of birds alerted was low (approximately a third, on average), disturbance events were temporary (with birds resuming undisturbed behaviour within minutes), and few of the small percentage of disturbance events that resulted in bird flight were attributed to airport scaring[25]. Nonetheless, as a precautionary approach, 800m is used as the zone within which some level of disturbance may occur from rock blasting.

The magnitude of any disturbance effects is likely to be greatest where blasting is occurring regularly, over a prolonged period, and any disturbance effects will probably only be apparent at distances less than 800m. The majority of locations where blasting might be required during construction will be short-term (days to a few weeks) and with relatively few, small magnitude blast events. In that scenario, any temporary displacement of birds from the immediate vicinity of the blast site will not affect survival rates or have any long-term effects on local bird populations. There are only five locations along the proposed road development where, to facilitate excavating out deep cuttings, blasting will be frequent and prolonged: Ballagh (Ch. 3+100 to Ch. 3+900), the N59 Letteragh Junction (Ch. 7+500 to Ch. 8+300), Lackagh Tunnel (both the western and eastern approaches from Ch.

[25] Disturbance-related flights accounted for c.30% of all recorded disturbance events; with less than 5% of those attributed to airport scaring.

10+900 to Ch. 11+150 and from Ch. 11+800 to Ch. 12+100), Castlegar (Ch. 12+550 to Ch. 13+650), and at the Galway Racecourse Tunnel (Ch. 14+200 to Ch. 15+400).

Ballindooley Lough is the only winter bird site within 800m of these locations that frequently hosts high numbers of SCI listed wintering bird species: the main lake is c.450m from the eastern approach to Lackagh Quarry (Ch. 11+800 to Ch. 12+100) and c.350m from the cutting at Castlegar. Therefore, Ballindooley Lough is the only winter bird site where long-term blasting may have a significant effect on wintering bird species. As acknowledged above, any landscape features, vegetation cover or buildings between the noise source and the receptor would serve to further reduce the ambient noise at a given distance.

Operational Noise Disturbance

The parameter most commonly used to describe noise levels is the L_{Aeq} which is defined as the A-weighted equivalent continuous steady sound level over a set time period and is effectively an average value. A typical noise level associated with a light goods vehicle (car or small van) at a road edge is 70dB L_{Aeq} and up to 85dB L_{Aeq} for heavy goods vehicles (HGV's).

The noise level associated with a stream of traffic is not constant but varies with the traffic volumes, vehicle type, traffic speed and road type. Moving away from the road edge, the road alignment (i.e. cuttings, embankments etc.) and distance will influence the level of noise at a particular location.

For the proposed road development, noise levels along the length of its route will vary depending on the factors noted above. It is possible to determine typical road traffic noise associated with the proposed road development using the Noise Footprint Graphs included in Appendix A of the TII *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes* (2014). The graphs enable the user to determine the distance from the road centreline whereby road traffic noise levels will fall below 60dB L_{den} depending on the roads vertical alignment, the traffic volumes, the percentage of HGV's and the road surface. This information has been used to identify the typical noise footprint associated with key sections of the route of the proposed road development.

At Briarhill Junction, at distances of 120m and greater from the road centreline, noise levels will typically be below 60dB L_{den}. It should be noted, due to the alignment of the existing N6 at Coolagh and Doughiska, road traffic noise levels are already elevated at this location and this is factored into the noise modelling and assessment.

Highest noise levels will be experienced between the N83 Tuam Road Junction and the N59 Moycullen Road where road traffic noise levels will be at or above 60dB L_{den} between 140 and 150m from the proposed road centreline. This applies to the sections of the proposed road development which are on embankment and at the new junctions.

Moving west, beyond the N59 Letteragh Junction towards Bearna, at distances of 50 to 70m from the proposed road centreline, noise levels will typically be below 60dB L_{den} due to the reduction in traffic volumes, traffic speed and the alignment profile.

Typically noise levels above 70dB do not extend beyond the immediate vicinity of the road carriageway and as such, the permanent displacement of birds from habitat areas beyond this would not be expected during operation. As discussed above under *General Construction Activity Disturbance*, some level of disturbance would be expected initially within the 60dB to 70dB zone (between the proposed road carriageway and 120m at Briarhill, the road carriageway and 150m from the N83 Tuam Road Junction to the N59 Moycullen Road, and between the road carriageway and 50-70m west of the N59 Moycullen Road) with birds habituating to the increased noise baseline. Below 60dB, behavioural changes or displacement would not be predicted to occur.

The ZoI for disturbance associated with general construction activities is c.300m, increasing to c.800m where frequent and long-term blasting is proposed and includes areas of bird habitat within Lough Corrib SPA and areas of bird habitat used by SCI bird species of Lough Corrib SPA and Inner Galway Bay SPA outside of the European sites.

7.9 Barrier Effect

The proposed road development will require the construction of new watercourse crossings of streams within the Bearna Stream catchment and these structures haves the potential to present a barrier to Otter movement within the Bearna Stream catchment.

The ZoI of this impact is the Bearna Stream catchment which includes part of Galway Bay Complex cSAC.

7.10 Mortality Risk from Construction works and Road Traffic

The proposed road development has the potential to result in the mortality of aquatic species in the River Corrib during construction of the River Corrib Bridge. It also has the potential to result in the mortality of Otter through the increased risk of road traffic collisions which could affect the Otter populations that use the River Corrib and Coolagh Lakes and those that use watercourses within the Bearna Stream catchment.

The ZoI of this impact is the River Corrib corridor and in the vicinity of the Coolagh Lakes, and within the Bearna Stream catchment, and includes Lough Corrib cSAC and Galway Bay Complex cSAC.

7.11 Summary

Table 7.2 below summarises the potential impacts associated with the proposed road development, and their ZoI.

Table 7.2: Identified Impacts and Potential Zone of Influence (ZoI)

Impact	Zone of Influence (ZoI)
Construction Impacts	
Habitat loss	Generally, within the footprint of the proposed road development but can also result from extreme cases of habitat degradation (see below)
Habitat fragmentation	Habitat areas or species ranges/territories through which the proposed road development traverses
Habitat degradation as a result of tunnelling/excavations	Area immediately above the Lackagh Tunnel and along the western and eastern approaches to the tunnel
Habitat degradation as a result of hydrogeological impacts	Groundwater dependant habitats within the hydrogeological ZoI. For hydrogeology ZoI refer to **Figures 10.2.1** to **10.3.6**
Habitat degradation as a result of hydrological impacts	Any wetland, coastal or marine habitat downstream of any watercourse crossings or drainage outfalls, and any aquatic/marine species therein
Habitat degradation as a result of air quality impacts	Dust generated during construction is only likely to be deposited in measurable quantities in the immediate vicinity of the construction works
Habitat degradation as a result of introducing/spreading non-native invasive plant species	Potentially any habitats crossed by, immediately adjacent to, or downstream of the proposed road development or along any of the haul routes are at risk from contaminated soil/material both sourced from within the proposed development boundary or that imported from offsite sources
Disturbance/displacement	Habitat areas used by wintering birds within 300m of general construction activities or those within 800m of areas requiring blasting over a prolonged period
Mortality risk from construction works	Aquatic species foraging or commuting along the River Corrib corridor
Operational Impacts	
Habitat degradation as a result of hydrogeological impacts	Groundwater dependant habitats within the hydrogeological ZoI. For hydrogeology ZoI refer to **Figures 10.2.1** to **10.3.6**
Habitat degradation as a result of shading impacts	Habitats beneath, or immediately adjacent to, viaduct structures, embankments or retaining walls where habitat will not be permanently lost – i.e. the proposed River Corrib Bridge, the proposed

Impact	Zone of Influence (ZoI)
	Menlough Viaduct, and sections of embankment and retaining walls between these structures.
Habitat degradation as a result of air quality impacts	Generally local to the road edge and not greater than a distance of 200m
Habitat degradation as a result of introducing/spreading non-native invasive plant species	Potentially any habitats crossed by, or immediately adjacent to, the proposed road development are at risk from contaminated soil/material both sourced from within the proposed development boundary or that imported from offsite sources
Barrier effect	The Bearna Stream catchment
Mortality risk from road traffic	Relevant to aquatic species along the River Corrib corridor and in the vicinity of the Coolagh Lakes, and within the Bearna Stream catchment

Plate 7.1: (a) Combined ZoI of the proposed road development and European sites

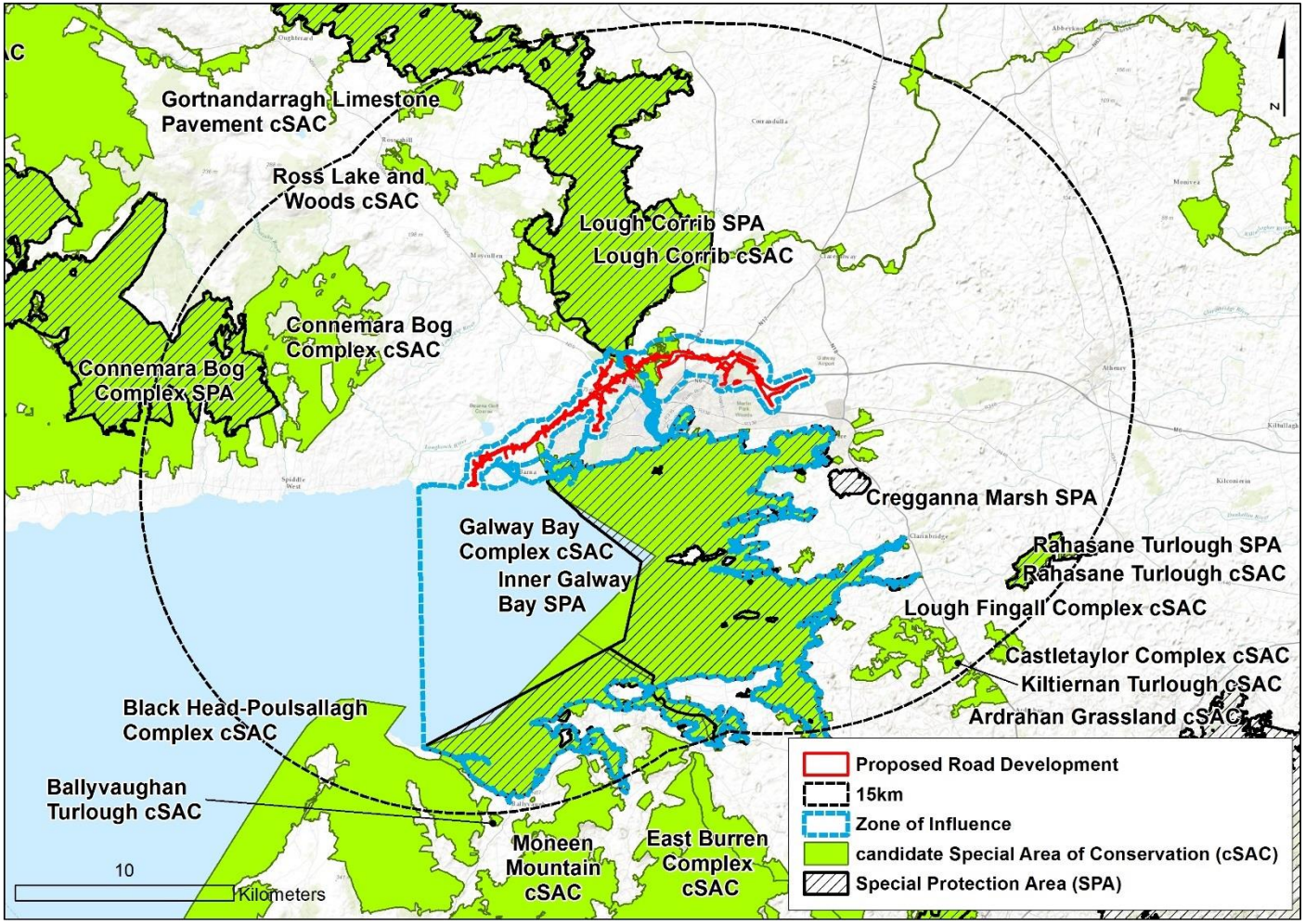
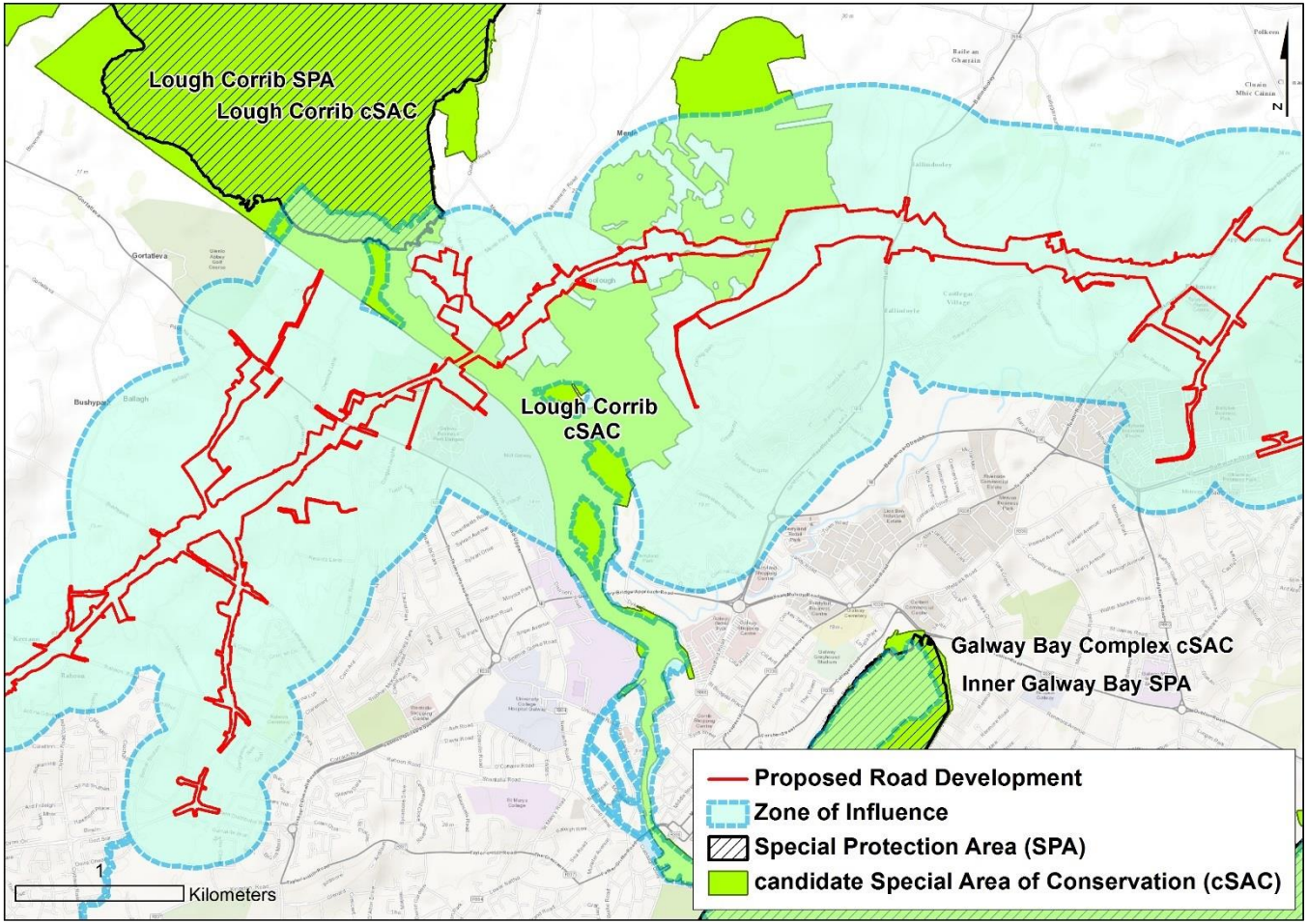


Plate 7.1: (b) Combined ZoI of the proposed road development and European sites (close up of Lough Corrib cSAC interaction with ZoI)



8 European sites within the Zone of Influence of the Proposed Road Development

8.1 Identifying European Sites within the ZoI of the Proposed Road Development

The nature and scale of the proposed road development, the identified potential impacts and their relationship to European sites were considered in order to determine which European sites were within the ZoI of the proposed road development, and therefore potentially at risk of the proposed road development affecting their conservation objectives.

The ZoI is a defined area within which there is potential for the proposed road development to affect the conservation objectives supporting the conservation condition of the QIs/SCIs of a European site.

In the case of QI habitats, if a European site lies beyond the ZoI, then the proposed road development cannot affect habitats within that site.

Consideration was also given as to whether the proposed road development had the potential to have *ex-situ* impacts on species listed as QIs/SCIs of any European sites beyond the ZoI of the proposed road development, taking into consideration the species' foraging range, home range and connections between maternity, breeding and hibernation sites. This is discussed further below.

Table 8.1 below lists the potential impacts associated with the proposed road development, their ZoI, and which European sites could be affected by each.

Table 8.1: Identified European Sites within the Zone of Influence (ZoI)

Potential Impact	Zone of Influence (ZoI)	European Sites within the ZoI
Potential Construction Impacts		
Habitat loss	Generally, within the footprint of the proposed road development but can also result from extreme cases of habitat degradation (see below)	Lough Corrib cSAC and potentially ex-situ sites associated with Lough Corrib SPA and Inner Galway Bay SPA
Habitat fragmentation	Habitat areas or species ranges/territories through which the proposed road development traverses	Lough Corrib cSAC and potential ex-situ sites associated with Lough Corrib SPA and Inner Galway Bay SPA
Habitat degradation – tunnelling/excavation	Area immediately above the Lackagh Tunnel and along the western and eastern approaches to the tunnel	Lough Corrib cSAC
Habitat degradation – hydrogeology	Groundwater dependant habitats within the hydrogeological ZoI.	Lough Corrib cSAC and potential ex-situ sites associated with

Potential Impact	Zone of Influence (ZoI)	European Sites within the ZoI
	For hydrogeology ZoI refer to **Figures 10.2.1** to **10.3.6**	Lough Corrib SPA and Inner Galway Bay SPA
Habitat degradation – hydrology	Any wetland, coastal or marine habitat downstream of any watercourse crossings or drainage outfalls, and any aquatic/marine species therein	Lough Corrib cSAC Galway Bay Complex cSAC Inner Galway Bay SPA and potential ex-situ sites Lough Corrib SPA and potential ex-situ sites
Habitat degradation – air quality	Dust generated during construction is only likely to be deposited in measurable quantities in the immediate vicinity of the construction works	Lough Corrib cSAC
Habitat degradation – non-native invasive species	Potentially any habitats crossed by, or immediately adjacent to, the proposed road development or along any of the haul routes are at risk from contaminated soil/material both sourced from within the proposed development boundary or that imported from offsite sources	Lough Corrib cSAC Galway Bay Complex cSAC Inner Galway Bay SPA
Disturbance/displacement	Habitat areas used by SCI wintering birds within 300m of general construction activities or those within 800m of areas requiring blasting over a prolonged period	Potential ex-situ sites associated with Lough Corrib SPA and Inner Galway Bay SPA
Habitat degradation – construction materials Mortality risk	Aquatic species foraging or commuting along the River Corrib corridor	Lough Corrib cSAC
Potential Operational Impacts		
Habitat degradation – hydrogeology	Groundwater dependant habitats within the hydrogeological ZoI. For hydrogeology ZoI refer to **Figures 10.2.1** to **10.3.6**	Lough Corrib cSAC and potential ex-situ sites associated with Lough Corrib SPA and Inner Galway Bay SPA
Habitat degradation – shading	Habitats beneath, or immediately adjacent to, viaduct structures, embankments or retaining walls where habitat will not be permanently lost – i.e. the proposed River Corrib Bridge, the proposed Menlough Viaduct, and sections of embankment and retaining walls between these structures.	Lough Corrib cSAC
Habitat degradation – air quality	Generally local to the road edge and not greater than a distance of 200m.	Lough Corrib cSAC

Potential Impact	Zone of Influence (ZoI)	European Sites within the ZoI
Habitat degradation – non-native invasive species	Potentially any habitats crossed by, or immediately adjacent to, the proposed road development or along any of the haul routes are at risk from contaminated soil/material both sourced from within the proposed development boundary or that imported from offsite sources	Lough Corrib cSAC Galway Bay Complex cSAC Inner Galway Bay SPA
Barrier effect	The Bearna Stream catchment	Galway Bay Complex cSAC
Mortality risk	Relevant to aquatic species along the River Corrib corridor and in the vicinity of the Coolagh Lakes, and within the Bearna Stream catchment	Lough Corrib cSAC Galway Bay Complex cSAC

8.2 Consideration of European sites Beyond the ZoI of the Proposed Road Development

European sites have been considered in the context of whether the proposed road development poses any risk of *ex-situ* impacts to the QI/SCI species' conservation objectives, despite the fact that the European sites themselves are beyond its ZoI. This is focussed on certain species where their foraging ranges, home ranges, nesting/roosting sites (and connections between same) may extend beyond the cSAC/SPA boundaries, independent of the absence of any hydrological or hydrogeological pathways between the European sites and the proposed road development.

These sites are Connemara Bog Complex cSAC (and the Marsh fritillary butterfly *Euphydryas aurinia*), Connemara Bog Complex SPA (and breeding populations of Cormorant, Merlin *Falco columbarius*, Golden plover and Common gull), Ross Lake and Woods cSAC (and the Lesser horseshoe bat) and Cregganna Marsh SPA (and the Greenland white-fronted goose *Anser albifrons flavirostris*).

1. Connemara Bog Complex cSAC lies c.6km to the north-west of the proposed road development. The Marsh fritillary butterfly is a species that requires a network of suitable habitat patches within its range to maintain the local metapopulation. Although long distance movements have been recorded (i.e. up to 20km), the species is generally relatively sedentary and 6.5km would be beyond the normal dispersal range of the species (Lavery, 1993; Hula et al.2004; Betzholtz et al. 2007; Junker & Schmitt, 2010; Botham et al., 2011; and, Zimmermann et al., 2011). Therefore, the proposed road development will not influence the existing population dynamic of the Connemara Bog Complex cSAC's Marsh fritillary population in any way or affect the conservation objectives supporting its conservation condition in the Connemara Bog Complex cSAC.
2. Connemara Bog Complex SPA lies c.9km to the north-west of the proposed road development. At this distance the proposed road development poses no risk of affecting breeding success at the nesting sites within the SPA: the lakes

for Cormorant and Common gull, and upland habitats for Merlin and Golden plover.

3. Ross Lake and Woods cSAC lies c.10km to the north of the proposed road development and is the closest European site selected for the Lesser horseshoe bat *Rhinolophus hipposideros*. The roost that forms the QI population for this European site (buildings at Ross House) is more than 13km from the proposed road development. This distance is regarded as being beyond the normal core foraging range of the Ross House population and beyond the normal commuting range of this species, except on exceptional occasions or over long periods of time; for example, bats dispersing and moving between areas in the wider landscape over a period of many years/generations. Furthermore, radio-tracking surveys of the Menlough population of bats (which were located within the scheme study area) undertaken for this project in 2014 and 2015 showed no evidence of linkage between that population and the Ross House roost. Due to the lack of a linkage between the proposed road development and the Ross House roost, the proposed road development will not influence the existing population dynamic of Ross Lake and Woods cSAC's Lesser horseshoe bat population in any way or affect the conservation objectives supporting its conservation condition in Ross Lake and Woods cSAC. Given that conclusion, it follows that the proposed road development will not have any impact on the Lesser horseshoe bat in any of the other cSACs selected for this species (which are all further removed from the proposed road development).
4. Cregganna Marsh SPA lies c.4km south-east of the proposed road development. There were no records of Greenland white-fronted geese from any of the winter bird sites surveyed for the proposed road development. Therefore, the proposed road development poses no risk to the winter population at this site.

All other SPAs are located more than 10km from the proposed road development. That distance is considered to be beyond the normal commuting range of wintering or breeding SCI species. The exception is birds wintering in Ireland migrating to/from their breeding grounds; for example, Whooper swans returning to winter in Ireland from their Icelandic breeding grounds. Current best scientific knowledge is that roads do not pose any risk of population level effects to wintering birds during these migratory movements (once habitat loss is considered in the context of staging areas; which does not arise in the context of the proposed road development), and breeding sites or supporting home ranges will not be affected beyond a distance of 10km. Accordingly, the proposed road development poses no risk to the conservation objectives of any other SPA sites.

8.3 Summary

Considering the ZoI of the proposed road development, it has been assessed as having the potential to affect (directly or indirectly) the following European sites:

- Lough Corrib cSAC
- Lough Corrib SPA

- Galway Bay Complex cSAC
- Inner Galway Bay SPA

The locations of these European sites relative to the proposed road development, and the predicted ZoI, are shown on **Figure 16**.

All other European sites are located beyond the ZoI and therefore, cannot be impacted by the proposed road development.

9 Examination and Analysis of Potential Direct and Indirect Impacts on European Sites

The following sections assesses the direct and indirect impacts of the proposed road development with respect to the four relevant European sites within the ZoI of the proposed road development: Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA and Inner Galway Bay SPA.

In respect of each of these European sites, the assessment below sets out the analysis of the potential impacts, the QIs/SCIs at risk of these potential impacts in view of the sites' conservation objectives (including their specific attributes and targets) and the QIs'/SCIs' conservation condition. The avoidance and design measures set out in **Section 2.6** are considered in assessing the potential impacts. The mitigation measures which will be implemented are presented in **Section 10** of this report and any residual impacts from the proposed road development with respect to European sites are assessed in **Section 11**. Based on the examination and analysis set out, it is the professional opinion of the authors of this NIS that with the implementation of the proposed mitigation measures the proposed road development will not adversely affect the integrity of any European sites and there is no reasonable scientific doubt to this conclusion. The assessment of the proposed road development in combination with any other plans or projects on European sites is presented in **Section 12**.

9.1 Lough Corrib cSAC

9.1.1 Qualifying Interest and Conservation Objectives of Lough Corrib cSAC

The QI Annex I habitats and species present in Lough Corrib cSAC, and the overall conservation objective for each, are listed below in **Table 9.1**. Those highlighted (in green) are the QI's which were recorded within the ZoI of the proposed road development. The Freshwater pearl mussel is also highlighted because whilst the QI population is not directly present within the ZoI there is a potential for indirect impacts through the potential for impacts on salmonid fish species in the River Corrib to affect a critical stage of the Freshwater pearl mussel's lifecycle within the catchment (see **Section 9.1.4.9**). Based on the potential impact sources and pathways identified in **Section 6**, none of the other QIs are at risk of impacts from the proposed road development.

Refer also to **Table 9.16** for how these impact pathways relate to the specific conservation objectives of each QI potentially affected by the proposed road development.

Table 9.1: Qualifying Interests and Conservation Objectives of Lough Corrib cSAC [26]. (Those highlighted (in green) are the QI's which were recorded within the ZoI of the proposed road development)

Qualifying Interests	Conservation Objectives
Annex I Habitats	
[3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)	To restore the favourable conservation condition
[3130] Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*	To restore the favourable conservation condition
[3140] Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp	To restore the favourable conservation condition
[3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	To maintain the favourable conservation condition
[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites)	To maintain the favourable conservation condition
[6410] *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	To maintain the favourable conservation condition
[7110] Active raised bogs *	To restore the favourable conservation condition
[7120] Degraded raised bogs still capable of natural regeneration	To restore the favourable conservation condition
[7150] Depressions on peat substrates of the *Rhynchosporion*	To restore the favourable conservation condition
[7210] Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* *	To maintain the favourable conservation condition
[7220] Petrifying springs with tufa formation (*Cratoneurion*) *	To maintain the favourable conservation condition
[7230] Alkaline fens	To maintain the favourable conservation condition
[8240] Limestone pavements *	To maintain the favourable conservation condition
[91A0] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	To maintain the favourable conservation condition
[91D0] Bog woodland *	To maintain the favourable conservation condition
Annex II Species	
[1029] Freshwater Pearl Mussel - *Margaritifera margaritifera*	To restore the favourable conservation condition

[26] National Parks and Wildlife Service. (2017) *Conservation Objectives: Lough Corrib SAC 000297. Version 1.* Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs.

Qualifying Interests	Conservation Objectives
[1092] White-clawed Crayfish - *Austropotamobius pallipes*	To maintain the favourable conservation condition
[1095] Sea Lamprey - *Petromyzon marinus*	To restore the favourable conservation condition
[1096] Brook Lamprey - *Lampetra planeri*	To maintain the favourable conservation condition
[1106] Atlantic Salmon - *Salmo salar* (only in fresh water)	To maintain the favourable conservation condition
[1303] Lesser Horseshoe Bat - *Rhinolophus hipposideros*	To restore the favourable conservation condition
[1355] Otter - *Lutra lutra*	To maintain the favourable conservation condition
[1393] Slender green feather-moss (Varnished hook-moss) - *Drepanocladus (Hamatocaulis) vernicosus*	To maintain the favourable conservation condition
[1833] Slender Naiad - *Najas flexilis*	To restore the favourable conservation condition

In conjunction with considering the generic conservation objective "To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected", the available site specific conservation objectives document for Lough Corrib cSAC (NPWS, 2017) also informed this assessment. This document sets out the attributes, measures and targets that define the favourable conservation condition of QI habitats and species within the European site. Affecting the conservation condition of QI habitats or species is deemed to constitute an adverse effect on the integrity of Lough Corrib cSAC.

The specific attributes and targets used to define the conservation objectives of the QI habitats and species within the ZoI of the proposed road development are presented in **Table 9.16** in **Section 9.1.4.10**. Those highlighted (in green) in that table correspond to the specific attributes and targets that could potentially be affected for each QI, by the identified impacts.

Although the Lesser horseshoe bat is present within the scheme study area, the roost that forms the QI population for this European site (Eborhall House) is more than 30km away from the proposed road development, on the northern shore of Lough Corrib. This distance would be regarded to be beyond the normal core foraging range of the Eborhall House population and beyond the normal commuting range of this species except on exceptional occasions or over long periods of time – for example, bats dispersing and moving between areas in the wider landscape over a period of many years/generations. Furthermore, radio-tracking surveys of the Menlough population of bats (which were identified within the scheme study area) undertaken for this project in 2014 and 2015 (*N6 Galway City Transport Project Route Selection Report*, Arup, 2016) did not suggest any evidence of movement between that population and the Eborhall House roost. Given the lack of any linkage between the scheme study area and the roosts that are the reason for designation of this European site, likely significant effects on the Lough Corrib cSAC's Lesser

horseshoe bat population have been ruled out. Although it is predicted in the EIA Report that there will be local level residual impacts on the Menlough Lesser horseshoe bat population, as a result of the proposed road development, these impacts will not affect the conservation objectives of Lough Corrib cSACs nor will they affect the QI Lesser horseshoe bat populations of any other European sites because this population does not form part of the QI population for Lough Corrib cSAC.

9.1.2 Ecological Baseline

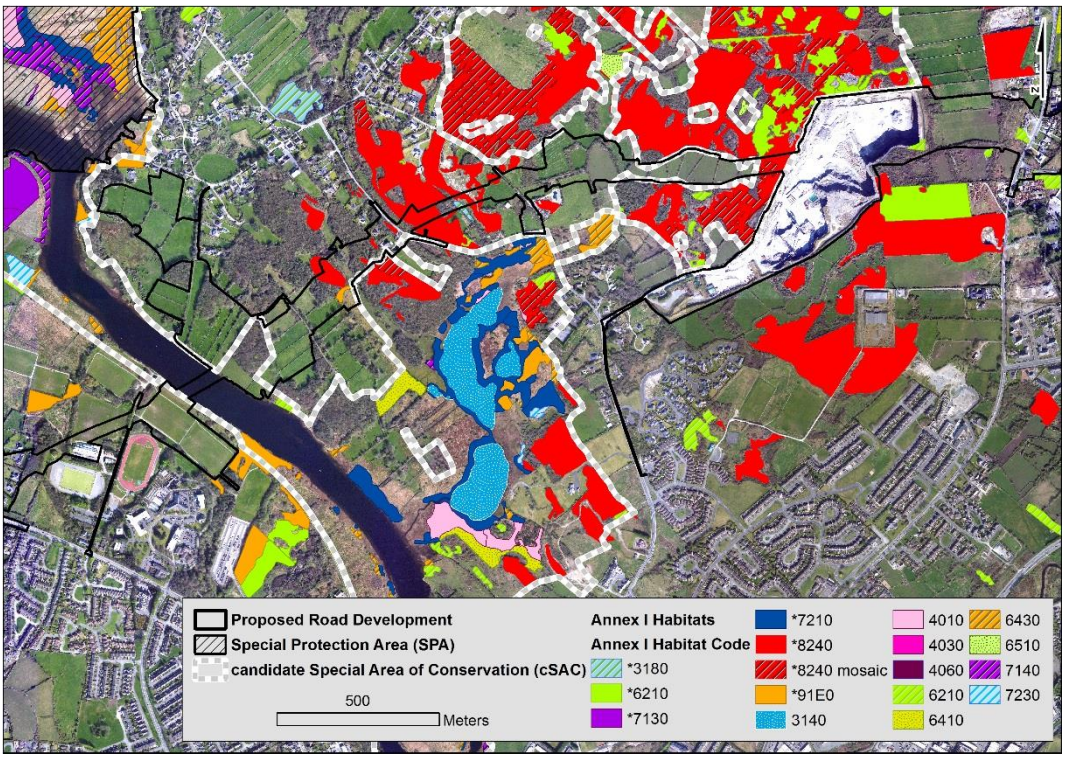
Section 5.1 above presents the ecological baseline within the study area of the proposed road development. This section presents the ecological baseline within the Lough Corrib cSAC.

9.1.2.1 Habitats

As noted in **Section 2.2** and **6.1**, the proposed road development and its boundary overlaps with, i.e. traverses through or adjacent to the Lough Corrib cSAC at four locations[27]: at the termination of the proposed drainage outfall from the N59 Link Road North at Kentfield; at the site of the proposed River Corrib Bridge between Dangan and Menlough; to the west of the Coolagh Lakes; and, to the west and north of Lackagh Quarry where the proposed road development will consist of a tunnel (Lackagh Tunnel) and approach road infrastructure (Ch. 10+620 to Ch. 11+800). Habitat mapping of each of these areas is provided showing both the Fossitt (2000) habitat classifications (ref **Figures 13.1** to **13.5**) and, where applicable, the priority Annex I or Annex I habitat types (ref **Figures 14.1** to **14.5**), as referenced in each of the sections below (**Sections 9.1.2.1.1** to **9.1.2.4**). An overview of the area is shown on **Plate 9.1** below. Approximately 4ha of the proposed road development lies within the Lough Corrib cSAC.

[27] The current versions of the digital designated area boundaries that can be downloaded from the NPWS website do not always accurately relate to features on the ground such as field boundaries, road margins etc. This is on account of the scale difference between the 6-inch maps used to originally define the European site boundaries and current larger scale vector mapping/orthophotography. The descriptions of habitat locations in this report, with respect to whether they are inside/outside of the Lough Corrib cSAC boundary, are an interpretation of their intended locations with respect to the field boundaries and legal designated area boundary as shown on the official Department of Culture, Heritage and the Gaeltacht boundary hardcopy maps. This approach was discussed and agreed with the NPWS.

Plate 9.1: The proposed road development and an overview of Annex I habitats in the vicinity of Lough Corrib cSAC



The full results of the habitat surveys carried out in Lough Corrib cSAC are presented in *N6 Galway City Transport Project – Habitat mapping and assessment of a section of Lough Corrib cSAC and surrounding areas* (Barron et al., 2017), which is included in **Appendix G**.

In summary, a total of 16 Annex I habitats, covering 155.2 ha within Lough Corrib cSAC and extending outside of the proposed development boundary, were recorded during the survey:

- Dystrophic lakes [3160]
- Wet heaths [4010]
- Dry heaths [4030]
- Alpine and Boreal heaths [4060]
- Calcareous grasslands [6210]
- Orchid-rich calcareous grasslands [*6210]
- *Molinia* meadows [6410]
- Hydrophilous tall-herb communities [6430]
- *Cladium* fens [*7210]
- Blanket bog (inactive) [7130]
- Blanket bog (active) [*7130]
- Transition mires and quaking bogs [7140]
- Alkaline fens [7230]

- Limestone pavement (exposed) [*8240]
- Limestone pavement (wooded) [*8240]
- Alluvial forests [*91E0]

The majority of these habitat types form part of, and are supported by, the wetland complex along the River Corrib corridor and associated with the Coolagh Lakes. The drier heath, grassland and exposed limestone rock habitats are predominantly located on the slopes of an elevated hill to the north of the Coolagh Lakes (which also support smaller areas of these habitat types beyond the wetland margins).

The River Corrib itself was classified as a Depositing/lowland river (FW2) as part of aquatic habitat surveys carried out in 2014 (**Appendix K**). The River Corrib channel in the vicinity of the proposed road development, and further downstream, does not correspond with any Annex I habitat type. Depositing lowland rivers can correspond with two Annex I habitat types, in an Irish context: Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation [3260]; and, Rivers with muddy banks with *Chenopodion rubri* p.p. and *Bidention* p.p. vegetation [3270]. In the vicinity of the proposed road development, the River Corrib lacks the aquatic plant species associated with the [3260] Annex I habitat type[28]. In this area, the River Corrib also lacks the muddy bank habitat and the vegetation/plant species associated with the [3270] Annex I habitat type.

Downstream of the proposed River Corrib Bridge, and beyond the proposed development boundary, the habitat present within Lough Corrib cSAC along the river banks consists of a mosaic of Wet grassland (GS4) and Reed swamp (FS1). Scrub (WS1), Dry calcareous and neutral grassland (GS1) and woodland (WD1, WN2 and WN6) are also present between the proposed crossing point of the River Corrib Bridge and the Coolagh Lakes. Many of these habitat types correspond with the Annex I habitat types[29] Calcareous grassland [6210], Residual alluvial forests [*91E0], Cladium fen [*7210], Hydrophilous tall herb [6430] and Transition mires [7140]. Although only Calcareous grassland and *Cladium* fen are QI habitats for Lough Corrib cSAC, many of the other wetland habitats are likely to provide a supporting role to these habitats within this mosaic.

The proposed drainage outfall from the N59 Link Road North will discharge to a drainage ditch in Lough Corrib cSAC at Kentfield. Habitats in this area included Treeline (WL2), Scrub (WS1) and Dry meadows and grassy verges (GS2), Wet grassland and Reed and large sedge swamp/Tall-herb swamp/Wet grassland (FS1/FS2/GS4). A patch of *Phragmites australis* Reed swamp (FS1) and an area of Rich fen and flush (PF1) are immediately to the east of the proposed development boundary. The fen area corresponds with the PF1_RFLU1a [30] vegetation community (*Carex viridula oedocarpa - Pinguicula vulgaris - Juncus bulbosus*

[28] The aquatic plant species recorded along the River Corrib are presented in **Appendix K**.
[29] Where abbreviated Annex I habitat names are used throughout this report, nomenclature follows that of *The Status of EU Protected Habitats and Species in Ireland. Overview Volume 1.* (National Parks & Wildlife Service, 2013a)
[30] Alkaline fen vegetation community classification as per the classification system described in Perrin, P.M., Barron, S.J., Roche, J.R. & O'Hanrahan, B. (2014). *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. Irish Wildlife Manuals, No. 79.* National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

flush; brown moss sub-community) of the Annex I habitat type *Alkaline fens* [7230].

The drainage ditch, to which the drainage outfall discharges, drains to the north-west for c.380m before turning north-east where it connects with the River Corrib after a further c.130m. Along or close to the drainage ditch, within the boundary of Lough Corrib cSAC, are Wet grassland (GS4), Wet heath (HH3), Transition mire (PF3) and Wet willow-alder-ash woodland (WN6) habitats. Some of these correspond with Annex I habitat types: *Molinia* meadow [6410], Wet heath [4010], Transition mire [7140] and Residual alluvial forests [*91E0], respectively.

The Coolagh Lakes correspond with the Annex I Hard water lakes [3140] habitat type and support a wetland complex of Wet grassland (GS4), Wet heath (HH3), Fen (PF1 and PF2) and Reed swamp (FS1). Many of these habitat types correspond with the Annex I habitat types[31] Residual alluvial forests [*91E0], *Cladium* fen [*7210], Alkaline fen [7230], Hydrophilous tall herb [6430], *Molinia* meadow [6410], Wet heath [4010] and Transition mires [7140]. Although only Calcareous grassland and Cladium fen are QI habitats for Lough Corrib cSAC, many of the other wetland habitats are likely to provide a supporting role to these habitats within this mosaic.

The area to the west of the Coolagh Lakes and to the north and east towards Lackagh Tunnel consisted of a mosaic of Exposed calcareous rock (ER2), Dry calcareous and neutral grassland (GS1), Oak-Ash-Hazel Woodland (WN2) and Scrub (WS1). Some of these areas corresponded with the Annex I habitats Calcareous grassland [*6210/6210] and Limestone pavement [*8240]. For the Annex I habitat types recorded, the majority are well defined by recent national studies co-ordinated by NPWS (refer to publications referenced in **Table 4.2** of this NIS) and for the purposes of this assessment, were identified and classified in accordance with those publications, where available.

However, in the case of *8240 Limestone pavement, some further definition of the habitat type was required. Though the Interpretation Manual of EU Habitats (CEC, 2013) does not specifically mention woodland being a component of the Annex I definition for *8240 Limestone pavement, its inclusion appears widely accepted (JNCC, 2009, 2014; Wilson & Fernández, 2013). The EU Interpretation Manual does include "scrub... (*e.g. Corylo-Fraxinetum*)", and the two corresponding categories from the UK National Vegetation Classification which relate to *8240 Limestone pavement are both woodland types. It is, however, stated by Rodwell *et al.* (2000) that limestone pavement habitats do not fit well in the NVC system, with there being nothing encountered that cannot be described in terms of fragments, or complexes of a variety of vegetation types, already represented elsewhere within the classification.

The National Survey of Limestone Pavement (NSLP) (Wilson & Fernández, 2013) describes two pavement types based on their morphology:

- blocky, characterised by a well-defined structure of clints and grikes

[31] Where abbreviated Annex I habitat names are used throughout this report, nomenclature follows that of *The Status of EU Protected Habitats and Species in Ireland. Overview Volume 1.* (National Parks & Wildlife Service, 2013a)

- shattered areas of loose rubble which generally lack a well-defined structure of clints and grikes

Wooded limestone pavement is described in the NSLP as a habitat which "includes low woodland formations dominated by Hazel and/or Ash with typical blocky pavement under the canopy". No justification is provided as to why hazel/ash woodland which has developed over shattered pavement is not included within the Annex I type. The EU Interpretation Manual does include 'shattered pavements' within its definition of the Annex I habitat. Recognising areas of blocky pavement as opposed to shattered pavement under woodland, when the ground is carpeted in a cover of bryophytes, can be difficult. Indeed, both blocky and shattered pavement types frequently occur together, which further complicates the distinction. The species occurring in woodland over blocky pavement and shattered pavement would be similar and can indeed be found in calcareous woodland on deeper soils, so the species do not assist in defining the habitat. As such, it was decided for the purposes of this assessment that areas of *8240 wooded Limestone pavement include those having a closed canopy of trees at least 3m tall with at least 50% of the surface comprising bedrock at the surface (the bedrock was normally covered by mosses) and retaining some evidence of limestone pavement structure. In the *8240 wooded limestone pavement habitats encountered, soil was generally present but was thin (< 2cm), though could be deeper in places – for example, in old grikes – due to a build-up of humus.

In the case of the Annex I habitat types *Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometea*)* (* important orchid sites) [6210/*6210], these were identified and classified in accordance with both the EU Interpretation Manual definition as well as O'Neill *et al.* (2013).

9.1.2.1.1 Proposed River Corrib Bridge

Habitat types recorded within Lough Corrib cSAC in the vicinity of the proposed River Corrib Bridge and the proposed drainage outfalls are shown on **Figure 13.1** (Fossitt habitat classifications) and **Figure 14.1** (Annex I habitat classifications) and are described in **Appendix G**. The detailed description below relates to each habitat area within Lough Corrib cSAC that lies within the proposed development boundary, and that will be directly affected by the proposed road development (c2.9ha will be directly impacted within Lough Corrib cSAC). None of these areas correspond with Annex I habitat types or support the conservation objectives of Lough Corrib cSAC. The reference codes used below (e.g. Area 1.a) correspond with the annotation on **Figure 15.1**.

The River Corrib itself was classified as a Depositing/lowland river (FW2) and does not correspond with any Annex I habitat type. None of the terrestrial habitat areas that lie within the proposed development boundary and within Lough Corrib cSAC corresponds with Annex I habitat types, are QI habitat of Lough Corrib cSAC, or support QI habitats of Lough Corrib cSAC.

Area 1.a

This habitat area is a mosaic of Dry meadows and grassy verges (GS2) and Scrub (WS1) on sloping ground facing the River Corrib. The scrub is dominated by *Rubus fruticosus* agg. with *Crataegus monogyna, Prunus spinosa* and *Salix cinerea* also present. The species associated with the grassland includes *Dactylis glomerata, Arrhenatherum elatius, Cynosurus cristatus, Carex flacca, Ranunculus repens, Centaurea nigra, Trifolium pratense and Prunella vulgaris.* Approximately 0.09ha of this habitat area lie within the proposed development boundary, with c0.01ha also within Lough Corrib cSAC.

This habitat area lacks a sufficient number of indicator species to correspond with any Annex I grassland habitat types. In considering *Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)* [6210], only a single indicator species for this Annex I habitat type in an Irish context, as listed in O'Neill et al. (2013), was recorded: *Centaurea nigra*. None of the plant species listed for this Annex I habitat type in CEC (2013) were present. Considering *Lowland hay meadows* [6510], only three indicator species for this Annex I habitat type in an Irish context, as listed in O'Neill et al. (2013), were recorded: *Centaurea nigra, Trifolium pratense* and *Prunella vulgaris*. Only a single species listed for this Annex I habitat in CEC (2013) is present (*Arrhenatherum elatius*).

Area 1.b

This habitat area consists of a gravel pathway along the west bank of the River Corrib, which was classified as Buildings and artificial surfaces (BL3), and a strip of Wet grassland (GS4) and Scrub (WS1) between the path and the river. The grassland strip appears to be periodically managed. The species associated with the grassland/scrub are *Agrostis stolonifera, Arrhenatherum elatius, Holcus lanatus, Lythrum salicaria, Filipendula ulmaria* and *Rubus fruticosus* agg., with fringing *Phragmites australis* and *Schoenoplectus lacustris* along the water's edge. Species associated with the scrub areas include *Salix cinerea* subsp. *oleifolia, Crataegus monogyna* and *Rubus fruticosus* agg. Approximately 0.07ha of this habitat area lie within the proposed development boundary and within Lough Corrib cSAC.

The pathway and scrub areas do not correspond to any Annex I habitat types. The grassland areas lack a sufficient number of indicator species to correspond with any Annex I grassland habitat types. There are no indicator species of Calcareous grassland [*6210/6210] and only a single species listed for this Annex I habitat in CEC (2013) is present (*Arrhenatherum elatius*).

Area 1.c

This habitat area is a linear section of scrub/treeline (WS1/WL2), comprised mostly of *Fraxinus excelsior* with occasional *Crataegus monogyna, Alnus glutinosa, Prunus spinosa* and *Ilex aquifolium.* Structurally, it is very sparse with large gaps between individual trees in places, particularly in the vicinity of the proposed crossing point for the River Corrib Bridge. This habitat area does not correspond with any Annex I habitat types. In particular, it does not correspond with any woodland habitat types; lacking any woodland structure as it is a narrow, linear feature made up of a gappy, single line of trees/bushes. Approximately 0.05ha of this habitat area will be directly affected.

Area 1.d

This habitat area is classified as Dry calcareous and neutral grassland (GS1) and corresponds with the *Cynosurus cristatus – Trifolium repens* grassland vegetation community (GS1_3b) [32]. This field covers an area of approximately 0.56ha and lies entirely within the proposed development boundary.

This habitat type does not correspond to either the priority or non-priority variant of the Annex I habitat type *Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometea*)* (* important orchid sites) [6210/*6210] on the basis that it does not support the required species composition for this habitat type. None of the High Quality Positive Indicator Species nor any of the Positive Indicator Species for this habitat in an Irish context (after O'Neill et al. 2013) are present. No species listed for this Annex I habitat in CEC (2013) are present.

Considering *Lowland hay meadows* [6510], it does not support the required species composition for this habitat type for this habitat in an Irish context, having only four indicator species present, as listed in O'Neill et al. (2013): *Centaurea nigra*, *Trifolium pratense*, *Plantago lanceolata* and *Ranunculus acris*. No species listed for this Annex I habitat in CEC (2013) are present.

Table 9.2 below is a record of the plant species recorded in a relevé taken here (grid reference ITM 528598 727805).

Table 9.2: Relevé data and species list for habitat area 1.d

Species	% Cover	Species	% Cover
Lolium perenne	50	*Carex hirta*	3
Ranunculus repens	40	*Rumex acetosa*	1
Trifolium repens	30	*Holcus lanatus*	1
Trifolium pratense	20	*Dactylis glomerata*	1
Festuca rubra	15	*Centaurea nigra*	1
Cynosurus cristatus	10	*Agrostis stolonifera*	1
Ranunculus acris	5	*Calliergonella cuspidata*	0.5
Plantago lanceolata	5	*Carex disticha*	0.3
Taraxacum officinale agg.	3	*Elytrigia repens*	0.1
Rumex crispus	3	*Cerastium fontanum*	0.1

Area 1.e

This habitat area is classified as Dry calcareous and neutral grassland (GS1) and corresponds with the *Cynosurus cristatus – Trifolium pratense* grassland vegetation community (GS1_3d). This field covers an area of approximately 0.69ha and lies entirely within the proposed development boundary. Of this, c.0.3ha also lies within the boundary of Lough Corrib cSAC.

[32] Grassland vegetation community classifications are as per the classification system described in O'Neill, F.H., Martin, J.R., Devaney, F.M. & Perrin, P.M. (2013) *The Irish semi-natural grasslands survey 2007-2012*.

This habitat type does not correspond to either the priority or non-priority variant of the Annex I habitat type *Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometea) (* important orchid sites)* [6210/*6210] on the basis that it does not support the required species composition for this habitat type. None of the High Quality Positive Indicator Species are present and only one of the seven Positive Indicator Species for this habitat type (after either O'Neill et al. 2013) is present.

Considering *Lowland hay meadows* [6510], it is currently not managed as a meadow and it does not support the required species composition for this habitat type, supporting none of the indicator species for this habitat in an Irish context, as listed in O'Neill et al. (2013), nor species listed for this Annex I habitat in CEC (2013).

Table 9.3 below is a record of the plant species recorded in a relevé taken here (grid reference ITM 528705 727740); indicator species for the Annex I habitat type are highlighted in bold font. There is some limestone rock in the north-east corner but this does not correspond with the Annex I Limestone pavement habitat type.

Table 9.3: Relevé data and species list for habitat area 1.e

Species	% Cover	Species	% Cover
Festuca rubra	20	*Ranunculus repens*	3
Rhytidiadelphus squarrosus	15	*Rumex obtusifolius*	3
Holcus lanatus	10	*Bellis perennis*	1
Plantago lanceolata	10	*Cerastium fontanum*	1
Ranunculus acris	7	*Luzula campestris*	1
Trifolium pratense	7	*Medicago lupulina*	1
Agrostis capillaris	5	*Prunella vulgaris*	1
Anthoxanthum odoratum	5	*Taraxacum officinale* agg.	1
Cynosurus cristatus	5	*Tortella tortuosa*	1
Lolium perenne	5	*Trifolium repens*	1
Calliergonella cuspidata	3	***Carex flacca***	0.5
Cirsium arvense	3		

Area 1.f

This habitat area is classified as Mixed broadleaved woodland (WD1) and corresponds with the *Fagus sylvatica – Prunus laurocerasus* woodland vegetation community (WD1_2f[33]). This woodland covers an area of approximately 1.58ha, of which c.1.54ha lies within the proposed development boundary. The majority of the woodland (c.1.45ha) also lies with the boundary of Lough Corrib cSAC.

Table 9.4 below is a record of the plant species recorded in a relevé taken here (grid reference ITM 528647 727837). As a Beech dominated woodland, with no

[33] Perrin, P., Martin, J., Barron, S., O'Neill, F., McNutt, K. & Delaney, A. (2008) National Survey of Native Woodlands 2003-2008. Volume II: Woodland classification.

Limestone pavement habitat present, this habitat type does not correspond with any Annex I woodland habitat types.

Table 9.4: Species list for habitat area 1.f

Species	% Cover	Species	% Cover
Fagus sylvatica	80	*Kindbergia praelonga*	0.1
Ilex aquifolium	50	*Lejeunea cavifolia*	0.1
Thamnobryum alopecurum	15	*Metzgeria furcata*	0.1
Fraxinus excelsior	10	*Neckera complanata*	0.1
Isothecium alopecuroides	0.3	*Radula complanata*	0.1
Arum maculatum	0.1	*Rhynchostegiella tenella*	0.1
Hedera helix	0.1	*Tortella tortuosa*	0.1

Area 1.g

This habitat area consists of a gravel access track and gateway into the adjoining woodland, which was classified as Buildings and artificial surfaces (BL3). This habitat area, being a man-made feature, does not correspond with any Annex I habitat types.

9.1.2.1.2 Proposed Drainage Outfall – N59 Link Road North

The termination of the proposed drainage outfall from the N59 Link Road North at Kentfield will discharge to a drainage ditch which ultimately outfalls to the Lough Corrib cSAC; and will require construction of the drainage outfall within the cSAC boundary.

Habitat types recorded within Lough Corrib cSAC in the vicinity of the proposed drainage outfall are shown on **Figure 13.2** (Fossitt habitat classifications) and **Figure 14.2** (Annex I habitat classifications). The detailed descriptions below relate to each habitat area within Lough Corrib cSAC that lies within, or adjacent to, the proposed development boundary. Area 4a is the only part of Lough Corrib cSAC that will be directly impacted (c.0.02ha) and this area does not correspond with any Annex I habitat types. The reference codes used below (e.g. Area 4.a) correspond with the annotation on **Figure 15.2**.

Area 4.a

The habitats associated with this railway embankment are a mosaic of Treeline (WL2), Scrub (WS1) and Dry meadows and grassy verges (GS2). The treeline/scrub comprises *Salix cinerea, Salix caprea, Alnus glutinosa, Rubus fruticosus* agg., *Prunus spinosa* and *Urtica dioica.* The rank grassland includes species such as *Dactylis glomerata, Arrhenatherum elatius, Cynosurus cristatus, Centaurea nigra, Cirsium arvense, Plantago lanceolata, Ranunculus acris, Trifolium pratense, Lathyrus pratensis* and *Potentilla anserina.* This habitat area lies within Lough Corrib cSAC, with approximately 0.02ha (c.150m^2) within the proposed development boundary.

This habitat lacks the indicator species to correspond with any Annex I habitat types. Considering *Lowland hay meadows* [6510], although it does have a number

of the species listed for this Annex I habitat in CEC (2013) (*Centaurea nigra*, *Plantago lanceolata*, *Ranunculus acris*, *Trifolium pratense* and *Lathyrus pratensis*) it is currently not managed as a meadow. It does not support sufficient species for this habitat type, and supports none of the indicator species for this habitat in an Irish context, as listed in O'Neill et al. (2013).

Area 4.b

A mosaic (c.0.08ha) of Reed and large sedge swamp/Tall-herb swamp/Wet grassland (FS1/FS2/GS4) lies to the west of the proposed drainage outfall, immediately adjacent to the proposed development boundary and within Lough Corrib cSAC. Species present include *Phragmites australis*, *Iris pseudacorus*, *Filipendula ulmaria*, *Typha latifolia* and *Epilobium hirsutum*. This habitat lacks the indicator species to correspond with any Annex I habitat types.

Area 4.c

A patch (c.0.3ha) of *Phragmites australis* Reed swamp (FS1) and an area of Rich fen and flush (PF1) lies immediately to the east of the proposed development boundary, within Lough Corrib cSAC. The fen area corresponds with the PF1_RFLU1a[34] vegetation community (*Carex viridula oedocarpa* - *Pinguicula vulgaris* - *Juncus bulbosus* flush; brown moss sub-community) of the Annex I habitat type *Alkaline fens* [7230] - a QI habitat of Lough Corrib cSAC.

Table 9.5 below is a record of the plant species in a relevé recorded here (grid reference ITM 527676 728255). Positive indicator species for the Annex I habitat type are highlighted in bold font.

Table 9.5: Relevé data and species list for habitat area 4.c

Species	% Cover	Species	% Cover
Agrostis stolonifera	5	*Hydrocotyle vulgaris*	7
Anagallis tenella	5	*Juncus bulbosus*	10
Aneura pinguis	0.1	*Leontodon autumnalis*	0.3
Anthoxanthum odoratum	1	*Leontodon saxatilis*	0.3
Bellis perennis	0.5	*Lophocolea heterophylla*	0.1
Bryum pseudotriquetrum	0.3	*Lotus corniculatus*	0.3
Calliergonella cuspidata	5	*Lythrum salicaria*	0.5
Calypogeia muelleriana	0.1	*Mentha aquatica*	0.1
Campylopus introflexus	0.3	*Molinia caerulea*	15
Carex echinata	1	*Pedicularis sylvatica*	0.3
Carex flacca	5	*Potentilla erecta*	3
Carex hostiana	0.5	*Prunella vulgaris*	3

[34] Alkaline fen vegetation community classification as per the classification system described in Perrin, P.M., Barron, S.J., Roche, J.R. & O'Hanrahan, B. (2014). *Guidelines for a national survey and conservation assessment of upland vegetation and habitats in Ireland. Version 2.0. Irish Wildlife Manuals, No. 79.* National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

Species	% Cover	Species	% Cover
Carex panicea	35	*Ranunculus acris*	0.3
Carex viridula	30	*Ranunculus flammula*	0.5
Centaurea nigra	0.5	*Rhytidiadelphus squarrosus*	0.5
Cirsium palustre	0.5	*Riccardia multifida*	0.1
Danthonia decumbens	0.1	*Rubus fruticosus agg.*	0.3
Drepanocladus cossonii	1	*Scapania irrigua*	0.1
Eriophorum angustifolium	0.1	*Scleropodium purum*	0.3
Festuca rubra	3	*Succisa pratensis*	10
Fissidens adianthoides	0.1	*Taraxacum officinale agg.*	1
Galium palustre	0.3	*Thuidium delicatulum*	0.1
Holcus lanatus	0.5	*Trifolium repens*	0.3

Area 4.d

There is an area (c.1.88ha) of Wet grassland (GS4) with a small (c.3%) cover of Rich fen and flush mosaic (PF1) to the north of the proposed drainage outfall, within Lough Corrib cSAC. Species present include *Molinia caerulea*, *Filipendula ulmaria*, *Anthoxanthum odoratum* and *Juncus conglomeratus*. This area corresponds with the *Molinia caerulea – Succisa pratensis* grassland community (1c) but there is insufficient herb cover or consistent indicator species for it to correspond with the *Molinia* meadow [6410] Annex I habitat type.

The drainage ditch, to which the drainage outfall discharges, drains to the north-west for c.380m before turning north-east where it connects with the River Corrib after a further c.130m. Along or close to the drainage ditch, within the boundary of Lough Corrib cSAC, are Wet grassland (GS4), Wet heath (HH3), Transition mire (PF3) and Wet willow-alder-ash woodland (WN6) habitats. Some of these correspond with Annex I habitat types: *Molinia* meadow [6410], Wet heath [4010], Transition mire [7140] and Residual alluvial forests [*91E0], respectively.

9.1.2.1.3 Menlough

The proposed development boundary overlaps with the Lough Corrib cSAC boundary at two points in the vicinity of Coolagh Lakes: between Ch. 9+850 and Ch. 10+050, and again between Ch. 10+075 and Ch. 10+100.

The Coolagh Lakes correspond with the Annex I Hard water lakes [3140] habitat type and support a wetland complex of Wet grassland (GS4), Wet heath (HH3), Fen (Pf1 and PF2) and Reed swamp (FS1). Many of these habitat types correspond with the Annex I habitat types[35] Residual alluvial forests [*91E0], Cladium fen [*7210], Alkaline fen [7230], Hydrophilous tall herb [6430], *Molinia* meadow [6410], Wet heath [4010] and Transition mires [7140]. Although only Calcareous grassland and

[35] Where abbreviated Annex I habitat names are used throughout this report, nomenclature follows that of *The Status of EU Protected Habitats and Species in Ireland. Overview Volume 1.* (National Parks & Wildlife Service, 2013a)

Cladium fen are QI habitats for Lough Corrib cSAC, many of the other wetland habitats are likely to provide a supporting role to these habitats within this mosaic.

Habitat types recorded within Lough Corrib cSAC and adjacent to the proposed road development between Ch. 9+850 and Ch. 10+100 are shown on **Figure 13.3** (Fossitt habitat classifications) and **Figure 14.3** (Annex I habitat classifications) and are described in **Appendix G**. The detailed descriptions below relate to each habitat area within Lough Corrib cSAC that lies within, or adjacent to, the proposed development boundary and that will be directly affected by the proposed road development (c.0.13ha will be directly impacted within Lough Corrib cSAC). None of these areas correspond with Annex I habitat types. The reference codes used below (e.g. Area 2.a) correspond with the annotation on **Figure 15.3**.

Area 2.a, Area 2.d, Area 2e and Area 2.g

These habitat areas are classified as Oak-Ash-Hazel Woodland (WN2) and correspond with the *Fraxinus excelsior – Hedera helix* woodland group and the *Corylus avellana – Oxalis acetosella* woodland vegetation community (WN2_2e). Typical species include *Corylus avellana, Fraxinus* excelsior, *Hedera helix, Prunus spinosa, Quercus robur, Ilex aquifolium, Acer pseudoplatanus and Lonicera periclymenum.* These woodlands cover an area of approximately 7.78ha; of which c.3.3ha lies within Lough Corrib cSAC. Of the c.3.3ha that lies with Lough Corrib cSAC, only c.0.08ha also lies within the proposed development boundary. These woodland blocks form a mosaic with patches of exposed and wooded Limestone pavement habitat across the local area from Menlough to the north of Lackagh Quarry. The proposed road development passes between Area 2.a and the other woodland blocks which lies closer to the Coolagh Lakes.

These woodlands lack the thin soil cover (on average less than 2cm deep) and cover of exposed limestone rock beneath the woodland canopy (i.e. at least 50% of the surface comprising exposed rock) to qualify as the wooded variant of the priority Annex I habitat type Limestone pavements [*8240].

Area 2.b

This habitat area (c.0.83ha) is classified as Wet grassland (GS4) and corresponds with the *Juncus effusus – Holcus lanatus* grassland vegetation community (GS4_2b). The species recorded here were *Agrostis stolonifera, Arrhenatherum elatius, Cirsium palustre, Filipendula ulmaria, Holcus lanatus, Juncus effusus, Lychnis flos-cuculi, Lythrum salicaria, Molinia caerulea, Plantago lanceolata, Potentilla anserina, Ranunculus acris, Ranunculus repens* and *Trifolium repens*. Approximately 0.25ha of this habitat area lies within the proposed development boundary; of which c.0.01ha also lies within Lough Corrib cSAC. This habitat does not have the requisite indicator species to correspond with any Annex I habitat types.

Area 2.c

This habitat area (c.0.64ha) is classified as Dry calcareous and neutral grassland (GS1) and corresponds with the *Holcus lanatus – Lolium perenne* grassland vegetation community (GS1_2c). The sward is dominated by *Holcus lanatus* with other typical species such as *Agrostis stolonifera, Trifolium repens, Ranunculus repens,* and *Plantago lanceolata* present. This habitat area lies within Lough Corrib cSAC, with less than $50m^2$ also within the proposed development boundary. This habitat does not have the requisite indicator species to correspond with any Annex I habitat types.

Area 2.f

This habitat area (c.0.38ha) was classified as Dry calcareous and neutral grassland (GS1) in 2014 in a mosaic with Scrub (WS1) and bracken (HD1). The grassland corresponded with the *Cynosurus cristatus – Trifolium pratense* grassland vegetation community (GS1_3d). The majority of this habitat area lies outside of Lough Corrib cSAC, save for a portion (c.0.01ha) of the access track which lies within the European site. Typical species included *Cynosurus cristatus, Trifolium pratense, Plantago lanceolata, Centaurea nigra* and *Filipendula ulmaria*.

In 2015, the habitat had been improved and was reclassified as Improved agricultural grassland (GA1) with the typical species of *Lolium perenne, Rumex acetosa, Plantago lanceolata, Trifolium repens, Holcus lanatus, Cirsium arvense, Odontites vernus, Ranunculus repens, Cynosurus cristatus* and *Trifolium pratense*. This habitat type does not correspond to the (priority) Annex I habitat type *Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometea) (* important orchid sites)* [6210/*6210] on the basis that it does not support the required species composition for this habitat type. None of the requisite High Quality Positive Indicator Species or Positive Indicator Species were present. Considering *Lowland hay meadows* [6510], only two indicator species were recorded (*Plantago lanceolata* and *Trifolium pratense*) and on that basis it does not support the required species composition for this habitat type.

Area 2.h

This habitat area is classified as Scrub (WS1) and is dominated by *Prunus spinosa*. Other typical species include *Rubus fruticosus* agg., *Hedera helix* and *Pteridium aquilinum.* The scrub covers approximately 0.16ha; all of which lies within Lough Corrib cSAC. Approximately 0.01ha also lies within the proposed development boundary. This habitat does not have the requisite indicator species to correspond with any Annex I habitat types.

Area 2.i

This is a local road and gravelled access track which is classified as Buildings and artificial surfaces (BL3). This habitat area runs along the boundary of Lough Corrib cSAC and, being a man-made feature, does not correspond with any Annex I habitat types.

Area 2.j

This is a local paved road which is classified as Buildings and artificial surfaces (BL3). Approximately 50m^2 lie within Lough Corrib cSAC. This habitat area, being a man-made feature, does not correspond with any Annex I habitat types.

9.1.2.1.4 Coolough and Proposed Lackagh Tunnel

The proposed road development and its boundary overlaps with i.e. traverses through or adjacent to the Lough Corrib cSAC at the following locations between Ch. 10+620 and Ch. 11+800, including a tunnel beneath the cSAC and the full extent of Lackagh Quarry:

- north of the road carriageway from Ch. 10+620 to Ch. 10+660 (Areas 3.a and 3.b)
- north and south of the western approach to the Lackagh Tunnel from Ch. 10+800 to Ch. 11+150 (Areas 3.g to 3.l)
- above the Lackagh Tunnel from Ch. 11+150 to Ch. 11+420 (Areas 3.m and 3.n)
- adjacent to the western boundary of Lackagh Quarry, south of the Lackagh Tunnel portal within the quarry
- adjacent to the western and northern boundary of Lackagh Quarry, north of the Lackagh Tunnel portal within the quarry

Habitat types recorded within Lough Corrib cSAC in the vicinity of the proposed Lackagh Tunnel (and western approach to same) and Lackagh Quarry are shown on **Figures 13.4** and **13.5** (Fossitt habitat classifications) and **Figures 14.4** and **14.5** (Annex I habitat classifications) and are described in **Appendix G**. The detailed descriptions below, and the reference codes used, relate to each habitat area within Lough Corrib cSAC shown on **Figures 15.4** and **15.5**. The descriptions relate to habitat areas that will be directly affected by the proposed road development (c. .2ha will be directly impacted within Lough Corrib cSAC). None of these areas correspond with Annex I habitat types.

Area 3.a

This habitat area lies adjacent to Lough Corrib cSAC and is classified as a mosaic of Oak-Ash-Hazel Woodland (WN2) and Scrub (WS1) and corresponds with the *Fraxinus excelsior – Hedera helix* woodland group and the *Geum urbanum – Veronica montana* vegetation community (WN2_2a). Typical species include *Fraxinus excelsior*, *Corylus avellana*, and *Rubus fruticosus* agg. These woodlands lack the thin soil cover (on average less than 2cm deep) and cover of exposed limestone rock beneath the woodland canopy (i.e. at least 50% of the surface comprising exposed rock) to qualify as the wooded variant of the priority Annex I habitat type Limestone pavements [*8240].

Area 3.b

This habitat area (c.0.28ha) is classified as a mosaic of Oak-Ash-Hazel Woodland (WN2) and Scrub (WS1) and corresponds with the *Fraxinus excelsior – Hedera helix* woodland group and the *Corylus avellana – Oxalis acetosella* woodland vegetation community (WN2_2e). Typical species include *Corylus avellana*,

Hedera helix and *Crataegus monogyna.* This area lies within Lough Corrib cSAC with c.0.03ha also within the proposed development boundary. These woodlands lack the thin soil cover (on average less than 2cm deep) and cover of exposed limestone rock beneath the woodland canopy (i.e. at least 50% of the surface comprising exposed rock) to qualify as the wooded variant of the priority Annex I habitat type Limestone pavements [*8240].

Area 3.c, Area 3.d, Area 3.e, Area 3.g, Area 3.h, Area 3.i and Area 3.j

These habitat areas are classified as a mosaic of Oak-Ash-Hazel Woodland (WN2) and Scrub (WS1) and correspond with the *Corylus avellana – Oxalis acetosella* woodland vegetation community (WN2_2e). Typical species include *Corylus avellana*, *Crataegus monogyna*, *Hedera helix* and *Rubus fruticosus* agg. These woodlands lack the thin soil cover (on average less than 2cm deep) and cover of exposed limestone rock beneath the woodland canopy (i.e. at least 50% of the surface comprising exposed rock) to qualify as the wooded variant of the priority Annex I habitat type Limestone pavements [*8240]. The soils in these woodland blocks were generally between 5cm and 10cm depth, on average. Bare rock cover was <10% in most cases but where rock cover was greater it consisted of large limestone blocks rather than the clint and grike rock structure associated with the Annex I habitat type.

These woodlands cover an area of approximately 2ha; of which c.1.82ha also lies within Lough Corrib cSAC. Of the c1.82ha that lies with Lough Corrib cSAC, only c.0.11ha also lies within the proposed development boundary. These woodland blocks form a mosaic with patches of exposed and wooded Limestone pavement habitat across the local area from Lackagh Quarry to Menlough.

Area 3.f

This habitat area is classified as a mosaic of Treelines (WL2) and Scrub (WS1) with some associated Dry meadows and grassy verges (GS2), and Spoil and Bare Ground (ED2) habitat. Approximately 0.08ha of this habitat area lies within the proposed development boundary and Lough Corrib cSAC. Typical species of the treeline/scrub are *Fraxinus excelsior*, *Prunus spinosa* and *Rubus fruticosus* agg.. Typical grassland species include *Agrostis stolonifera*, *Centaurea nigra*, *Holcus lanatus*, *Leontodon autumnalis*, *Plantago lanceolata*, *Plantago major*, *Potentilla anserina*, *Ranunculus repens*, *Senecio jacobaea* and *Trifolium repens*. These habitats do not correspond with any Annex I habitat types.

9.1.2.2 Otter

Evidence of Otter activity was abundant and widespread within Lough Corrib cSAC along the River Corrib corridor and the south-eastern shore of Lough Corrib. However, there are no Otter holts or couches (resting places) present along the River Corrib in the vicinity of the proposed River Corrib Bridge (see **Table 9.6** for summary of results). One Otter couch site was recorded at the Coolagh Lakes but more than 600m from the proposed road development.

Table 9.6: Otter holts/couches recorded

Ref. No.	Feature	Status and description
H1	Couch site	Active couch site along river bank >1km from the proposed road development
H2	Couch site	Active couch site along river bank >1km from the proposed road development
H3	Couch site	Active couch site along river bank c.450m from the proposed road development
H4	Potential natal holt	Dense scrub patch with abundant Otter signs surrounding and in the vicinity, well-worn and used trails leading into scrub – evidence suggestive of juvenile Otter being present. >1km from the proposed road development
H5	Couch site	Active couch site along river bank >1km from the proposed road development
H6	Couch site	Active couch site along river bank >1km from the proposed road development
H7	Couch site	Active couch site along river bank >1km from the proposed road development
H8	Couch site	Active couch site along river bank >1km from the proposed road development
H9	Couch site	Active couch site along river bank c.600m from the proposed road development

The full results of the Otter surveys are shown on **Figure 6**.

9.1.2.3 White-clawed crayfish

There were no White-clawed crayfish recorded at any of the survey sites within the scheme study area, including the River Corrib. No other evidence of the presence of the species within the scheme study area was observed (i.e. Otter spraints will commonly contain crayfish remains if they form part of their diet). Therefore, White-clawed crayfish are not present in Lough Corrib cSAC within the ZoI of the proposed road development, in the area between Lough Corrib and Galway Bay.

9.1.2.4 Fish

The River Corrib is an important salmonid watercourse, supporting both Atlantic salmon and Brown trout. The River Corrib system is also designated under the Habitats Directive as part of a cSAC (Lough Corrib cSAC) for its Atlantic salmon *Salmo salar*, Sea lamprey *Petromyzon marinus* and Brook lamprey *Lampetra planeri* populations. Water quality in the lower reaches of the River Corrib, where the proposed road development would cross the river, is classified as unpolluted

(Q4[36]) by the EPA (sampled at the Salmon Weir - http://gis.epa.ie/Envision). There are no records of Atlantic salmon spawning in the vicinity, or downstream, of the proposed River Corrib Bridge.

There are records of Sea lamprey spawning below the Salmon Weir in Galway City (O'Connor, 2007) and the species has also been recorded by IFI spawning in the upper catchment in Cong, Co. Mayo. Brook lamprey have been recorded widely throughout the River Corrib catchment (O'Connor, 2007). No suitable lamprey ammocoete nursery habitat was recorded in the vicinity of the proposed River Corrib Bridge, or the associated drainage outfalls to the river.

Whilst there are no records of Atlantic salmon or Sea lamprey at the proposed River Corrib Bridge crossing, the River Corrib provides important habitat for Atlantic salmon, and both lamprey species, particularly in the context of its function as a migration corridor from the sea to the spawning areas for Atlantic salmon and Sea lamprey.

9.1.2.5 Lesser Horseshoe Bat

There is a Lesser horseshoe bat population within the scheme study area, centred around the maternity site at Menlo Castle. The foraging area used by this Lesser horseshoe bat population extends from Dangan/Kentfield on the west bank of the River Corrib, to a mating and hibernation site in Castlegar c.3.5km to the east.

The Lesser horseshoe bat roost (and associated Lesser horseshoe bat population) that forms the QI population for this European site (Eborhall House) is more than 30km away from the proposed road development, on the northern shore of Lough Corrib. This distance would be regarded to be beyond the normal core foraging range of the Eborhall House population and beyond the normal commuting range of this species except on exceptional occasions or over long periods of time – for example, bats dispersing and moving between areas in the wider landscape over a period of many years/generations. Furthermore, radio-tracking surveys of the Menlough population of bats (which were identified within the scheme study area) undertaken for this project in 2014 and 2015 (Arup, 2016) did not suggest any evidence of movement between that population and the Eborhall House roost. Given the lack of any linkage between the scheme study area and the roosts that are the reason for designation of this European site, the Menlo Castle Lesser horseshoe bat population does not form part of the QI population for Lough Corrib cSAC. Although it is predicted in the EIA Report that there will be local level residual impacts on the Menlough Lesser horseshoe bat population, as a result of the proposed road development, these impacts will not affect the conservation objectives of Lough Corrib cSACs, nor will they affect the QI Lesser horseshoe bat population of any other European site, because this population does not form part of the QI population for either Lough Corrib cSAC or any other European site designated for this species.

[36] EPAs biological water quality rating system, after Toner *et al.*, 2005: Q5, Q4-5 and Q4 = Unpolluted, Class A; Q3-4 = Slightly polluted, Class B; Q3 or Q2/3 = Moderately polluted Class C; and, Q2, Q1/2 or Q1 = Seriously polluted Class D.

9.1.2.6 Freshwater pearl mussel

There are no Freshwater pearl mussel populations within that portion of Lough Corrib cSAC crossed by, or downstream of, where the proposed road development interacts with this European site (see also **Section 9.1.4.9**); the QI population in Lough Corrib cSAC is associated with the Owenriff River, c.23km to the north.

9.1.2.7 Varnished-hook moss and Slender naiad

The nearest known site for Varnished hook-moss, at Gortachalla Lough, is north of Moycullen and more then 10km from the proposed road development.

Slender naiad is not known from any of the waterbodies within Lough Corrib cSAC that lie within the scheme study area.

9.1.3 Potential Direct and Indirect Impacts[37]

The proposed road development and its boundary overlaps with, i.e. traverses through or adjacent to one European site, namely Lough Corrib cSAC at four locations: at the termination of the proposed drainage outfall from the N59 Link Road North at Kentfield; at the site of the proposed River Corrib Bridge between Dangan and Menlough; to the west of the Coolagh Lakes (Ch. 9+850 to Ch. 10+100); and, to the west and north of Lackagh Quarry where the proposed road development will consist of a tunnel (Lackagh Tunnel) and approach road infrastructure (Ch. 10+620 to Ch. 11+800).

The following, are the impacts by which the proposed road development could (in the absence of mitigation measures) potentially affect the QIs of Lough Corrib cSAC:

- Habitat loss and habitat fragmentation
- Habitat degradation through structural effects to the overlying/adjacent limestone bedrock associated with the proposed Lackagh Tunnel and approaches
- Habitat degradation as a result of the proposed road development affecting the functioning and quality of the existing hydrogeological regime
- Habitat degradation as a result of the proposed road development affecting water quality in receiving watercourses during construction
- Habitat degradation as a result of air quality impacts
- Habitat degradation as a result of shading effects from elevated structures or high embankment
- Habitat degradation as a result of introducing/spreading non-native invasive plant species to habitat areas within Lough Corrib cSAC

[37] In combination effects are considered in **Section 12** separately from the direct and indirect impacts discussed this section

- Mortality risk to aquatic species in the River Corrib during construction of the proposed River Corrib Bridge
- Mortality risk to Otter during operation through collisions with road traffic

9.1.4 Examination and Analysis of Potential Direct and Indirect Impacts

9.1.4.1 Habitat loss/fragmentation

Habitats

Through the evolution of the proposed road development, elements were included in the design, which avoided direct impacts on habitat areas within Lough Corrib cSAC. These include, the siting and design of the proposed River Corrib Bridge which avoids any direct impacts on QI Annex I habitat within Lough Corrib cSAC and the clear span design, with no in-stream piers, which avoids any loss of in-stream habitat. A retaining wall on the southern side of the proposed road development at approximately Ch. 9+880 to Ch. 10+050 and on both sides of the proposed road development at approximately Ch. 10+850 to Ch. 11+150 forms part of the design to avoid the encroachment of the proposed road development on Annex I habitat within Lough Corrib cSAC. The proposed Lackagh Tunnel is beneath an area of QI Annex I habitats in Lough Corrib cSAC (Limestone pavement and Calcareous grassland) avoiding any direct habitat loss. It remains however, that the proposed development boundary includes habitat areas within Lough Corrib cSAC at the four locations as detailed above in **Section 9.1.4**.

At some of these locations, QI Annex I habitats are present within the proposed development boundary however, not all lands within both the proposed development boundary and Lough Corrib cSAC are required to facilitate construction works. The design of the proposed road development does not permit construction compounds or materials stockpiles to be located within Lough Corrib cSAC. Nor does it allow permanent fencing to be erected on areas of Annex I habitat within Lough Corrib cSAC.

Mitigation measures are required to ensure that no construction works will take place within any Annex I habitat areas in Lough Corrib cSAC that lie within the proposed development boundary (**Section 10.1** and **Figures 15.1** to **15.4**). This is reflected in the assessment presented in this section of the NIS related to habitat loss, i.e. the assessment below does not discuss habitat loss in the restricted area of construction works.

In a worst-case scenario, habitat degradation could result in habitat loss over time. These are discussed separately below and include: potential structural impacts associated with tunnelling, potential hydrogeological impacts, potential hydrological impacts, potential air quality impacts, and impacts potentially arising from the spread/introduction of non-native invasive plant species.

The loss of any habitat areas outside of Lough Corrib cSAC will not have any indirect impacts on QI habitats, or habitats supporting QI species, due to the absence of any impact pathways – i.e. the habitats lost outside of this European site do not

provide a supporting role to any QI habitats within Lough Corrib cSAC, nor to QI species. Similarly, loss of non-QI habitats within the Lough Corrib cSAC boundary will not have any indirect impacts on QI habitats due to the absence of any impact pathways – i.e. the non-QI habitats lost within the European site do not provide a supporting role to any QI habitats, nor to QI species.

The overlap of the proposed development boundary with Lough Corrib cSAC covers an area of approximately 4ha. Of this, approximately 2ha of this habitat area will be retained with approximately 2ha of this habitat area being lost within Lough Corrib cSAC.

Proposed River Corrib Bridge

At the proposed River Corrib Bridge crossing, the proposed road development does not impact upon any QI habitats within Lough Corrib cSAC (**Figure 14.1**). On the west bank, the area of habitat loss within Lough Corrib cSAC is c.0.08ha; comprising a gravelled pathway, a patch of bramble scrub and a narrow band of rank grassland. On the east bank the area of habitat loss within Lough Corrib cSAC is c.2ha; comprising a block of woodland and two agricultural fields with a treeline along the river bank. The area of woodland that will be lost is c0.7ha, with the grassland and treeline habitat comprising a further c.1.3ha. The total area of habitat loss within Lough Corrib cSAC at the proposed River Corrib Bridge crossing is c.1.7ha.

None of these habitats corresponds with any Annex I habitat types. None of these habitat types are QIs of Lough Corrib cSAC, and they do not provide a supporting role to any QI habitats within Lough Corrib SAC, nor to QI species (see species discussions below). Therefore, their loss from Lough Corrib cSAC will not affect the conservation objective attributes and targets supporting the conservation condition of any of the QI habitats or species of Lough Corrib cSAC (see **Table 9.16**).

Proposed Drainage Outfall - N59 Link Road North

The proposed drainage outfall for the N59 Link Road North at Kentfield will result in the loss of a treeline and scrub along the raised former railway embankment, along with some associated rank grassland habitat. The total area of habitat loss for the proposed Drainage Outfall for N59 Link Road North within Lough Corrib cSAC is c.0.02ha (c.150m^2).

None of these habitats corresponds with any Annex I habitat types (**Figure 14.2**). None of these habitat types are QIs of Lough Corrib cSAC, and they do not provide a supporting role to any QI habitats within Lough Corrib cSAC, nor to QI species (see species discussions below). Therefore, their loss from Lough Corrib cSAC will not affect the conservation objective attributes and targets supporting the conservation condition of any of the QI habitats or species of Lough Corrib cSAC (see **Table 9.16**).

Menlough

No construction works will be undertaken, and there will be no habitat loss, within those areas of QI Annex I habitat located inside the boundary of Lough Corrib cSAC (**Figure 14.3**).

Between Ch. 9+850 and Ch. 10+050, the proposed road development will result in the loss of c.0.02ha Oak-ash-hazel woodland, calcareous grassland and wet grassland habitat. The second area, (between Ch. 10+075 and Ch. 10+100) consists of predominantly Oak-ash-hazel woodland (two separate patches) along with a patch of *Prunus spinosa* dominated Scrub and a field access track, covering an area of c.0.11ha. A small portion of the Coolagh Road that lies within Lough Corrib cSAC will also be affected (c.50m^2). The total area of habitat loss within Lough Corrib cSAC in the Menlough area is c.0.13ha.

None of the directly affected habitat areas within Lough Corrib cSAC correspond with any Annex I habitat types. None of these habitat types are QIs of Lough Corrib cSAC, and they do not provide a supporting role to any QI habitats within Lough Corrib SAC, nor to QI species (see species discussions below). Therefore, their loss from Lough Corrib cSAC will not affect the conservation objective attributes and targets supporting the conservation condition of any of the QI habitats or species of Lough Corrib cSAC (see **Table 9.16**).

Coolough and Proposed Lackagh Tunnel

No construction works will be undertaken, and there will be no habitat loss, within those areas of QI Annex I habitat located inside the boundary of Lough Corrib cSAC (refer to **Figure 14.4** and **Figure 14.5**). This includes those habitats above the proposed Lackagh Tunnel and those within Lough Corrib cSAC adjacent to the western and northern boundaries of Lackagh Quarry.

Between Ch. 10+620 to Ch. 10+660, the proposed road development will result in the loss of c.0.03ha of Oak-ash-hazel woodland and scrub inside Lough Corrib cSAC, to the north of the proposed road carriageway.

Between Ch. 10+750 to Ch. 10+810, the proposed road development will result in the loss of c.0.11ha of *Prunus spinosa* dominated scrub/treeline, and two patches of calcareous/neutral grassland, totalling c.0.11ha inside Lough Corrib cSAC to the north of the proposed road carriageway. North of the western approach to the Lackagh Tunnel, from Ch. 10+800 to Ch. 11+150, the proposed road development will result in the loss of c.0.07ha of Oak-ash-hazel woodland and scrub that lies within Lough Corrib cSAC and within the proposed development boundary. This habitat area does not correspond to any Annex I habitat type. South of the western approach to the Lackagh Tunnel, from Ch. 10+800 to Ch. 11+150, the proposed road development will result in the loss of c.0.02ha of scrub, c.0.02ha of Oak-ash-hazel woodland, and c.0.07ha of a mosaic of treeline, scrub, rank grassland and disturbed ground within Lough Corrib cSAC. This habitat area does not correspond to any Annex I habitat type.

The total area of habitat loss within Lough Corrib cSAC in the vicinity of the proposed Lackagh Tunnel area is c.0.2ha.

None of the affected habitat areas within Lough Corrib cSAC correspond with any Annex I habitat types. None of these habitat types are QIs of Lough Corrib cSAC, and they do not provide a supporting role to any QI habitats within Lough Corrib cSAC, nor to QI species (see species discussions below). Therefore, their loss from Lough Corrib cSAC will not affect the conservation objective attributes and targets

supporting the conservation condition of any of the QI habitats or species of Lough Corrib cSAC (see **Table 9.16**).

Otter

As there were no Otter breeding or resting places, holt or couch sites, present within the ZoI of the proposed road development, habitat loss will not result in any decline in the number of available holt or couch sites within Lough Corrib cSAC.

In the context of river systems, the *Threat Response Plan Otter* Lutra lutra *2009-2011* document (Department of the Environment, Heritage and the Gaeltacht, 2011) defines terrestrial Otter habitat as a 10m zone of riparian habitat along the river banks. On the River Corrib, the construction of the proposed bridge structure will not result in the loss of any in-stream habitat. Construction of the bridge structure (a supporting pier) will result in the permanent loss of c.20m^2 of Otter habitat on the west bank of the river. On the east bank, the supporting pier will result in the loss of c.24m^2 of Otter habitat. On both river banks, some vegetation cutting/removal will likely be required to facilitate the construction works and potentially on an ongoing basis during operation (potentially c.40m of linear length on the east bank). Some effects to any remaining vegetation underneath the bridge structure would also be expected as a result of shading effects. The construction of the proposed drainage outfalls to the River Corrib will, also, result in the combined permanent loss of approximately 23m^2 of riparian habitat (S15, S18A and S18B). Overall, c.67m^2 of Otter habitat will be permanently lost from within Lough Corrib cSAC as a result of the proposed road development.

Habitat loss of such a comparatively small scale, in the context of the in-stream and riparian habitat resource along the River Corrib between the lake and Galway City (in itself a small proportion of Otter habitat available in the wider Lough Corrib cSAC – i.e. less than 0.0007% of the total 1,054ha quoted in the conservation objectives document for Lough Corrib cSAC) does not constitute a significant decline. This assessment is made on the basis that the habitat loss and changes associated with the proposed road development will not reduce the number of available breeding or resting places, will not affect prey availability or abundance, and will therefore, not affect the local Otter population's ability to maintain itself—even over the short-term. This is evidenced at many bridge and culvert sites across the country, even in cases where habitats are converted to hard surfaces (such as where a precast concrete culvert is installed), where Otter routinely use highly modified habitat within culverts and beneath bridges.

There will not be any in-stream works associated with the construction of the proposed River Corrib Bridge and the bridge structure is elevated above the river and much of the floodplain. As a result, there will not be any fragmentation of Otter habitat along the River Corrib.

Bankside and riparian habitat loss, or modification, associated with construction of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of Otter in Lough Corrib cSAC (see **Table 9.16**).

Sea lamprey, Brook lamprey and Atlantic salmon

The function of the River Corrib, for Sea lamprey, Brook lamprey and Atlantic salmon, in the vicinity of the proposed River Corrib Bridge is primarily as a migration corridor between Galway Bay and spawning areas upstream in the catchment. Habitat loss relating to the river is restricted to two c.3m sections of riverbank that will be lost to construct the proposed drainage outfalls (one on each bank– refer to **Section 6** for description of the proposed drainage design). Habitats in the vicinity are neither suitable spawning habitat for these species nor nursery habitat for lamprey ammocoetes, and therefore any habitat loss associated with such works will have no effect on the species ability to maintain their population within the catchment—even in the short-term.

There will not be any in-stream works associated with the construction of the proposed River Corrib Bridge and therefore, no fragmentation of Sea lamprey, Brook lamprey or Atlantic salmon habitat.

Bankside and riparian habitat loss, or modification, associated with construction of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of Sea lamprey, Brook lamprey or Atlantic salmon in Lough Corrib cSAC (see **Table 9.16**).

Summary

A summary of the potential habitat loss/fragmentation impacts are presented in **Table 9.7** below.

Table 9.7: Summary of Habitat Loss/Fragmentation Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Construction		
Loss of QI habitat or loss of non-QI habitat types that have a supporting role in maintaining the conservation status of QI habitats	Yes There are no areas of QI Annex I habitats within Lough Corrib cSAC that lie beneath the footprint of the proposed road development. Neither will the proposed road development result in the loss of any habitats that support the QI habitats that are present in Lough Corrib cSAC. However, within Lough Corrib cSAC there are areas of the QI habitats Limestone pavement [*8240] and Calcareous grassland [6210] that lie within the proposed development boundary yet outside of the footprint of the road carriageway which could be directly impacted if not	Yes To ensure that no QI Annex I habitats in Lough Corrib cSAC are directly impacted by the proposed road development (as outlined in **Section 10.1**)

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
	protected from construction works.	
Fragmentation of habitat	No The proposed road development will not result in the fragmentation of any QI habitats nor will it fragment the River Corrib corridor	No
Loss of habitat that may have a role in supporting the conservation status of: Otter Sea lamprey Brook lamprey Atlantic salmon	No Habitat loss within, or along the banks of, the River Corrib is minimal and will not affect any breeding or resting sites or the species' ability to maintain their populations	No
Operation		
Not applicable	No	No

9.1.4.2 Habitat degradation – tunnelling/excavation

There are three specific locations associated with the proposed Lackagh Tunnel discussed below, where construction will involve tunnelling beneath, or deep excavations immediately adjacent to, QI habitats within Lough Corrib cSAC (see **Figures 1.8** to **8.14** for design and **Figures 14.4** and **14.5** for Annex I habitats). For the description of this assessment Lackagh Tunnel and its approaches is discussed in three sections but the overall impact of the Lackagh Tunnel and its approaches has been assessed as one.

Section 1: Stabilisation of Lackagh Quarry Face

Lackagh Quarry lies immediately adjacent to the boundary of Lough Corrib cSAC and construction works associated with, or in close proximity to, the quarry walls could affect the structural integrity[38] of the limestone supporting the QI habitats above. These habitats comprise a mosaic of wooded Limestone pavement [*8240], scrub covered Limestone pavement [*8240], exposed Limestone pavement [*8240], and Calcareous grassland [6210]. The worst-case scenario would be large scale rockfall and the resulting loss of habitat that would be associated with such an impact.

Section 2: Lackagh Tunnel

Lackagh Tunnel will comprise of a twin bored mined (drill and blast) tunnel through limestone beneath Lough Corrib cSAC. There is the risk that such works could impact upon the structural integrity of the overlying QI Limestone pavement above

[38] Structural Integrity of the rockmass that supports the mosaic of Limestone pavement and Calcareous grassland is the physical and mechanical geotechnical properties that control the behaviour of the geotechnical Limestone pavement environment

or affect the existing hydrogeological regime. This in turn could affect the supported QI habitats.

Section 3: Western Approach to Lackagh Tunnel

The Western Approach to Lackagh Tunnel is set within thick subsoils that are bound to the north and south by Lough Corrib cSAC and the mosaic of Limestone pavement associated QI habitats. There is the risk that such works could impact upon the structural integrity of the adjacent QI Limestone pavement or Calcareous grassland habitats or affect the existing hydrogeological regime.

Overall

A design and detailed construction methodology have been developed for construction works for the three sections of Lackagh Tunnel to ensure that the structural integrity of the limestone supporting the QI habitat at the surface is not affected (for a summary refer to **Section 2.5.7.6** with the full description provided in **Appendix F**). However, mitigation measures in the form of ensuring the monitoring of rock slopes during tunnel construction and monitoring of blasting locally are required to ensure there is no risk to the structural integrity of the rock mass supporting any habitats above.

Summary

A summary of the potential direct or indirect impacts associated with the proposed Lackagh Tunnel tunnelling/excavations are presented in **Table 9.8** below.

Table 9.8: Summary of Impacts Associated with Constructing the Lackagh Tunnel

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Construction		
Tunnelling and excavations at the proposed Lackagh Tunnel affecting the structural integrity of surface-level habitats: [*8240] [6210]	Yes If construction works resulted in impact to the structural integrity of the rock mass above the tunnel resulting in the damage to or loss of QI Limestone pavement/Calcareous grassland habitat area within the cSAC above	Yes To ensure there is no risk to the structural integrity of the rock mass supporting the QI habitats in Lough Corrib cSAC (**Section 12.2**)
Operation		
During operation, the proposed Lackagh Tunnel poses no risk to the structural of the rock mass above the tunnel	No	No

9.1.4.3 Habitat degradation – hydrogeology

As discussed above in **Section 6.3**, the following groundwater bodies are within the hydrogeological ZoI and are potentially affected by the proposed road development. The hydrogeological ZoI also includes habitat areas within Lough Corrib cSAC (for

locations relative to the proposed road development and Lough Corrib cSAC, refer to **Figures 10.2.1** to **10.3.6**):

- Ross Lake GWB
- Lough Corrib Fen 1 (Menlough) GWB
- Lough Corrib Fen 1 (Lackagh) GWB
- GWDTE Lough Corrib Fen 2
- Clare-Corrib GWB

There are no groundwater dependant habitats listed as QIs of Lough Corrib cSAC (or supporting QI habitats in the cSAC) present within the hydrogeological ZoI of the proposed road development in either Ross Lake GWB or in GWDTE Lough Corrib Fen 2 (refer to **Figures 10.2.1** to **10.2.2** and **Figures 10.3.1** to **10.3.4**, and also **Figures 11.1** to **11.4** for Annex I habitat mapping).

In the Lough Corrib Fen 1 (Menlough) GWB and the Lough Corrib Fen 1 (Lackagh) GWB, the hydrogeological ZoI includes both springs that contribute to the Coolagh Lakes and support the associated wetland complex of QI habitats. As described in **Section 5.2**, the main contributor to the Coolagh Lakes is the Western Coolagh Spring which is supplied by groundwater from the Lough Corrib Fen 1 (Menlough) GWB. There is a potential for a very low flow rate of seepage from the Lough Corrib Fen 1 (Lackagh) GWB, through the clayey subsoil, to the Eastern Coolagh Spring but this spring only contributes a very small fraction of the groundwater contribution to the Coolagh Lakes.

The Coolagh Lakes themselves are Hard water lakes [3140] and support the wetland habitats Alkaline fen [7230] and Cladium fen [*7210]. All of these habitat types are QI habitats of Lough Corrib cSAC. The fringing habitats associated with the Coolagh Lakes are also considered as part of the conservation objectives of the Hard water lakes habitat for their supporting role.

Within the Lough Corrib Fen 1 (Menlough) GWB and the Lough Corrib Fen 1 (Lackagh) GWB, only the following elements of the proposed road development have the potential to interact with groundwater during construction, based upon the design of the proposed road development and the groundwater monitoring data presented in **Appendix A** and **Appendix F**:

- excavating and installing the support piers for the Menlough Viaduct
- the western approach to the Lackagh Tunnel
- the Lackagh Tunnel itself

With the exception of the potential for intercepting groundwater conduits when constructing the supporting piers for the Menlough Viaduct, the construction of the proposed road development will not affect the existing hydrogeological regime in terms of the quantity of water supply to the Coolagh Lakes or the frequency of flooding as groundwater dewatering during construction is not permitted within the design (see Section 5.1.1 of **Appendix A**). Mitigation measures are required to ensure that any groundwater conduits that may be intercepted during construction of the Menlough Viaduct will be maintained.

The Clare-Corrib (Terryland) GWB overlaps with groundwater dependant habitats along the eastern edge of the Coolagh Lakes (**Figures 10.3.7** and **10.3.8**). Construction works in Lackagh Quarry and along the Menlough Road have the potential to interact with groundwater.

The Limestone pavement adjacent to the Western Approach to Lackagh Tunnel and Lackagh Quarry, as well as that above the Lackagh Tunnel, will have no groundwater impacts from the proposed road development during construction or operation; the pavement will remain drained and recharge will continue to follow exiting pathways through the unsaturated zone to the water table. There is however a risk that the accidental spillage of pollutants during construction could affect groundwater quality in the GWB which in turn could affect the conservation objectives of the Coolagh Lakes and the supported fringing wetland habitats (see **Table 9.9** below).

Where the construction works drain to any of the infiltration basins, this risk is removed. The infiltration basins are designed to be used during both construction phase for site runoff and operational phase for road runoff and will be part of the initial works undertaken for the proposed road development. The design of each infiltration basin is specific to the local hydrogeology, taking into account the unsaturated zone available and including placement of engineered appropriate subsoil to provide the required infiltration capacity. All infiltration basins include pre-treatment by hydrocarbon interceptor and containment area to provide an appropriate holding time to contain accidental spillages. All infiltration basins will be excavated into bedrock, with an over excavation to accommodate the thickness of appropriate subsoil. The sides of the excavation will be lined to control groundwater infiltration so that all discharges drain through a constructed subsoil appropriately placed for the thickness of the unsaturated zone. The design of the infiltration basins, coupled with the inclusion of hydrocarbon interceptor and containment area, will provide an appropriate level of protection to prevent contamination of groundwater from the infiltration basins during construction and operation.

There is however a risk, in those sections of the proposed road development underlain by limestone, of accidental spills during construction in areas where the bedrock outcrops, such as those areas where the groundwater has extreme or high vulnerability (Figure 3.01 and 3.02 of **Appendix A**) or where the karst limestone outcrops due to cuttings and excavations. Mitigation measures are required to ensure that groundwater quality is not affected during construction.

During operation, impacts to groundwater quantity could occur as a result of dewatering or sealing of cuttings or tunnels changing flow paths. Impacts to groundwater quality could be caused by discharging contaminated road runoff to ground or where leachate/runoff from limestone fill could affect the pH of acidic groundwater along the western section of the proposed road development.

As a consequence of the sealed design of the tunnels and approaches, none of the cuttings in the Lough Corrib Fen 1 (Menlough) GWB or the Lough Corrib Fen 1 (Lackagh) GWB require operational dewatering and, therefore, there will not be any operational impacts on groundwater supply or flow paths within the GWBs in that regard.

Although the drainage design (as described in **Section 2**, and **Appendices A**, **F** and **D**) will ensure that groundwater quality will be maintained during operation, it is important that they are inspected to ensure that karst features do not affect the functioning of the infiltration basins during operation. If this is identified during routine inspections of the infiltration basins then mitigation is required to ensure any issues are addressed so that they continue to function as designed for the operational lifespan of the proposed road development (see **Section 10.3.1.2**).

Summary

A summary of the potential hydrogeological impacts associated with the proposed road development are presented in **Table 9.9** below.

Table 9.9: Summary of Hydrogeological Impacts

Potential Direct and Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Construction		
Construction works affecting groundwater quantity that supports QI wetland habitats: e.g. Coolagh Lakes	The installation of the supporting piers of the proposed Menlough Viaduct has the potential to interact with groundwater conduits and potentially affect groundwater flow locally with the Lough Corrib Fen 1 (Menlough) GWB – which in turn could affect groundwater supply to the Western Coolagh Spring that contributes to the Coolagh Lakes, supporting QI wetland habitats in the cSAC	Yes To ensure that construction works will not affect the existing groundwater regime (as outlined in **Section 10.3**)
Construction works affecting groundwater quality	Yes Affecting the quality of groundwater supporting groundwater dependant habitats in Lough Corrib cSAC could affect the distribution, extent, diversity and area of QI wetland habitats	Yes To ensure that construction works will not affect groundwater quality in the underlying aquifer (as outlined in **Section 10.3**)
Operation		
Groundwater quantity being affected during operation	Yes Although the design of the proposed road development will not restrict or inhibit existing groundwater flow paths supporting groundwater dependant habitats in Lough Corrib cSAC, it is important that they are inspected to ensure that karst features do not affect the functioning of	Yes To ensure that the infiltration basins continue to function as designed for the operational lifespan of the proposed road development (as outlined in **Section 10.3**)

Potential Direct and Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
	the infiltration basins during operation	
Groundwater quality being affected during operation	Yes The drainage design (as described in Section 2, and Appendices G, H and I) will ensure that groundwater quality will be maintained during operation However, it is important that they are inspected to ensure that karst features do not affect the functioning of the infiltration basins during operation	Yes To ensure that the infiltration basins continue to function as designed for the operational lifespan of the proposed road development (as outlined in **Section 10.3**)

9.1.4.4 Habitat degradation – hydrology

Potential Hydrological Impacts on Surface Water Quality during Construction

Water Quality

It is extremely unlikely that a pollution event of a magnitude that would affect the conservation objectives of the QI aquatic species would occur during construction. The proposed road development crosses the river close to the downstream end of the catchment, which limits the ZoI of water quality impacts to that portion of Lough Corrib cSAC downstream of the proposed road development. Any pollution events that may occur would be expected to be relatively minor in comparison to the dilution factor and assimilative capacity of the River Corrib, or to be any more than temporary in nature. Therefore, any pollution event during construction would not have any perceptible or far-reaching effects within the catchment.

Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and construction mitigation is required to mitigate potential damage through various avoidance, reduction, mitigation and monitoring measures designed to prevent any untreated construction runoff water entering directly the River Corrib.

Summary

There is the potential for water quality to be affected during construction of the proposed road development as there is the potential for accidental spillages of pollutants to affect water quality in receiving watercourses/waterbodies and mitigation measures are required.

The proposed road development has the potential to affect the range, area, or structure/function of QI habitats within Lough Corrib cSAC, the range of QI species, or the ability of these QI habitats or species populations to maintain themselves in the long-term due to effects on water quality. The proposed road development therefore also has the potential to inhibit any efforts to restore

favourable conservation status, where this forms part of the conservation objectives (or might in the future).

Therefore, the proposed road development has the potential to affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats and species of Lough Corrib (see **Table 9.16**) through impacts on water quality during construction.

A summary of the potential direct or indirect impacts associated with the hydrological regime are presented in **Table 9.10** below.

Table 9.10: Summary of Hydrological Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required
Construction		
Construction works affecting surface water quality	Yes Affecting the quality of surface water supporting aquatic/wetland habitats and species could affect the quality and extent of those habitats and the aquatic species they support	Yes To ensure that water quality in the receiving environment is not affected during construction (as outlined in **Section 10.4**)

9.1.4.5 Habitat degradation – air quality

Emissions from car exhausts, and the deposition of particulate matter and heavy metals produced by engine, brake and tyre wear, can contribute to increased deposition of pollutants such as oxides of nitrogen (NO_x, NO_s), volatile organic compounds (VOCs), particulate matter (PM), heavy metals (HM) and ammonia (NH_4) in the vicinity of a road carriageway. This can affect the ecosystems and vegetation present, influencing plant growth rates and species composition, diversity, and abundance.

The current understanding of air quality impacts from roads and their interaction/effects on ecology are set out in the TII guidance document *Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes* (National Roads Authority, 2011) and two UK reports: *The Ecological Effects of Diffuse Air Pollution from Road Transport* (Bignal et al., 2004) and *The Ecological Effects of Air Pollution from Road Transport: An Updated Review* (Natural England, 2016).

Although carbon monoxide (CO), carbon dioxide (CO_2) and sulphur dioxide (SO_2) are generated by vehicles they are not currently thought to be of importance in terms of contributing to air quality impacts to vegetation and are not discussed further (Bignal et al., 2004; Natural England, 2016).

NO_x, NO_s and NH_3

Air quality modelling of NO_x concentrations and deposition rates was calculated for Lough Corrib cSAC at distances up to 200m from the proposed road development (refer to Table 3 in **Appendix L** for the results). The Air Quality Standards Regulations (AQS) 2011 (S.I. No. 180 of 2011) have a limit value of 30µg/m^3 for the protection of vegetation.

The predicted annual average NO_x concentration at various distances from the proposed road edge complies with the limit value of 30µg/m^3 for the Do-Minimum scenario in 2024 and 2039, with NO_x concentrations reaching 32% of this limit in 2024 and 2039. For the Do-Something scenario, the limit values are complied with in 2024 at 88% of the limit value and complied with in 2039 with the predicted concentration at 92% of the limit value, including background concentrations at 10m from the road edge. The potential impact of the proposed road development results in a maximum increase in NO_x concentrations of a maximum of 18.02µg/m^3 at 10m from the proposed road edge. All predicted concentrations are in compliance with the Air Quality Standard for the protection of vegetation (limit value of 30µg/m^3). Therefore, even at 10m from the road edge, harmful effects on vegetation from NO_x are not predicted.

The contribution of the proposed road development to the NO_2 dry deposition rate along the 200m transect from the road edge is a maximum increase in the NO_2 dry deposition rate of 1.15kg(N)/ha/yr in 2024 and 1.18kg(N)/ha/yr in 2039 for the Do-Something scenario. This is approximately 20% of the critical load for the lower boundary limit of inland and surface water habitats of 5-10kg(N)/ha/yr (National Road Authority, 2011). Modelled background concentrations for 1990, 2000 and 2020 nitrogen deposition are provided in the EPA research document *'Development of Critical Loads for Ireland: Simulating Impacts on Systems (SIOS)* (Aherne, Henry and Wolniewicz, 2017). In the area of the proposed road development, background levels are in the range of 1 to 2.5kg(N)/ha/yr which, with the addition of the predicted increases of 1.15kg(N)/ha/yr in 2024 and 1.18kg(N)/ha/yr in 2039 for the Do-Something scenario is still below the 5kg(N)/ha/yr critical load (3.68kg(N)/ha/yr). Therefore, harmful effects on vegetation from NO_2 are not predicted.

Dust emissions associated with construction works could, in extreme circumstances, affect adjoining habitats (potentially burying sensitive habitats or plant species). Best practice construction methodologies (e.g. watering of the construction site/access roads and road cleaning) and mitigation measures (dust screens during construction – see **Section 10.5**) are required to minimise construction generated dust and to contain it within the proposed development boundary.

Ammonia (NH_3) is emitted in small amounts by vehicles but atmospheric concentrations are well below critical levels for this pollutant (Bignal et al., 2004 and Natural England, 2016) and therefore, effects on vegetation within Lough Corrib cSAC are not predicted.

Volatile Organic Compounds (VOCs)

In terms of volatile organic compounds (VOCs), modelled benzene concentrations are 8.2% of the air quality standard of 5µg/m^3 for the protection of human health (refer to Table 4 in **Appendix L** for full results). Comparisons of emission factors of VOCs (mg/vehicle/km) have been examined in order to estimate an appropriate ratio of ethylene to benzene. The highest ratio of ethylene to benzene determined was 3:1, for vehicles which were primarily diesel emissions. Increases in ethylene from the proposed road development have been predicted using this ratio and results were 0.28-0.33µg/m^3 at 10m from the road edge (refer to Table 5 in **Appendix L** for full results). No background data is available for ethylene. There is little evidence of ecological damage by vehicle related VOCs and given the low concentrations predicted, there will not be any impacts on vegetation within Lough Corrib cSAC are not predicted.

PM and HM

Heavy metals from car emissions are associated with emissions of Particulate Matter, PM_{10} (particulate matter less than 10µm) and $PM_{2.5}$ (particulate matter less than 2.5µm). An assessment of emissions of PM_{10} and $PM_{2.5}$ was prepared in accordance with TII guidelines using the DMRB modelling spreadsheet. Predicted concentrations are compared to the air quality standard of 40µg/m^3 and 25µg/m^3 respectively for the protection of human health. The maximum predicted concentrations for the Do-Something scenario including background concentrations was 51.6% and 52% of the standards respectively.

Particulate matter (PM) and heavy metals (HM) decay at an exponential rate with distance from a road and the highest concentrations are generally present within 20-30m. The only area of QI Annex I habitat present in Lough Corrib cSAC within this zone is to the south-east of the road carriageway between Ch. 9+850 and Ch. 10+150. The prevailing winds in this area are from the west and south-west and with Lough Corrib cSAC to the south-east of the proposed road development, this limits the ability of air borne pollutants to reach and affect habitats there (see Section 4.2.3 of **Appendix L**). The shortest straight line distance from the road carriageway in consideration of the prevailing wind direction (from the west only, as winds from the south-west would carry pollutants away from the cSAC) is c.23m and the majority of PM/HM generated by road traffic will be deposited outside of the Lough Corrib cSAC boundary. In 2016, prevailing winds were from the west only 15% of the time. Given the 20-30m zone within which the majority of PM/HM would be deposited, the low concentrations predicted, the prevailing wind direction and frequency, and dispersion due to the elevation of the road, direct or indirect impacts on vegetation within Lough Corrib cSAC from PM or HM are not predicted.

Overall

As the proposed road development crosses Lough Corrib cSAC at the River Corrib, the elevation of the bridge structure and embankment will result in good dispersion of traffic generated pollution. The design of bridge structure itself includes barriers (c.2m in height) which will serve to contain the majority of pollutants. Considering the above, and the low levels of pollutants predicted during operation of the proposed road development, the proposed road development will not have an effect

on any QI Annex I habitats – the closest of which is located c.150m from the proposed road development, beyond the ZoI of any air quality impacts.

Where the proposed road development overlaps with, or lies immediately adjacent to, Lough Corrib cSAC between Ch. 9+850 and Ch. 10+900, there are QI Annex I habitats in closer proximity – for example, an area of Limestone pavement and Calcareous grassland c.15m from the road carriageway at Menlough. As with the River Corrib crossing, the proposed road development is elevated in this area (dispersing pollutants), low levels of pollutants are predicted during operation, and the ZoI of those pollutants does not extend to include habitats within Lough Corrib cSAC. Therefore, there will not be any effects on QI Annex I habitats in Lough Corrib cSAC in the vicinity.

From Ch. 10+900 to the western portal of the Lackagh Tunnel the proposed road development is in cutting; the sides of which will act as a barrier to contain traffic generated pollutants. The same applies in Lackagh Quarry, where the road carriageway is surrounded by the quarry walls up to 40m in height. Where the proposed road development tunnels beneath Lough Corrib cSAC, emissions generated here will not be physically able to interact with habitat areas above.

However, during construction, mitigation is required to contain dust emissions and avoid any impacts to QI habitats or species within Lough Corrib cSAC (see **Section 10.5**).

Summary

During operation, impacts on vegetation within Lough Corrib cSAC as a consequence of the design of the proposed road development (either on embankment, in cutting, or underground) are not predicted due to the low levels of pollutants predicted, and their restricted ZoI.

During construction, the proposed road development will generate dust which could affect vegetation within Lough Corrib cSAC where the proposed road development lies within or in close proximity to this European site. Mitigation measures are required to contain dust emissions during construction (see **Section 10.5**).

A summary of the potential air quality impacts associated with the proposed road development are presented in **Table 9.11** below.

Table 9.11: Summary of Air Quality Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Construction		
Dust generated during construction works within, or in close proximity to, Lough Corrib cSAC affecting the extent, diversity or structure of habitats within Lough Corrib cSAC in the vicinity of the proposed road development	Yes As dust deposition could affect the extent, diversity or structure of habitats within Lough Corrib cSAC	Yes To ensure that dust generated during construction does not impact upon the QI habitats or species of Lough Corrib cSAC (as outlined in **Section 10.5**)

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Operation		
A reduction in air quality during operation affecting the extent, diversity or structure of habitats within Lough Corrib cSAC in the vicinity of the proposed road development	No As potential air quality effects associated with the proposed road development are not predicted to affect the extent, diversity or structure of any habitats within Lough Corrib cSAC	No

9.1.4.6 Habitat degradation – shading

There are two locations where the proposed road development has the potential to cause some level of shading to habitats within Lough Corrib cSAC (refer to **Figures 13.1** to **13.5** and **14.1** to **14.5** for design and habitat information at these locations):

- at the site of the proposed River Corrib Bridge where the elevated structure pass over habitats within the cSAC (Ch. 9+400 – Ch. 9+500) and a section of raised embankment (Ch. 9+500 – Ch. 9+600) on its eastern approach

where a section of raised embankment/retaining wall and viaduct run adjacent to the cSAC boundary between Ch. 9+850 and Ch. 10+150) Bunce et al. (1999), presents Ellenberg indicator values[39] for British and Irish vascular plant species – these are values which indicate the environmental conditions that would be expected if a given plant species is present (e.g. light or shade loving species, indicator of dry/wet conditions). The majority of the plant species found in open grassland habitats have values of seven or eight on the light indicator scale. Values of eight indicate "a light loving plant rarely found where relative illumination in summer is less than 40%" and values of 7 indicate "plant generally in well-lit places, but also occurring in partial shade". Therefore, it is reasonable to conclude that any significant reduction in light levels as a result of shading from a bridge/viaduct deck would affect the habitat in an adverse way.

Broome *et al.* (2005) carried out research as to the effects of shading from bridge structures on estuarine marsh vegetation in North Carolina, U.S.A[40]. The results of this study found a significant correlation between light levels under bridges and the height to width ratio (HW ratio) of the structure, and concluded that those bridges with a HW ratio of <0.5 significantly affected plant growth and productivity underneath. HW ratios of between 0.5 and 0.68 resulted in measurable effects but

[39] Ellenberg values are derived from data on a restricted range of habitats (and may not hold true over a species full range) and are only intended to give an indication of the environmental conditions present, on what is an arbitrary scale

[40] There are a number of factors and limitations to consider in interpreting the findings of the North Carolina (NC) study with regard to the impacts of a bridge over the Lough Corrib cSAC: the NC study assessed the impacts on estuarine wetlands, a very different habitat type to the grassland habitat in question at the River Corrib; due to the significant difference in latitude between both locations (in the region of 18°) the effects of shading would be expected to be different; and, the small sample size of the NC study. However, based on the evidence put forward in that study, and adopting the precautionary principle, it is considered that the conclusions reached in this report in relation to the potential shading impacts of the proposed River Corrib Bridge are reasonable.

with a reduced significance. Complete loss of vegetation was noted at a single bridge with a HW ratio of 0.28.

The proposed road development has a HW ratio of between 0.52 and 0.69 where it crosses Lough Corrib cSAC at the River Corrib (height of between 13 and 15m and deck width of between approximately 21 m to 25m).

Placing an elevated bridge structure over grassland habitat would also result in drying out of the area due to a reduction in direct precipitation; this would also be expected to affect vegetation growth and influence species composition.

A shading analysis study has been carried out to model how the proposed road development will affect ambient light levels in the vicinity of Lough Corrib cSAC – this report is presented in **Appendix M**. A series of computer simulations have been carried out in order to calculate the effect of the proposed road development on solar exposure for adjacent lands within Lough Corrib cSAC.

The computer simulations are based on a 3d design of the proposed road development. The sunlight exposure is calculated by ray racing and the software use is Radiance. Points on the ground can either receive or not direct sunlight. The cumulative number of hours that a point can see direct sunlight is used as the measure of solar exposure. Solar exposure has been calculated for equinoxes and solstices. The latitude and longitude used to determine the solar geometry are: 53.3°N and 9°W. The information is presented on a sample series of falsecolor diagrams in **Appendix M** that show the distribution of solar exposure on the ground for each of these locations. The colour scale indicates the number of hours that sunlight is received at a given point, throughout the day considered. It is also possible to trace the effect of shadowing throughout the year from this sequence of sketches.

The results of the shading study carried out found that there would be a significant reduction in ambient light levels during the summer months; reduced from >12 to an equivalent of <4 hours of sunlight (see Figures 10, 11, 12 and 14 in **Appendix M**). This would indicate that there will certainly be some level of effect on the vegetation composition as a result of shading. However, in the summer period background light levels are reached within 20m of the River Corrib Bridge (Figure 14 of **Appendix M**). No shading effect are predicted to be associated with the adjoining embankment section and the western end of the Menlough Viaduct from Ch. 9+500 to Ch. 10+150.

The habitats within Lough Corrib cSAC that are affected by shading from the proposed road development are not QI habitats and nor do they provide a supporting role to any other QI habitats within Lough Corrib cSAC. The shading effects predicted will be minor and localised and will not have any direct or indirect impact upon the conservation objectives supporting the QI species (Otter, Atlantic salmon, Brook lamprey and Sea lamprey); i.e. would not compromise any habitat used by these species within Lough Corrib cSAC.

Therefore, any habitat degradation that may occur as a result of shading will not affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats or species of Lough Corrib cSAC (see **Table 9.16**).

Summary

A summary of the potential shading impacts associated with the proposed road development are presented in **Table 9.12** below.

Table 9.12: Summary of Shading Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Construction/Operation		
A reduction in sunlight and direct precipitation affecting the vegetation composition and structure of habitats within Lough Corrib cSAC beneath or adjacent to elevated structures/embankment: River Corrib Bridge Embankment from Ch. 9+850 to Ch. 10+100	No, As the shading study demonstrates that there are no areas of QI habitat, or habitat areas supporting QI habitat or species, that will be affected by shading from the proposed road development	No

9.1.4.7 Habitat degradation – non-native invasive species

Non-native invasive plant species have been recorded along, or in close proximity to the proposed road development[41] (see **Section 5.5**). Therefore, construction works have the potential to accidentally cause their introduction/spread to habitat areas within Lough Corrib cSAC. This has the potential to have long-term effects on plant species composition, diversity and abundance in affected habitats.

Given the presence of non-native invasive plant species cover in the immediate vicinity of the proposed road development, there is the potential that these species will recolonize vegetated areas within the proposed development boundary post-construction. As such, there is also a risk that routine maintenance works may inadvertently spread contaminated vegetation cuttings.

Summary

Introducing or spreading non-native invasive plant species to Lough Corrib cSAC, during construction or operation, has the potential to affect the conservation objective attributes and targets supporting the conservation condition of its QI habitats (see **Table 9.16**).

A summary of the potential direct and indirect impacts associated with non-native invasive plant species is presented in **Table 9.13** below.

[41] Non-native invasive aquatic plant species (or fauna species) were not recorded in aquatic habitats impacted by construction works.

Table 9.13: Summary of Non-native Invasive Species Impacts

Potential Direct and Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Construction/Operation		
Introducing or spreading non-native invasive species to habitats within Lough Corrib cSAC	Yes Introducing/spreading non-native invasive plant species could affect the distribution, extent, diversity and area of QI habitats or habitat areas supporting QI species	Yes To ensure that non-native invasive plant species are not spread within, or introduced to, habitat areas within Lough Corrib cSAC (as outlined in **Section 10.7**)

9.1.4.8 Mortality risk

During construction of the proposed River Corrib Bridge, there is a risk of construction materials accidentally falling into the River Corrib and killing/injuring aquatic QI species of Lough Corrib cSAC – Otter, Atlantic salmon, Brook lamprey and Sea lamprey. It is extremely unlikely that any such event would occur in the first place, and would result in any of the above species being killed or injured. Even if such an event were to occur, it is also extremely unlikely to affect more than a small number of individuals. Therefore, it is unlikely to have any effect on the populations of these QI species. Nevertheless, mitigation is required to remove this risk (see **Section 10.10**, and **Appendix D**).

The introduction of a new bridge structure over the River Corrib increases the risk of road traffic collisions with Otter. Given that the proposed River Corrib Bridge is an elevated structure through the river valley for a significant distance on each river bank (c.450m to the west and c.90m to the east) the risk is greatly reduced, and removed entirely in the vicinity of the River Corrib itself. There are also a small number of drainage channels and a stream (close to Ch. 9+950) which could potentially bring Otter into close proximity with the proposed road development where it is on embankment, even though none of these are crossed by the proposed road development. There are sections of retaining wall in this area over 2m in height which will prevent Otter gaining access to the proposed road carriageway. There are however some sections of embankment which will require the installation of mammal fencing to prevent Otter gaining access to the proposed road carriageway (National Roads Authority, 2008b).

Summary

As there is a risk of construction works and road traffic during operation posing a mortality risk to aquatic QI species of Lough Corrib cSAC, the proposed road development has the potential to affect the conservation objective attributes and targets supporting the conservation condition of Otter, Atlantic salmon, Brook lamprey or Sea lamprey in Lough Corrib cSAC (see **Table 9.16**).

A summary of the potential impacts associated with the mortality risk posed by the proposed road development is presented in **Table 9.14** below.

Table 9.14: Summary of Mortality Risk Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Construction		
Accidentally dropping construction materials into the River Corrib during construction of the proposed River Corrib Bridge could result in the mortality of aquatic QI species: Otter Atlantic salmon Sea lamprey Brook lamprey	Yes Mortality of QI species could affect populations numbers – although given the low risk and temporary nature of works above the river, this is unlikely to result in any long-term population level effects	Yes To ensure that construction materials are contained within the works area (as outlined in **Section 10.10.1**)
Operation		
Mortality/road traffic collision risk to Otter	Yes Operation of the proposed road development present a permanent risk of Otter mortality due to road traffic collisions and could have long-term effects on the Otter population of Lough Corrib cSAC	Yes To ensure that Otter cannot gain access to the road carriageway (as outlined in **Section 12.10.2**)

9.1.4.9 Freshwater pearl mussel

There are no Freshwater pearl mussel populations within the ZoI of the proposed road development; the QI population in Lough Corrib cSAC is associated with the Owenriff River, c.23km to the north. The glochidial larval stage of the Freshwater pearl mussel's life-cycle relies upon salmonid fish as a host species. As a result, it is important to maintain a sufficient juvenile salmonid population to maintain the Freshwater pearl mussel population. Therefore, the proposed road development could affect the conservation objectives of this species in Lough Corrib cSAC if it were to affect salmonid fish species populations in the River Corrib catchment.

However, the proposed road development has the potential to affect the conservation condition of Atlantic salmon in Lough Corrib cSAC (and therefore, also the potential to affect any other salmonid fish populations in the catchment) via any of the potential impacts: habitat loss, habitat degradation affecting water quality, disturbance/displacement effects, barrier effect, or mortality risk. Therefore, the proposed road development has the potential to affect the conservation objective attributes and targets supporting the conservation condition of the Freshwater pearl mussel in Lough Corrib cSAC (see **Table 9.16**).

9.1.4.10 Summary

This section presents a summary of the potential impacts on the QIs of Lough Corrib cSAC as a result of the proposed road development and how these impacts relate to affecting the site's conservation objectives.

Table 9.15 below, lists the QIs of Lough Corrib cSAC and how the impacts discussed below relate to each. Those highlighted in green are those QIs which are present within the ZoI of the proposed road development.

Table 9.15: Qualifying Interests of Lough Corrib cSAC and Potential Impacts

Qualifying Interests	Impact
Annex I Habitats	
[3110] Oligotrophic waters containing very few minerals of sandy plains (*Littorelletalia uniflorae*)	No potential impact – not present within the ZoI
[3130] Oligotrophic to mesotrophic standing waters with vegetation of the *Littorelletea uniflorae* and/or of the *Isoëto-Nanojuncetea*	No potential impact – not present within the ZoI
[3140] Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp.	Habitat degradation – hydrogeology Habitat degradation – hydrology
[3260] Water courses of plain to montane levels with the *Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation	No potential impact – not present within the ZoI
[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites)	Habitat loss Habitat degradation – tunnelling/excavation Habitat degradation – air quality Habitat degradation – non-native invasive species
[6410] *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*)	Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – non-native invasive species
[7110] Active raised bogs *	No potential impact – not present within the ZoI
[7120] Degraded raised bogs still capable of natural regeneration	No potential impact – not present within the ZoI
[7150] Depressions on peat substrates of the *Rhynchosporion*	No potential impact – not present within the ZoI
[7210] Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* *	Habitat degradation – hydrogeology Habitat degradation – hydrology Habitat degradation – non-native invasive species
[7220] Petrifying springs with tufa formation (*Cratoneurion*) *	No potential impact – not present within the ZoI
[7230] Alkaline fens	Habitat degradation – hydrogeology Habitat degradation – hydrology

Qualifying Interests	Impact
	Habitat degradation – non-native invasive species
[8240] Limestone pavements *	Habitat loss Habitat degradation – tunnelling/excavation Habitat degradation – air quality Habitat degradation – non-native invasive species
[91A0] Old sessile oak woods with *Ilex* and *Blechnum* in the British Isles	No potential impact – not present within the ZoI
[91D0] Bog woodland *	No potential impact – not present within the ZoI
Annex II Species	
[1029] Freshwater Pearl Mussel - *Margaritifera margaritifera*	None recorded within watercourses affected by the proposed road development, however impacts to salmonid fish species could indirectly affect the Freshwater pearl mussel – see Atlantic salmon below for impacts
[1092] White-clawed Crayfish - *Austropotamobius pallipes*	No potential impact – not present within the ZoI
[1095] Sea Lamprey - *Petromyzon marinus*	Habitat degradation – hydrology Mortality risk
[1096] Brook Lamprey - *Lampetra planeri*	Habitat degradation – hydrology Mortality risk
[1106] Atlantic Salmon - *Salmo salar* (only in fresh water)	Habitat degradation – hydrology Mortality risk
[1303] Lesser Horseshoe Bat - *Rhinolophus hipposideros*	No potential impact – QI population not present within the ZoI (**Section 9.1.2.5**)
[1355] Otter - *Lutra lutra*	Habitat degradation – hydrology Mortality risk
[1393] Slender green feather-moss (Varnished hook-moss) - *Drepanocladus (Hamatocaulis) vernicosus*	No potential impact – not present within the ZoI
[1833] Slender naiad - *Najas flexilis*	No potential impact – not present within the ZoI

The relationship between, and potential influence of, these impacts with respect to the QI habitat and species within the ZoI of the proposed road development and the attributes/targets upon which their favourable conservation condition is considered and measured is considered further below and also presented in **Table 9.16**

[3140] Hard oligo - mesotrophic waters with benthic vegetation of Chara *spp.*

Affecting water quality in the Coolagh Lakes and/or affecting the functioning or quality of the existing hydrogeological regime during construction (even though the risk of any perceptible effect is low) could affect the Annex I status of the lake thereby reducing habitat area and the distribution of this habitat type within Lough Corrib cSAC. These impacts could also affect the type, abundance and distribution

of the typical species supported by the lakes, the vegetation composition and distribution, the area and condition of the fringing aquatic vegetation, lake substratum quality and water chemistry.

[6410]* Molinia *meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*), [7210] Calcareous fens with* Cladium mariscus *and species of the* Caricion davallianae * and *[7230] Alkaline fens

Affecting water quality in the receiving environment and/or affecting the functioning or quality of the existing hydrogeological regime could affect ecosystem functioning and the condition of areas of these habitat types such that their area and distribution is reduced within Lough Corrib cSAC. These impacts could also affect the vegetation composition and structure and the abundance and distribution of typical and locally distinctive species associated with QI habitats.

Introducing/spreading non-native invasive plant species could locally affect the extent, diversity, and vegetation composition or structure of habitats within Lough Corrib cSAC.

[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites)* and *[8240] Limestone pavements *

Construction of the Lackagh Tunnel could affect the structural integrity[42] of the rock mass supporting the habitats above within Lough Corrib cSAC, and result in damage to, or loss of, the QI Annex I habitats Limestone pavement and Calcareous grassland habitat area. With respect to these QI habitats and their conservation objectives, habitat loss could affect the habitat area of Calcareous grassland and Limestone pavement within Lough Corrib cSAC, and could also affect the distribution of these habitat types within the European site.

Within Lough Corrib cSAC there are areas of the QI habitats Limestone pavement [*8240] and Calcareous grassland [6210] that lie within the proposed development boundary yet outside of the footprint of the proposed road carriageway which could be directly impacted, if not protected from construction works. With respect to these QI habitats and their conservation objectives, habitat loss could affect the habitat area of Calcareous grassland and Limestone pavement within Lough Corrib cSAC, and could also affect the distribution of these habitat types within the European site.

Dust deposition arising from construction activities could locally affect the extent, diversity, and vegetation composition or structure of these habitats within Lough Corrib cSAC, where they are present in the vicinity of the proposed road development.

Introducing/spreading non-native invasive plant species could locally affect the extent, diversity, and vegetation composition or structure of these habitats within Lough Corrib cSAC.

[42] Structural Integrity of the mosaic of Limestone pavement and Calcareous grassland is the physical and mechanical geotechnical properties that control the behaviour of the geotechnical Limestone pavement environment

[1095] Sea Lamprey

Affecting water quality in the River Corrib catchment during construction (even though the risk of any perceptible effect is low) could affect the quality, extent and availability of any spawning or juvenile habitat present downstream of the proposed road development which could have a long-term effect on the European sites' Sea lamprey population. Constructing a bridge over the River Corrib poses a mortality risk to fish species beneath the structure which, in a worst case scenario, could also have a population level effect.

[1096] Brook Lamprey

Affecting water quality in the River Corrib catchment during construction (even though the risk of any perceptible effect is low) could affect the quality, extent and availability of any juvenile habitat present downstream of the proposed road development which could have a long-term effect on the European sites' Brook lamprey population. Constructing a bridge over the River Corrib poses a mortality risk to fish species beneath the structure which, in a worst case scenario, could also have a population level effect.

[1106] Atlantic Salmon

Affecting water quality in the River Corrib catchment during construction (even though the risk of any perceptible effect is low) could affect fish numbers, particularly so were the impact to occur during the adult/smolt migration periods, and could have a long-term effect on the European sites' Atlantic salmon population. Constructing a bridge over the River Corrib poses a mortality risk to fish species beneath the structure which, in a worst case scenario, could also have a population level effect.

[1029] Freshwater Pearl Mussel

As discussed above for Atlantic salmon, affecting water quality in the River Corrib catchment during construction (even though the risk of any perceptible effect is low) and/or the mortality risk associated with bridge construction works over the River Corrib, could affect salmonid fish numbers. This in turn could also affect recruitment in the Freshwater pearl mussel populations upstream as salmonid fish are a host species for the glochidial larval stage of the Freshwater pearl mussel's life cycle. Therefore, affecting salmonid fish numbers could have a long-term effect on the European sites' Freshwater pearl mussel population.

[1355] Otter

Reducing water quality in the River Corrib catchment during construction (even though the risk of any perceptible effect is low) could affect the quality and availability of breeding/resting sites downstream in Lough Corrib cSAC and affect fish numbers locally. This impact could have a long-term effect on the European sites' Otter population.

The mortality risk posed by the proposed road development could have a long term effect on Otter numbers and distribution within Lough Corrib cSAC. Constructing a bridge over the River Corrib poses a mortality risk to Otter beneath the structure which, in a worst case scenario, could also have a population level effect.

Table 9.16: Potential Impacts on the Conservation Objectives of Lough Corrib cSAC (Those rows highlighted in green are the attributes potentially affected by the proposed road development)

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
[3140] Hard oligo - mesotrophic waters with benthic vegetation of *Chara* spp. To restore the favourable conservation condition of Hard oligo-mesotrophic waters with benthic vegetation of *Chara* spp. in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area stable or increasing, subject to natural processes	Over the long-term, affecting surface water quality, groundwater quality or reducing groundwater supply to the Coolagh Lakes could affect the Annex I status of the lakes, affecting the area of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Habitat distribution: Occurrence	No decline, subject to natural processes.	Over the long-term, affecting surface water quality, groundwater quality or reducing groundwater supply to the Coolagh Lakes could affect the Annex I status of the lakes, affecting distribution of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Typical species: Occurrence	Typical species present, in good condition, and demonstrating typical abundances and distribution	Over the long-term, affecting surface water quality, groundwater quality or reducing groundwater supply to the Coolagh Lakes could affect the type, abundance and distribution of the typical species supported by the lakes	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation composition: characteristic zonation - Occurrence	All characteristic zones should be present, correctly distributed and in good condition	Over the long-term, affecting surface water quality, groundwater quality or reducing groundwater supply to the Coolagh Lakes could affect the vegetation zonation, distribution and condition associated with the lakes	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation distribution: maximum depth – Metres	No change to maximum depth of vegetation, subject to natural processes	Affecting groundwater supply to the Coolagh Lakes could reduce water levels and hence the depth and vegetation profiles	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Hydrological regime: water level fluctuations – Metres	Maintain appropriate natural hydrological regime necessary to support the habitat	Reducing groundwater supply to the Coolagh Lakes would affect the natural hydrogeological regime required to support the habitat in its current state	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Lake substratum quality: Various	Restore appropriate substratum type, extent and chemistry to support the vegetation	Affecting surface water quality or groundwater quality could affect substratum chemistry and quality Affecting groundwater supply could affect the depth profile of the lakes and hence the substratum extent – reducing lake substratum quality	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Water quality: transparency – Metres	Restore appropriate Secchi transparency. There should be no decline in Secchi depth/transparency	Affecting surface water quality, groundwater quality or reducing groundwater supply to the Coolagh Lakes would not directly affect water transparency values However, reducing groundwater supply could affect water levels and hence indirectly affect water transparency through increasing the concentrations of suspended solids/sediments in the water column	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Water quality: nutrients – µg/l P or mg/l N	Restore the concentration of nutrients in the water column to sufficiently low levels to support the habitat and its typical species	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes would not directly affect nutrient levels However, reducing groundwater supply could affect water levels and hence indirectly lead to increased concentrations of nutrients in the lakes	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Water quality: phytoplankton biomass – µg/l Chlorophyll a	Maintain appropriate water quality to support the habitat, including high chlorophyll *a* status	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes would not directly affect nutrient levels However, reducing groundwater supply could affect water levels and hence indirectly lead to increased concentrations of nutrients in the lakes	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Water quality: phytoplankton composition – EPA phytoplankton composition metric	Maintain appropriate water quality to support the habitat, including high phytoplankton composition status	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes would not directly affect nutrient levels However, reducing groundwater supply could affect water levels and hence indirectly lead to increased concentrations of nutrients in the lakes	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Water quality: attached algal biomass – Algal cover and EPA phytobenthos metric	Restore/maintain trace/absent attached algal biomass (<5% cover) and high phytobenthos status	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes would not directly affect nutrient levels However, reducing groundwater supply could affect water levels and hence indirectly lead to increased concentrations of nutrients in the lakes	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Water quality: macrophyte status – EPA macrophyte metric (The Free Index)	Restore high macrophyte status	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes would not directly affect nutrient levels However, reducing groundwater supply could affect water levels and hence indirectly lead to increased concentrations of nutrients in the lakes	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Acidification status: pH units, mg/l	Maintain appropriate water and sediment pH, alkalinity and cation concentrations to support the habitat, subject to natural processes	Affecting surface water quality, groundwater quality or reducing groundwater supply to the Coolagh Lakes would not directly affect nutrient levels However, reducing groundwater supply could affect water levels and hence indirectly lead to increased concentrations of nutrients in the lakes - eutrophication can lead to at least temporary increases in pH to toxic levels (>9/9.5)	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Water colour: mg/l PtCo	Restore/maintain appropriate water colour to support the habitat	No Affecting groundwater quality or groundwater supply to the Coolagh Lakes would not affect water colour in the Coolagh Lakes	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Dissolved organic carbon (DOC): mg/l	Restore/maintain appropriate organic carbon levels to support the habitat	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes would not directly affect nutrient levels However, reducing groundwater supply could affect water levels and hence indirectly lead to increased DOC concentrations in the lakes	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Turbidity: nephelometric turbidity units/ mg/l SS/ other appropriate unit	Restore/maintain appropriate turbidity to support the habitat	No Affecting groundwater quality or groundwater supply to the Coolagh Lakes would not affect turbidity levels in the Coolagh Lakes	No
Fringing habitat: area and condition – Hectares	Maintain the area and condition of fringing habitats necessary to support the natural structure and functioning of habitat 3140	Over the long-term, affecting surface water quality, groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce the area and condition of fringing habitats	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
[6210] Semi - natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) To maintain the favourable conservation condition of Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) in Lough Corrib cSAC in owing list of attributes and targets:			
Habitat area: Hectares	Area stable or increasing, subject to natural processes	There are areas of Calcareous grassland [6210] in Lough Corrib cSAC that lie within the proposed development boundary yet are not directly beneath the footprint of the proposed road development. Construction works could result in the loss of areas of Calcareous grassland habitat. Restricting grazing from calcareous grassland habitat above the proposed Lackagh Tunnel could result in habitat area loss through scrub encroachment. The proposed Lackagh Tunnel has been designed to avoid any impacts to the structural integrity of the rock mass support to Limestone pavement and Calcareous grasslands habitat above it in Lough Corrib cSAC – however the tunnel must be constructed as detailed in Appendix F for impacts to be avoided. Dust emissions during construction could result in the loss of Calcareous grassland habitat within Lough Corrib cSAC, and a reduction in habitat distribution locally, where present adjacent to the construction works between Ch. 9+850 to Ch. 10+100. Introducing/spreading non-native invasive plant species to Lough Corrib cSAC could result in the loss of areas of Calcareous grassland habitat and potentially affect habitat distribution	Retain areas of QI Annex I habitat within Lough Corrib cSAC and within the proposed development boundary, and avoid vegetation change or scrub encroachment by not restricting grazing access. **Section 10.1** (and **Figures 15.1** to **15.5**) Monitoring that sufficient rock stability measures are installed to protect structural integrity of the rock mass **Section 10.2** Measures to contain dust emissions during construction **Section 10.5** Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Habitat distribution: Occurrence	No decline, subject to natural processes.	*As above for habitat area*	*As above for habitat area*
Vegetation composition: typical species – Number at a representative number of monitoring stops	At least 7 positive indicator species present, including 2 "high quality" species	The potential impacts associated with the proposed Lackagh Tunnel, dust emissions and introducing/spreading non-native invasive plant species could affect the number of positive indicator species recorded locally within Limestone pavement and Calcareous grasslands habitat areas adjacent to the proposed road development (as above under *Habitat area*). Restricting grazing from Calcareous grassland habitat above the proposed Lackagh Tunnel could affect the vegetation composition and result in scrub encroachment.	*As above for habitat area*
Vegetation composition: negative indicator species – Percentage at a representative number of monitoring stops	Negative indicator species collectively not more than 20% cover, with cover by an individual species not more than 10%.	No The proposed road development will not directly affect Calcareous grassland habitat within Lough Corrib cSAC and therefore, will not affect negative indicator species cover on Calcareous grassland habitat (non-native species as per O'Neill et al., 2013)	No
Vegetation composition: non-native species – Percentage at a representative number of monitoring stops	Cover of non-native species not more than 1%	Introducing or spreading non-native invasive plant species to habitat areas within Lough Corrib cSAC would have the potential to negatively affect Calcareous grassland habitat areas in terms of vegetation composition	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation structure: woody species and bracken (*Pteridium aquilinum*) – Percentage at a representative number of monitoring stops	Cover of woody species (except *Juniperus communis*, *Rosa spinosissima*, *Dryas octopetala* and *Helianthemum oelandicum*) and bracken (*Pteridium aquilinum*) not more than 5% cover	Although, the proposed road development will not directly affect Calcareous grassland habitat within Lough Corrib cSAC, restricting grazing from calcareous grassland habitat above the proposed Lackagh Tunnel could affect the vegetation structure and result in scrub encroachment.	Retain areas of QI Annex I habitat within Lough Corrib cSAC and within the proposed development boundary, and avoid vegetation change or scrub encroachment by not restricting grazing access **Section 10.1** (and **Figures 15.1** to **15.5**)
Vegetation composition: broadleaf herb: grass ratio – Percentage at a representative number of monitoring stops	Broadleaf herb component of vegetation between 40 and 90%	Restricting grazing from calcareous grassland habitat above the proposed Lackagh Tunnel could affect the vegetation composition and result in scrub encroachment. The impacts associated with dust emissions and introducing/spreading non-native invasive plant species could affect the broadleaved herb to grass ratio of Calcareous grassland habitat areas adjacent to the proposed road development (as above under *Habitat area*).	Retain areas of QI Annex I habitat within Lough Corrib cSAC and within the proposed development boundary, and avoid vegetation change or scrub encroachment by not restricting grazing access. **Section 10.1** (and **Figures 15.1** to **15.5)** Measures to contain dust emissions during construction **Section 10.5** Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Vegetation structure: sward height – Percentage at a representative number of monitoring stops	At least 30% of sward between 5cm and 40cm tall	Restricting grazing from calcareous grassland habitat above the proposed Lackagh Tunnel could affect the vegetation composition and result in scrub encroachment. Introducing/spreading non-native invasive plant species to Lough Corrib cSAC could affect the percentage of Calcareous grassland habitat at a suitable sward height.	Retain areas of QI Annex I habitat within Lough Corrib cSAC and within the proposed development boundary, and avoid vegetation change or scrub encroachment by not restricting grazing access. **Section 10.1** (and **Figures 15.1** to **15.5**) Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation structure: litter – Percentage at a representative number of monitoring stops	Litter cover not more than 25%	No The proposed road development will not directly affect Calcareous grassland habitat within Lough Corrib cSAC and therefore, will not increase litter cover in Calcareous grassland habitat in Lough Corrib cSAC	No
Physical structure: bare soil – Percentage at a representative number of monitoring stops	Not more than 10% bare soil	No The proposed road development will not contribute to physical disturbance levels leading to any increase in bare ground in Calcareous grassland habitats in Lough Corrib cSAC	No
Physical structure: disturbance Square metres	Area showing signs of serious grazing or other disturbance less than 20m²	No The proposed road development will not contribute to, or affect physical disturbance or increase grazing levels in Calcareous grassland habitats in Lough Corrib cSAC	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
[6410] *Molinia* meadows on calcareous, peaty or clayey-silt laden soils (*Molinion caeruleae*) To maintain the favourable conservation condition of *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area stable or increasing, subject to natural processes	Over the long-term, reducing surface water quality or groundwater supply/quality to the Coolagh Lakes could reduce the area of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Habitat distribution: Occurrence	No decline, subject to natural processes	Over the long-term, reducing surface water quality or reducing groundwater supply to the Coolagh Lakes could reduce the area (and hence distribution) of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation composition: typical species – Number at a representative number of monitoring stops	At least seven positive indicator species present, including one "high quality" species as listed in O'Neill et al. (2013)	Over the long-term, reducing surface water quality or reducing groundwater supply to the Coolagh Lakes could result in drying out of this habitat type here (and hence affect the species composition)	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation composition: negative indicator species – Percentage at a representative number of monitoring stops	Negative indicator species collectively not more than 20% cover, with cover by an individual species not more than 10%	No The proposed road development will not directly affect *Molinia* meadow habitat within Lough Corrib cSAC and therefore, will not affect negative indicator species cover on *Molinia* meadow habitat (non-native species as per O'Neill et al., 2013)	No
Vegetation composition: non-native species – Percentage at a representative number of monitoring stops	Non-native species cover not more than 1%	The proposed road development will not directly affect *Molinia* meadow habitat within Lough Corrib cSAC and therefore, will not affect negative indicator species cover on Molinia meadow habitat (non-native species as per O'Neill et al., 2013) However, non-native invasive plant species could also be considered separate to that list – and could have the potential to negatively affect *Molinia* meadow habitat areas	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Vegetation composition: moss species –representative number of monitoring stops	Hair mosses (*Polytrichum* spp.) not more than 25% cover	Over the long-term, reducing surface water quality or reducing groundwater supply to the Coolagh Lakes could result in drying out of this habitat type here (and hence affect the species composition and moss cover)	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation structure: woody species and bracken – Percentage at a representative number of monitoring stops	Cover of woody species and bracken (*Pteridium aquilinum*) not more than 5% cover	No The proposed road development will not directly affect *Molinia* meadow habitat within Lough Corrib cSAC and therefore, will not increase woody species or bracken cover in *Molinia* meadow habitat in Lough Corrib cSAC	No
Vegetation structure: broadleaf herb: grass ratio – Percentage at a representative number of monitoring stops	Broadleaf herb component of vegetation between 40 and 90%	Over the long-term, reducing surface water quality or reducing groundwater supply to the Coolagh Lakes could result in drying out of this habitat type here (and hence affect the vegetation structure)	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation structure: sward height – Percentage at a representative number of monitoring stops	At least 30% of sward between 10cm and 80cm tall	Over the long-term, reducing surface water quality or reducing groundwater supply to the Coolagh Lakes could result in drying out of this habitat type here (and hence affect the vegetation structure)	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation structure: litter – Percentage at a representative number of monitoring stops	Litter cover not more than 25%	No The proposed road development will not directly affect Calcareous grassland habitat within Lough Corrib cSAC and therefore, will not increase litter cover in Calcareous grassland habitat in Lough Corrib cSAC	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Physical structure: bare soil – Percentage at a representative number of monitoring stops	Not more than 10% bare soil	No The proposed road development will not contribute to physical disturbance levels leading to any increase in bare ground in *Molinia* meadow habitats in Lough Corrib cSAC	No
Physical structure: disturbance – Square metres	Area showing signs of serious grazing or other disturbance less than 20m²	No The proposed road development will not contribute to, or affect, physical disturbance or increase grazing levels in Calcareous grassland habitats in Lough Corrib cSAC	No
[*7210] Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* To maintain the favourable conservation condition of Calcareous fens with *Cladium mariscus* and species of the Caricion davallianae in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area stable or increasing, subject to natural processes	Over the long-term, reducing surface water quality in the River Corrib or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce the area of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Habitat distribution: Occurrence	No decline, subject to natural processes.	Over the long-term, reducing surface water quality in the River Corrib or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce the area (and hence distribution) of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Ecosystem function: hydrology – Metres	Maintain appropriate natural hydrological regimes necessary to support the natural structure and functioning of the habitat	Reducing groundwater supply to the Coolagh Lakes would affect the natural hydrogeological regime supporting any associated fen habitat	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Ecosystem function: peat formation – Flood duration	Maintain active peat formation, where appropriate	Reducing groundwater supply to the Coolagh Lakes could affect the duration of flooding and areas where there is active peat formation	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Ecosystem function: water quality – Water chemistry measures	Maintain appropriate water quality, particularly nutrient levels, to support the natural structure and functioning of the habitat	Over the long-term, reducing groundwater supply to the Coolagh Lakes could reduce water levels and affect background nutrient concentrations	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Vegetation structure: typical species – Presence	Maintain vegetation cover of typical species including brown mosses and vascular plants	Reducing surface water quality in the River Corrib or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce or result in the loss of typical species from areas of this habitat type (at least locally) in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation composition: non-native species – Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Introducing or spreading non-native invasive plant species to habitat areas within Lough Corrib cSAC could have the potential to negatively affect fen habitat areas in terms of vegetation composition	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation composition: trees and shrubs – Percentage cover in local vicinity of a representative number of monitoring stops	Cover of scattered native trees and shrubs not more than 10%	Reducing groundwater supply to the Coolagh Lakes would affect the natural hydrogeological regime which could result in the drying out of fen habitat, potentially leading to increases in tree/shrub cover	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Physical structure: disturbed bare ground – Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground not more than 10%. Where tufa is present, disturbed bare ground not more than 1%	No The proposed road development will not contribute to physical disturbance levels leading to any increase in bare ground in fen habitats in Lough Corrib cSAC	No
Physical structure: drainage – Percentage area in local vicinity of a representative number of monitoring stops	Areas showing signs of drainage as a result of drainage ditches or heavy trampling not more than 10%	No The proposed road development will not contribute to the installation of artificial drainage nor will it lead to any increase in the trampling of fen habitat in Lough Corrib cSAC	No
Indicators of local distinctiveness: Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat. This includes species on the Flora (Protection) Order, 2015 and/or the red data lists	Over the long-term, reducing surface water quality in the River Corrib or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could affect population sizes and/or the distribution of rare, threatened or scarce species associated with fen habitat in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
[7230] Alkaline fens To maintain the favourable conservation condition of Alkaline fens in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area stable or increasing, subject to natural processes	Over the long-term, reducing surface water quality or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce the area of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Habitat distribution: Occurrence	No decline, subject to natural processes	Over the long-term, reducing surface water quality or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce the area (and hence distribution) of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Ecosystem function: soil nutrients– Soil pH and appropriate nutrient levels at a representative number of monitoring stops	Maintain soil nutrient status within natural range	No The proposed road development will not directly impact upon any fen habitat areas in Lough Corrib cSAC and will not contribute to soil nutrient levels.	No
Ecosystem function: peat formation – Flood duration	Maintain active peat formation, where appropriate	Reducing groundwater supply to the Coolagh Lakes could affect the duration of flooding and areas where there is active peat formation	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Ecosystem function: hydrology – Metres	Maintain appropriate natural hydrological regime necessary to support the natural structure and functioning of the habitat	Reducing groundwater supply to the Coolagh Lakes would affect the natural hydrogeological/hydrological regime supporting any associated fen habitat	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Ecosystem function: water quality – Water chemistry measures	Maintain appropriate water quality, particularly nutrient levels, to support the natural structure and functioning of the habitat	Over the long-term, reducing surface water quality or reducing groundwater supply to the Coolagh Lakes could reduce water levels and affect background nutrient concentrations	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Community diversity: Abundance of variety of vegetation communities	Maintain variety of vegetation communities, subject to natural processes	Over the long-term, reducing surface water quality or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce the community diversity of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation composition: number of positive indicator species (brown mosses) – Number of species at a representative number of 2m x 2m monitoring stops	Number of brown moss species present at each monitoring stop is at least one	Over the long-term, reducing surface water quality or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce the number of brown moss species associated with affected areas of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation composition: number of positive indicator species (vascular plants) – Number of species at a representative number of 2m x 2m monitoring stops	Number of positive vascular plant indicator species present at each monitoring stop is at least two for small-sedge flushes and at least three for black bog-rush (*Schoenus nigricans*) flush and bottle sedge (*Carex rostrata*) fen	Over the long-term, reducing surface water quality or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could reduce the number of positive indicator species associated with affected areas of this habitat type in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation composition: negative indicator species – Percentage cover at a representative number of 2m x 2m monitoring stops	Total cover of negative indicator species less than 1%	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could result in drying out of fen habitat affording opportunities for negative indicator species to spread or colonise affected fen areas.	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Vegetation composition: non-native species – Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of non-native species less than 1%	Introducing or spreading non-native invasive plant species to habitat areas within Lough Corrib cSAC would have the potential to negatively affect fen habitat areas in terms of vegetation composition	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Vegetation composition: native trees and shrubs – Percentage cover in local vicinity of a representative number of monitoring stop	Cover of scattered native trees and shrubs less than 10%	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could result in drying out of fen habitat affording opportunities for tree/shrub species to spread or colonise affected fen areas.	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation composition: soft rush and common reed cover – Percentage cover in local vicinity of a representative number of monitoring stops	Total cover of soft rush (*Juncus effusus*) and common reed (*Phragmites australis*) less than 10%	Affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could result in drying out of fen habitat affording opportunities for soft rush to spread or colonise affected fen areas.	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3**
Vegetation structure: height – Percentage of leaves/shoots at a representative number of 2m x 2m monitoring stops	Proportion of live leaves and/or flowering shoots of vascular plants that are more than 5cm above the ground surface should be at least 50%	No As the proposed road development is remote from fen habitats in Lough Corrib cSAC it cannot influence vegetation height (the principle cause of vegetation height impacts is grazing)	No
Physical structure: disturbed bare ground – Percentage cover at, and in local vicinity of, a representative number of 2m x 2m monitoring stops	Cover of disturbed bare ground less than 10%.	No The proposed road development will not contribute to physical disturbance levels leading to any increase in bare ground in fen habitats in Lough Corrib cSAC	No
Physical structure: drainage – Percentage area in local vicinity of a representative number of monitoring stops	Areas showing signs of drainage as a result of drainage ditches or heavy trampling less than 10%	No The proposed road development will not contribute to the installation of artificial drainage nor will it lead to any increase in the trampling of fen habitat in Lough Corrib cSAC	No
Physical structure: tufa formations – Percentage cover in local vicinity of a representative number of 2m x 2m monitoring stops	Disturbed proportion of vegetation cover where tufa is present is less than 1%	No The proposed road development will not contribute to physical disturbance levels affecting tufa formations in fen habitats in Lough Corrib cSAC	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Indicators of local distinctiveness –Occurrence and population size	No decline in distribution or population sizes of rare, threatened or scarce species associated with the habitat. This includes species on the Flora (Protection) Order, 2015 and/or the red data lists	Over the long-term, reducing surface water quality or affecting groundwater quality or reducing groundwater supply to the Coolagh Lakes could affect population sizes and/or the distribution of rare, threatened or scarce species associated with fen habitat in Lough Corrib cSAC	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
[8240] Limestone pavements * To maintain the favourable conservation condition of Limestone pavements* in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Habitat area: Hectares	Area stable or increasing, subject to natural processes.	There are areas of Limestone pavement [*8240] in Lough Corrib cSAC that lie within the proposed development boundary yet are not directly beneath the footprint of the proposed road development. Construction works could result in the loss of areas of Limestone pavement habitat. Restricting grazing from exposed Limestone pavement habitat above the proposed Lackagh Tunnel could result in habitat area loss through scrub encroachment. The proposed Lackagh Tunnel has been designed to avoid any impacts to the structural integrity of the rock mass support to Limestone pavement habitat above it in Lough Corrib cSAC – however the tunnel must be constructed as detailed in Appendix F for impacts to be avoided. Dust emissions during construction could result in the loss of Limestone pavement habitat within Lough Corrib cSAC, and a reduction in habitat distribution locally, where present adjacent to the construction works between Ch. 9+850 to Ch. 10+100 Introducing/spreading non-native invasive plant species to Lough Corrib cSAC could result in the loss of areas of Limestone pavement habitat and potentially affect habitat distribution	Retain areas of QI Annex I habitat within Lough Corrib cSAC and within the proposed development boundary, and avoid vegetation change or scrub encroachment by not restricting grazing access. **Section 10.1** (and **Figures 15.**1 to **15.5**) Monitoring that sufficient rock stability measures are installed to protect structural integrity of the rock mass **Section 10.2** Measures to contain dust emissions during construction **Section 10.5** Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Habitat distribution: Occurrence	No decline, subject to natural processes	*As above for habitat area*	*As above for habitat area*

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation composition: typical species – Number at a representative number of monitoring stops	At least seven positive indicator species present	The impacts associated with the proposed Lackagh Tunnel, dust emissions and introducing/spreading non-native invasive plant species could affect the number of positive indicator species recorded locally within Limestone pavement habitat areas adjacent to the proposed road development (as above under *Habitat area*)	*As above for habitat area*
Vegetation composition: bryophyte layer – Percentage at a representative number of monitoring stops	Bryophyte cover at least 50% on wooded pavement	Dust emissions during construction or introducing/spreading non-native invasive plant species could reduce bryophyte cover on wooded Limestone pavement habitat within Lough Corrib cSAC, where present adjacent to the construction works between Ch. 9+850 to Ch. 0+100	Measures to contain dust emissions during construction **Section 10.5** Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Vegetation composition: negative indicator species – Percentage at a representative number of monitoring stops	Collective cover of negative indicator species on exposed pavement not more than 1%	The proposed road development will not directly affect Limestone pavement habitat within Lough Corrib cSAC and therefore, will not affect negative indicator species cover on limestone pavement habitat (non-native species as per Wilson & Fernandez, 2013) However, non-native invasive plant species could also be considered separate to that list – and would have the potential to negatively affect Limestone pavement habitat areas	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation composition: negative indicator species – Percentage at a representative number of monitoring stops	Collective cover of negative indicator species on exposed pavement not more than 1%	No The proposed road development will not directly affect Calcareous grassland habitat within Lough Corrib cSAC and therefore, will not affect negative indicator species cover on Calcareous grassland habitat (non-native species as per O'Neill et al., 2013)	No
Vegetation composition: non-native species – Percentage at a representative number of monitoring stops	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 development will not directly affect Limestone pavement habitat within Lough Corrib cSAC and therefore, will not affect non-native species cover on limestone pavement habitat (non-native species as per Wilson & Fernandez, 2013) However, non-native invasive plant species could also be considered separate to that list – and would have the potential to negatively affect Limestone pavement habitat areas	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Vegetation composition: scrub – Percentage at a representative number of monitoring stops	Scrub cover no more than 25% of exposed pavement	Restricting grazing from Limestone pavement habitat above the proposed Lackagh Tunnel could affect the vegetation composition and result in scrub encroachment.	Retain areas of QI Annex I habitat within Lough Corrib cSAC and within the proposed development boundary, and avoid vegetation change or scrub encroachment by not restricting grazing access. **Section 10.1** (and **Figures 15.1** to **15.5**)
Vegetation composition: bracken cover – Percentage at a representative number of monitoring stops	Bracken (*Pteridium aquilinum*) cover no more than 10% on exposed pavement	Restricting grazing from Limestone pavement habitat above the proposed Lackagh Tunnel could affect the vegetation composition and result in bracken encroachment.	Retain areas of QI Annex I habitat within Lough Corrib cSAC and within the proposed development boundary, and avoid vegetation change or scrub encroachment by not restricting grazing access. **Section 10.1** (and **Figures 15.1** to **15.5**)

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation structure: woodland canopy – Percentage at a representative number of monitoring stops	Canopy cover on wooded pavement at least 30%	No The proposed road development will not directly affect Limestone pavement habitat within Lough Corrib cSAC and therefore, will not affect woodland canopy cover on limestone pavement habitat	No
Vegetation structure: dead wood – Occurrence in a representative number of monitoring stops	Sufficient quantity of dead wood on wooded pavement to provide habitat for saproxylic organisms	No The proposed road development will not directly affect Limestone pavement habitat within Lough Corrib cSAC and therefore will not restrict the supply/presence of dead wood on limestone pavement habitat	No
Physical structure: disturbance – Occurrence in a representative number of monitoring stops	No evidence of grazing pressure on wooded pavement	No The proposed road development will not contribute to physical disturbance levels from increased grazing (or otherwise) to limestone pavement habitat in Lough Corrib cSAC	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Indicators of local distinctiveness: Occurrence	Indicators of local distinctiveness are maintained. This includes species on the Flora (Protection) Order, 2015 and/or the red data lists, and other rare or localised species, as well as archaeological and geological features, which often support distinctive species	No The proposed road development will not directly affect Limestone pavement habitat within Lough Corrib cSAC and there are no locally distinctive species within those areas of Limestone pavement habitat present within the proposed development boundary. The survey results on the wider area within Lough Corrib cSAC did not note any locally distinct areas of Limestone pavement (nor archaeological or geological features) that could potentially be affected by the proposed road development. Therefore this attribute/target will not be affected	No
[1029] Freshwater Pearl Mussel - *Margaritifera margaritifera* To restore the favourable conservation condition of Freshwater Pearl Mussel in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Distribution: Kilometres	Maintain at 9.1km. The conservation objective applies to the Owenriff freshwater pearl mussel population	No The QI population is more than 20km upstream of the proposed road development and therefore, it cannot affect the distribution of the species in the Owenriff River	No
Population size: Number of adult mussels	Restore Owenriff population to at least one million adult mussels	Although the proposed road development does not directly affect Freshwater pearl mussel populations in Lough Corrib cSAC, affecting host fish numbers could have knock-on-effects on Freshwater pearl mussel recruitment and the overall population	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4** Measures to prevent construction materials entering the River Corrib during bridge construction **Section 10.10.1**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Population structure: recruitment – Percentage per size class	Restore to at least 20% of population no more than 65mm in length; and at least 5% of population no more than 30mm in length	Although the proposed road development does not directly affect Freshwater pearl mussel populations in Lough Corrib cSAC, affecting host fish numbers could have knock-on-effects on Freshwater pearl mussel recruitment and the overall population	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4** Measures to prevent construction materials entering the River Corrib during bridge construction **Section 10.10.1**
Population structure: adult mortality – Percentage	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	No The QI population is more than 20km upstream of the proposed road development and therefore, it cannot affect adult mortality rates in the Owenriff River	No
Suitable habitat extent – Kilometres	Restore suitable habitat in more than 8.3km in the Owenriff and Glenawbeg rivers and any additional stretches necessary for salmonid spawning	No The Owenriff River is more than 20km upstream of the proposed road development and therefore, it cannot affect habitat extent	No
Suitable habitat: condition – Kilometres	Restore condition of suitable habitat	No The Owenriff River is more than 20km upstream of the proposed road development and therefore, it cannot affect habitat condition	No
Water quality: macroinvertebrate and phytobenthos (diatoms) – Ecological Quality Ratio (EQR)	Restore water quality - macroinvertebrates: EQR greater than 0.90 (Q4-5 or Q5); phytobenthos: EQR greater than 0.93	No The Owenriff River is more than 20km upstream of the proposed road development and therefore, it cannot affect water quality	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Substratum quality: filamentous algae (macroalgae), macrophytes (rooted higher plants) – Percentage	Restore substratum quality - filamentous algae: absent or trace (<5%); macrophytes: absent or trace (<5%)	No The Owenriff River is more than 20km upstream of the proposed road development and therefore, it cannot affect substratum quality	No
Substratum quality: sediment – Occurrence	Restore substratum quality - stable cobble and gravel substrate with very little fine material; no artificially elevated levels of fine sediment	No The Owenriff River is more than 20km upstream of the proposed road development and therefore, it cannot affect substratum quality	No
Substratum quality: oxygen availability –Redox potential	Restore to no more than 20% decline from water column to 5cm depth in substrate	No The Owenriff River is more than 20km upstream of the proposed road development and therefore, it cannot affect oxygen levels/conditions	No
Hydrological regime: flow variability –Metres per second	Restore appropriate hydrological regimes	No The Owenriff River is more than 20km upstream of the proposed road development and therefore, it cannot affect the hydrological regime	No
Host fish: Number	Maintain sufficient juvenile salmonids to host glochidial larvae	As discussed below – under Atlantic salmon – the proposed road development has the potential to affect fish numbers in the River Corrib as a consequence of affecting water quality in the river	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4** Measures to prevent construction materials entering the River Corrib during bridge construction **Section 10.10.1**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Fringing habitat: area and condition – Hectares	Maintain the area and condition of fringing habitats necessary to support the population	No The Owenriff River is more than 20km upstream of the proposed road development and therefore, it cannot affect the associated fringing habitat	No
[1095] Sea Lamprey - *Petromyzon marinus* To restore the favourable conservation condition of Sea Lamprey in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Distribution: extent of anadromy – Percentage of river accessible	Greater than 75% of main stem length of rivers accessible from estuary	No The proposed road development has a clear span bridge design over the River Corrib and will not present a barrier to Sea lamprey accessing habitat in the River Corrib catchment/Lough Corrib cSAC	No
Population structure of juveniles: Number of age/size groups	At least three age/size groups present	Affecting water quality in the River Corrib could influence the quality, extend and availability of any juvenile habitat present downstream of the proposed road development, which may, at least locally, affect the population structure	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**
Juvenile density in fine sediment: Juveniles/m²	Mean catchment juvenile density at least 1/m²	Affecting water quality in the River Corrib could influence the quality, extend and availability of any juvenile habitat present downstream of the proposed road development and affect the density of juvenile lamprey present	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Extent and distribution of spawning habitat: m² and occurrence	No decline in extent and distribution of spawning beds	The success of Sea lamprey spawning activity below the Salmon Weir in Galway City is unknown (O'Connor, 2007). Affecting water quality in the River Corrib could influence the quality, extend and availability of any spawning habitat present downstream of the proposed road development	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**
Availability of juvenile habitat: Number of positive sites in 3rd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive, with a minimum of four positive sites in a catchment, which are at least 5km apart	Affecting water quality in the River Corrib could influence the quality, extent, usage and availability of any juvenile habitat present downstream of the proposed road development	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**
Mortality risk	Not defined in any existing conservation objectives document	Although unlikely to have a population level effect, construction materials falling into the River Corrib during bridge construction could result in fish mortality	Measures to prevent construction materials entering the River Corrib during bridge construction **Section 10.10.1**
[1096] Brook Lamprey - *Lampetra planeri* To maintain the favourable conservation condition of Brook Lamprey in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Distribution: Percentage of river accessible	Access to all water courses down to first order streams	No The proposed road development has a clear span bridge design over the River Corrib and will not present a barrier to Sea lamprey accessing habitat in the River Corrib catchment/Lough Corrib cSAC	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Population structure of juveniles: Number of age/size groups	At least three age/size groups of brook/river lamprey present	Affecting water quality in the River Corrib could influence the quality, extend and availability of any juvenile habitat present downstream of the proposed road development, which may, at least locally, affect the population structure	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**
Juvenile density in fine sediment: Ammocoetes/m²	Mean catchment juvenile density of brook/river lamprey at least 5/m²	Affecting water quality in the River Corrib could influence the quality, extend and availability of any juvenile habitat present downstream of the proposed road development and affect the density of juvenile lamprey present	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**
Extent and distribution of spawning habitat: m² and occurrence	No decline in extent and distribution of spawning beds	No Habitat downstream of the proposed road development is not suitable as Brook lamprey spawning habitat and therefore, is beyond the ZoI of construction or operation – i.e. slow, deep flow to the Salmon Weir and a relatively deep (>40cm) tidally influenced channel between it and Galway Bay	No
Availability of juvenile habitat: Number of positive sites in 2nd order channels (and greater), downstream of spawning areas	More than 50% of sample sites positive	Affecting water quality in the River Corrib could influence the quality, extend and availability of any juvenile habitat present downstream of the proposed road development and affect the density of juvenile lamprey present	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Mortality risk	Not defined in any existing conservation objectives document	Although unlikely to have a population level effect, construction materials falling into the River Corrib during bridge construction could result in fish mortality	Measures to prevent construction materials entering the River Corrib during bridge construction **Section 10.10.1**
[1106] Atlantic Salmon - *Salmo salar* (only in fresh water) To maintain the favourable conservation condition of Atlantic Salmon in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Distribution: extent of anadromy – Percentage of river accessible	100% of river channels down to second order accessible from estuary	No The proposed road development has a clear span bridge design over the River Corrib and will not present a barrier to Atlantic salmon accessing habitat in the River Corrib catchment/Lough Corrib cSAC	No
Adult spawning fish: Number	Conservation Limit (CL) for each system consistently exceeded	A reduction in water quality in the River Corrib could affect stocks of Atlantic salmon in the river, with an increased risk of a population level effect if a pollution event were to occur in conjunction with fish migrating upstream from the sea to spawning grounds Although unlikely to have a population level effect, construction materials falling into the River Corrib during bridge construction could result in fish mortality	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4** Measures to prevent construction materials entering the River Corrib during bridge construction **Section 10.10.1**
Salmon fry abundance: Number of fry/5 minutes electrofishing	Maintain or exceed 0+ fry mean catchment - wide abundance threshold value. Currently set at 17 salmon fry/5 min sampling	No With spawning areas and nursery habitat for fry (shallow, fast flowing riffle habitat) upstream of the proposed road development, the proposed road development will not affect salmon fry abundance in the catchment	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Out - migrating smolt abundance: Number	No significant decline	A reduction in water quality in the River Corrib could affect numbers of out-migrating smolt in the river, with an increased risk of a population level effect if a pollution event were to occur in conjunction with fish migrating downstream to the sea Although unlikely to have a population level effect, construction materials falling into the River Corrib during bridge construction could result in fish mortality	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4** Measures to prevent construction materials entering the River Corrib during bridge construction **Section 10.10.1**
Number and distribution of redds: Number and occurrence	No decline in number and distribution of spawning redds due to anthropogenic causes	No There is no Atlantic salmon spawning habitat downstream of the proposed road development and therefore, it cannot affect the number and distribution of redds	No
Water quality: EPA Q value	At least Q4 at all sites sampled by EPA	The proposed road development has the potential to reduce water quality in the River Corrib at EPA sampling points downstream	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
[1355] Otter *Lutra lutra* To maintain the favourable conservation condition of Otter in Lough Corrib cSAC, which is defined by the following list of attributes and targets:			
Distribution: Percentage positive survey sites	No significant decline	Disturbance or displacement of Otter during construction or operation will not affect the distribution of Otter along the River Corrib However, there is a mortality risk to Otter posed by road traffic. Although the potential or Otter to gain access to the road carriageway within Lough Corrib cSAC is limited (given the elevated bridge structure across the river valley) there is still the potential for the proposed road development to pose a permanent mortality risk to Otter, which could have long-term effects on the local population	Use of Otter resistant fencing to prevent Otter gaining access to the road carriageway **Section 10.10.2**
Extent of terrestrial habitat: Hectares	No significant decline. Area mapped and calculated as 1,054ha along river banks/lake shoreline/around ponds	No The proposed road development will not result in a significant decline in terrestrial Otter habitat Area of habitat that will be affected along the river banks and the at the N59 drainage outfall (S15) is c.67m^2 – an area that is insignificant in the context of the 1,054ha of Otter habitat mapped in Lough Corrib cSAC (i.e. 0.0007%)	No
Extent of freshwater (river) habitat: Kilometres	No significant decline. Length mapped and calculated as 314.2km	No The proposed road development will not reduce the extent of river habitat in Lough Corrib cSAC	No
Extent of freshwater (lake) habitat: Hectares	No significant decline. Area mapped and calculated as 4,178ha	No The proposed road development will not reduce the extent of lake habitat in Lough Corrib cSAC	No

Attributes and measures	Target	Potential Impacts Requiring Mitigation?	Are mitigation measures required?
Couching sites and holts: Number	No significant decline	The proposed road development affecting water quality in the River Corrib during construction could (at least temporarily) affect usage of holt/couch sites available for Otter in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Fish biomass available: Kilograms	No significant decline	As discussed above under Atlantic salmon, the potential for the proposed road development to affect water quality and to result in the mortality of fish species during bridge construction, has the potential to affect fish numbers in the River Corrib	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4** Measures to prevent construction materials entering the River Corrib during bridge construction **Section 10.10.1**
Barriers to connectivity: Number	No significant increase	No The proposed road development has a clear span bridge design over the River Corrib and will not present a barrier to Otter movement along the River Corrib corridor	No
Mortality risk posed by road traffic	Not defined in any existing conservation objectives document	Although the potential or Otter to gain access to the road carriageway within Lough Corrib cSAC is limited (given the elevated bridge structure across the river valley) there is still the potential for the proposed road development to pose a permanent mortality risk to Otter, which could have long-term effects on the local population	Use of Otter resistant fencing to prevent Otter gaining access to the road carriageway **Section 10.10.2**

9.2 Galway Bay Complex cSAC

9.2.1 Qualifying Interests and Conservation Objectives of Galway Bay Complex cSAC

The QI habitats and species of Galway Bay Complex cSAC, and the overall conservation objective for each, are listed below in **Table 9.17** The proposed road development does not traverse the Galway Bay Complex cSAC and the pathway for potential impacts between the proposed road development and this cSAC are hydrological. Those highlighted (in green) are the QIs which have been recorded within Galway Bay Complex cSAC[43] and within the hydrological ZoI of the proposed road development. None of the other QIs, as they are terrestrial habitats, are at risk of hydrological impacts from the proposed road development.

Table 9.17: Qualifying Interests and Conservation Objectives of Galway Bay Complex cSAC[44]

Qualifying Interests	Conservation Objective
Annex I Habitats	
[1140] Mudflats and sandflats not covered by seawater at low tide	To maintain the favourable conservation condition
[1150] Coastal lagoons*	To restore the favourable conservation condition
[1160] Large shallow inlets and bays	To maintain the favourable conservation condition
[1170] Reefs	To maintain the favourable conservation condition
[1220] Perennial vegetation of stony banks	To maintain the favourable conservation condition
[1310] *Salicornia* and other annuals colonising mud and sand	To maintain the favourable conservation condition
[1330] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	To restore the favourable conservation condition
[1410] Mediterranean salt meadows (*Juncetalia maritimi*)	To restore the favourable conservation condition
[3180] Turloughs *	To maintain the favourable conservation condition
[5130] *Juniperus communis* formations on heaths or calcareous grasslands	To restore the favourable conservation condition
[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites)	To maintain the favourable conservation condition

[43] As presented in the conservation objectives (and supporting) documents from the NPWS on-line database - https://www.npws.ie/protected-sites/sac/000268 <accessed January 2017>
[44] NPWS (2013e) *Conservation Objectives: Galway Bay Complex SAC 000268. Version 1*. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

Qualifying Interests	Conservation Objective
[7210] Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* *	To maintain the favourable conservation condition
[7230] Alkaline fens	To maintain the favourable conservation condition
Annex II Species	
[1355] Otter *Lutra lutra*	To restore the favourable conservation condition
[1365] Harbour seal *Phoca vitulina*	To maintain the favourable conservation condition

In conjunction with considering the generic conservation objective "To maintain or restore the favourable conservation condition of the Annex I habitat(s) and/or the Annex II species for which the SAC has been selected", the available site specific conservation objectives document for Galway Bay Complex cSAC (NPWS, 2013) also informed this assessment. This document sets out the attributes, measures and targets that define the favourable conservation condition of QI habitats and species within the European site. Affecting the conservation condition of QI habitats or species would constitute an adverse effect on the integrity of Galway Bay Complex cSAC.

The specific attributes and targets used to define the conservation objectives of the QI habitats and species within the ZoI of the proposed road development are presented in **Table 9.23** below.

9.2.2 Ecological Baseline

Galway Bay Complex cSAC is selected for a range of Annex I habitat types ranging from Limestone pavement [*8240] and Calcareous grassland [*6210] to coastal and marine Annex I habitat types (**Table 9.17**).

The proposed road development does not traverse the Galway Bay Complex cSAC and given the nature of the proposed road development and the potential impact pathways (see **Section 9.2.3** below), the description here is focussed on the downstream coastal and marine habitats, and the QI species they support, which are the QIs which fall within the zone of influence of the proposed road development. The descriptions are based upon the information presented in the conservation objectives for Galway Bay Complex cSAC, and the relevant supporting documents.

Galway Bay is classified as the Annex I habitat Large shallow inlets and bays [1160], associated with which are Reefs [1170], Tidal mudflats [1140], Lagoons [*1150], Salicornia mud [1310], Perennial vegetation of stony banks [1220] and Atlantic salt meadows [1330]. These habitats are also supported by a network of other habitat types including the freshwater rivers and streams that flow into the bay, the transitional waters of the estuary and terrestrial habitat along the coastline.

Rusheen Bay, to which some of the rivers/streams crossed by the proposed road development will drain (Bearna Stream catchment and the Knocknacarragh Stream), comprises a mosaic of most of these habitat types: Large shallow inlets

and bays [1160], associated with which are Reefs [1170], Tidal mudflats [1140], Perennial vegetation of stony banks [1220] and Atlantic salt meadows [1330].

The habitats within Galway Bay also support QI populations of Otter and Harbour seal.

9.2.3 Potential Direct and Indirect Impacts

As the proposed road development does not traverse Galway Bay Complex cSAC, none of the QI habitats or species will be directly impacted by the proposed road development and there is no risk of direct habitat loss or habitat fragmentation. Galway Bay Complex cSAC is also beyond the ZoI of any air quality effects from the proposed road development.

The unmitigated hydrogeological ZoI of the proposed road development (see **Figures 10.2.1** to **10.3.6** and also Figures 6.01 and 6.02 of the Hydrogeology Assessment Report in **Appendix A**) does not extend as far as Galway Bay Complex cSAC. Therefore, there is no potential for indirect impacts to groundwater dependant habitats within Galway Bay Complex cSAC through affecting the existing hydrogeological regime.

The proposed road development will not affect any Otter breeding/resting sites and will not result in any long-term disturbance or displacement of Otter from habitat areas within, or connected to, Galway Bay Complex cSAC. At a distance of more than 1km from the construction or operation of the proposed road development it poses no risk of disturbance to Harbour seal in Galway Bay.

However, there are the following impacts by which the proposed road development could (in the absence of mitigation measures) potentially affect the QIs of Galway Bay Complex cSAC:

- Habitat degradation as a result of the proposed road development affecting water quality in receiving watercourses and Galway Bay during construction
- Habitat degradation as a result of introducing/spreading non-native invasive plant species to habitat areas within Galway Bay Complex cSAC
- Barrier effect - the installation of new culvert structures on watercourses within the Bearna Stream catchment has the potential to present a barrier to Otter movement (the lower portion of the Bearna Stream catchment lies within Galway Bay Complex cSAC)
- Mortality risk - with new watercourse crossings on watercourses within the Bearna Stream catchment, the proposed road development poses a mortality risk to Otter through collisions with road traffic

9.2.4 Examination and Analysis of Potential Direct and Indirect Impacts

9.2.4.1 Habitat degradation – hydrology

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a significant negative impact on water quality in receiving watercourses, and consequently downstream in Galway Bay. The effects of frequent and/or prolonged pollution events in a river system can be extensive and far-reaching and can have significant long-term effects. In an extreme scenario, with a pollution event of sufficient magnitude, the marine environment could also be affected. A reduction in water quality in Galway Bay has the potential to reduce the area and distribution of affected habitats, the structure, extent and distribution of vegetation and fauna species communities, and affect the quality/condition of breeding and resting sites for Otter and the Harbour seal (see **Table 9.23**).

However, it is extremely unlikely that a pollution event of such a magnitude would occur during construction. Any pollution events that may occur would be expected to be relatively minor in comparison to the dilution factor and assimilative capacity of a coastal water body the size of Galway Bay, or to be any more than temporary in nature, and therefore would not have any perceptible or far-reaching effects within the bay. This is particularly so given the high flushing by tidal waters over spring and neap tides and the tidal mixing available.

Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and mitigation measures are required to further minimise the risk of the proposed road development having any effect on water quality in receiving watercourses during construction.

A total of 16 of the proposed mainline road drainage outfalls will discharge to surface watercourses (five of which discharge to the River Corrib, two directly and three indirectly), one mainline road drainage outfalls to a tributary of Ballindooley Lough, seven mainline and link road drainage outfalls will discharge to existing public surface water sewers and two (covered tunnel sections) are to be pumped to the public foul sewer, one mainline road drainage networks discharges to an existing infiltration field for the existing N6. There are additional side road drainage networks which also discharge to local ditches and surface water sewer networks.

The drainage network and discharge points are shown on **Figures 2.1** to **2.15**. However, given the drainage design, as described in **Section 2** and in **Appendix B** (which includes attenuation and pollution control elements), it is not predicted that the normal operating water quality of the drainage outfalls, even in the unlikely event of a pollution incident, would have any significant effect on water quality in receiving watercourses or in Galway Bay.

As a consequence of the small scale of the proposed road development surface area relative to the overall freshwater catchment that discharges to Galway Bay, there will be no discernible impact on the flow regime within the Galway Bay Complex cSAC at either local or regional scale. The conservation objective of the various QIs of this cSAC require that the natural hydrological regime is maintained in terms

of the natural tidal regime, salinities, sediment supply and water quality. The drainage design proposed minimises the potential for local change in runoff and recharge rates having 39 outfalls over the 17.5km road length and the provision of storm water treatment and attenuation upstream of these outfalls to throttle discharge rates to greenfield runoff rates.

Summary

Considering the design of the proposed road development, and in particular the drainage design which will attenuate and treat road drainage prior to discharge to the surface water network (see **Sections 2** above and **10** below, and in **Appendix A**, **Appendix B** and **Appendix C**), and it's location relative to Galway Bay, the proposed road development will not directly or indirectly affect the functioning of the existing hydrological regime during construction or operation and will not affect surface water quality (or water quality in Galway Bay) during operation.

However, taking the precautionary approach there is the potential for water quality to be affected during construction and operation. During construction there is the potential for accidental spillages of pollutants to affect water quality in receiving watercourses/waterbodies and mitigation measures are required.

The proposed road development has the potential to affect the range, area, or structure/function of QI habitats within Galway Bay Complex cSAC, the range of QI species, or the ability of these QI habitats or species populations to maintain themselves in the long-term due to effects on water quality. The proposed road development therefore also has the potential to inhibit any efforts to restore favourable conservation status, where this forms part of the conservation objectives (or might in the future).

Therefore, the proposed road development has the potential to affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats and species of Galway Bay Complex cSAC (see **Table 9.23**) through impacts on water quality during construction.

A summary of the potential direct or indirect impacts associated with the proposed road development are presented in **Table 9.18** below.

Table 9.18: Summary of Hydrological Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required
Construction		
Construction works affecting the hydrological regime	No Construction of the proposed road development will not affect the functioning of any rivers which flow into or lie within Galway Bay Complex cSAC, either in terms of flow of flooding regime, and will not affect the tidal regime or hydrological functioning of Galway Bay	No
Construction works affecting surface water quality	Yes Affecting the quality of surface water discharging to the marine environment could affect the associated aquatic/coastal/marine habitats and species	Yes To ensure that water quality in the receiving environment is not affected during construction (as outlined in **Section 10.4**)
Operation		
The hydrological regime being affected during operation	No The design of the proposed road development will not affect the functioning of any rivers which flow into or lie within Galway Bay Complex cSAC, either in terms of flow of flooding regime, and will not affect the tidal regime or hydrological functioning of Galway Bay	No
Surface water quality being affected during operation	No The drainage design (as described in Section 2, and Appendix B) will ensure that surface water quality will be maintained during operation	No

9.2.4.2 Habitat degradation – non-native invasive species

Non-native invasive plant species have been recorded along, or in close proximity to the proposed road development[45] (see **Section 5.5**). Therefore, construction works have the potential to accidentally cause their introduction/spread to habitat areas within Galway Bay Complex cSAC. This has the potential to have long-term

[45] Non-native invasive aquatic plant species (or fauna species) were not recorded in aquatic habitats impacted by construction works.

effects on plant species composition, diversity and abundance in affected habitats. Although the proposed road development is remote from Galway Bay Complex cSAC, there are two principal pathways by which non-native invasive species could be introduced to this European site from the proposed road development: the haul routes shown on **Figures 3.1** and **3.2** which cross the Galway Bay Complex cSAC at Bearna Woods, along the R336, and construction works will be carried out upstream in the Bearna Stream catchment and non-native invasive plant species could be carried downstream to Bearna Woods and Rusheen Bay. This could potentially affect the areas of Calcareous grassland habitat [*6210/6210] known to be present around the margins of Rusheen Bay.

Given the presence of non-native invasive plant species cover in the immediate vicinity of the proposed road development, there is the potential that these species will recolonize vegetated areas within the proposed development boundary post-construction. As such, there is also a risk that routine maintenance works may inadvertently spread contaminated vegetation cuttings.

Summary

Introducing or spreading non-native invasive plant species to Galway Bay Complex cSAC, during construction or operation, has the potential to affect the conservation objective attributes and targets supporting the conservation condition of its QI habitats (see **Table 9.23**).

A summary of the potential direct and indirect impacts associated with non-native invasive plant species are presented in **Table 9.19** below.

Table 9.19: Summary of Hydrological Impacts

Potential Direct and Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Construction/Operation		
Introducing or spreading non-native invasive species to habitats within Galway Bay Complex cSAC	Yes Introducing/spreading non-native invasive plant species could affect the distribution, extent, diversity and area of QI habitats or habitat areas supporting QI species	Yes To ensure that non-native invasive plant species are not spread within, or introduced to, habitat areas within Galway Bay Complex cSAC (as outlined in **Section 10.7**)

9.2.4.3 Barrier effect

Otter were recorded in the Bearna Stream catchment and within that catchment the proposed road development crosses the Bearna Stream and the Tonabrocky Stream. Two culvert structures are proposed on these watercourses which have the potential to present a barrier to Otter movement during the construction (as instream works will be required) and operation of the proposed road development. Although where the proposed road development crosses these watercourses they are not within Galway Bay Complex cSAC, the lower portion of the Bearna Stream does lie within this European site. Otter using these watercourses are likely to form part of that European site's Otter population. Construction of these culverts will likely be

completed within a twelve month period (and also considering that instream works are not permitted by IFI between the months of October and June (inclusive)) and any barrier effect created would not result in any long-term effects on the local Otter population.

Summary

The proposed road development may present a barrier effect to Otter within the Bearna Stream catchment which may affect the Otter population of Galway Bay Complex cSAC and therefore, may affect the conservation objectives supporting the conservation condition of Otter in Galway Bay Complex cSAC.

A summary of the potential impacts associated with the barrier effect posed by the proposed road development are presented in **Table 9.20** below.

Table 9.20: Summary of Barrier Effect Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Operation		
Barrier effect to Otter movement throughout the Bearna Stream catchment	Yes Operation of the proposed road development may present barrier to Otter movement that could affect the Otter population of Galway Bay Complex cSAC	Yes To ensure that Otter movements are not restricted in the Bearna Stream catchment (as outlined in **Section 10.9**)

9.2.4.4 Mortality risk

The introduction of a new culverts on watercourses within the Bearna Stream catchment increases the risk of road traffic collisions with Otter. Sections of the proposed road carriageway in the vicinity will require the installation of mammal fencing to prevent Otter gaining access to the carriageway (National Roads Authority, 2008b).

Summary

As there is a risk of road traffic during operation posing a mortality risk to the Otter population of Galway Bay Complex cSAC, the proposed road development has the potential to affect the conservation objective attributes and targets supporting the conservation condition of Otter in Galway Bay Complex cSAC (see **Table 9.23**).

A summary of the potential impacts associated with the mortality risk posed by the proposed road development are presented in **Table 9.21** below.

Table 9.21: Summary of Mortality Risk Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the QIs?	Are mitigation measures required?
Operation		
Mortality/road traffic collision risk to Otter	Yes Operation of the proposed road development presents a permanent risk of Otter mortality due to road traffic collisions and could have long-term effects on the Otter population of Galway Bay Complex cSAC	Yes To ensure that Otter cannot gain access to the proposed road carriageway (as outlined in **Section 10.10.2**)

9.2.4.5 Summary

This section presents a summary of the potential impacts of the proposed road development on the QIs of Galway Bay Complex cSAC and how these impacts relate to affecting the site's conservation objectives.

Table 9.22 below, lists the QIs of Galway Bay Complex cSAC and how the impacts associated with the proposed road development relate to each. Those highlighted in green are those QIs which are present within the ZoI of the proposed road development.

Table 9.22: Qualifying Interests of Galway Bay Complex cSAC and Potential Impacts

Qualifying Interests	Impact
Annex I Habitats	
[1140] Mudflats and sandflats not covered by seawater at low tide	Habitat degradation – hydrology
[1150] Coastal lagoons*	Habitat degradation – hydrology
[1160] Large shallow inlets and bays	Habitat degradation – hydrology
[1170] Reefs	Habitat degradation – hydrology
[1220] Perennial vegetation of stony banks	Habitat degradation – hydrology
[1310] *Salicornia* and other annuals colonising mud and sand	Habitat degradation – hydrology
[1330] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)	Habitat degradation – hydrology
[1410] Mediterranean salt meadows (*Juncetalia maritimi*)	Habitat degradation – hydrology
[3180] Turloughs *	No potential impact – not present within ZoI.
[5130] *Juniperus communis* formations on heaths or calcareous grasslands	No potential impact – not present within ZoI.

Qualifying Interests	Impact
[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites)	Habitat degradation - non-native invasive plant species
[7210] Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae* *	No potential impact – not present within ZoI.
[7230] Alkaline fens	No potential impact – not present within ZoI.
Annex II Species	
[1355] Otter *Lutra lutra*	Habitat degradation – hydrology Barrier effect (Bearna Stream catchment) Mortality risk (Bearna Stream catchment)
[1365] Harbour seal *Phoca vitulina*	Habitat degradation – hydrology

The relationship between, and potential influence of, these impacts with respect to the QI habitat and species within the ZoI of the proposed road development and the attributes/targets upon which their favourable conservation condition is considered and measured is considered further below and also presented in **Table 9.23**.

[1140] Mudflats and sandflats not covered by seawater at low tide

Affecting water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the natural condition of the intertidal sand/mud community complex that is an integral part of this habitat type.

[1150] Coastal lagoons*

Affecting water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the number and extent of typical plant species and specialised fauna species associated with coastal lagoon habitat.

[1160] Large shallow inlets and bays

Affecting water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the extent, distribution and structure of the plant and animal communities that are an integral part of this habitat type.

[1170] Reefs

Affecting water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the extent and structure of the plant and animal communities that are an integral part of this habitat type.

[1220] Perennial vegetation of stony banks

Affecting water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the area and distribution of this habitat type, could affect the vegetation structure through the range of coastal habitats present, and could affect the range of typical shingle flora plant communities.

[1310] Salicornia and other annuals colonising mud and sand

Affecting water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the area and distribution of this habitat type, could affect the vegetation structure through the range of coastal habitats present, and could affect vegetation cover, vegetation height and the typical plant species and plant sub-communities present.

[1330] Atlantic salt meadows (Glauco-Puccinellietalia maritimae), [1410] Mediterranean salt meadows (Juncetalia maritimi)

Affecting water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the area and distribution of this habitat type, could affect the vegetation structure through the range of coastal habitats present, and could affect vegetation cover, vegetation height and the typical plant species and plant sub-communities present.

*[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia) (*important orchid sites)*

There is the potential for the proposed road development to introduce or spread non-native invasive plant species to Rusheen Bay, via the Bearna Stream as a result of the proposed haul route along the R336 which could potentially affect the areas of Calcareous grassland habitat [*6210/6210] known to be present around the margins of Rusheen Bay. This impact could affect habitat area and distribution and negatively affect the vegetation structure and composition.

[1355] Otter

Affecting water quality in the Bearna Stream and Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the quality and availability of breeding/resting sites downstream in Galway Bay Complex cSAC and affect fish numbers, particularly in the Bearna Stream. Any barrier effect associated with the proposed road development within the Bearna Stream catchment could affect the territory size of any QI Otter populations that use watercourses within that catchment, which in turn could affect local population dynamics through factors such intraspecific competition for resources. The mortality risk posed by the proposed road development within the Bearna Stream catchment could have a long term effect on Otter numbers within Galway Bay Complex cSAC.

[1365] Harbour seal

Affecting water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) could affect the condition of Harbour seal breeding and haul out sites.

Table 9.23: Potential Impacts on the Conservation objectives of Galway Bay Complex cSAC (Those rows highlighted in green are the attributes potentially affected by the proposed road development)

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
[1140] Mudflats and sandflats not covered by seawater at low tide To maintain the favourable conservation condition of Mudflats and sandflats not covered by seawater at low tide in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	The permanent habitat area is stable or increasing, subject to natural processes	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the area of mudflats/sandflats in the cSAC	No
Community distribution: Hectares	Conserve the following community types in a natural condition: Intertidal sandy mud community complex; and Intertidal sand community complex.	A reduction in water quality in receiving watercourses during construction could affect the distribution of fauna communities in Galway Bay	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
[1150] Coastal lagoons* To restore the favourable conservation condition of Coastal lagoons in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area stable, subject to slight natural variation.	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the area of Coastal lagoons in the cSAC	No
Habitat distribution: Occurrence	No decline, subject to natural processes.	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the distribution of Coastal lagoons in the cSAC	No
Salinity regime: Practical salinity units (psu)	Median annual salinity and temporal variation within natural ranges	No, the proposed road development affecting water quality in Galway Bay during construction will not	No

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
		affect the salinity profile of Coastal lagoons in the cSAC	
Hydrological regime: Metres	Annual water level fluctuations and minima within natural ranges	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the hydrological regime in Galway Bay	No
Barrier: connectivity between lagoon and sea Permeability	Appropriate hydrological connections between lagoons and sea, including where necessary, appropriate management	No, the proposed road development affecting water quality in Galway Bay during construction will not affect lagoon/sea connectivity	No
Water quality: Chlorophyll *a*: µg/L	Annual median chlorophyll *a* within natural ranges and less than 5µg/L	No, the proposed road development affecting water quality in Galway Bay during construction will not affect Chlorophyll levels in lagoon habitats in Galway Bay	No
Water quality: Molybdate Reactive Phosphorus (MRP): mg/L	Annual median MRP within natural ranges 0.1mg/L	No, the proposed road development affecting water quality in Galway Bay during construction will not affect MRP levels in lagoon habitats in Galway Bay	No
Water quality: Dissolved Inorganic Nitrogen (DIN): mg/L	Annual median DIN within natural ranges and less than 0.15mg/L	No, the proposed road development affecting water quality in Galway Bay during construction will not affect DIN levels in lagoon habitats in Galway Bay	No
Depth of macrophyte colonisation: Metres	Macrophyte colonisation to at least 2m depth	No, the proposed road development affecting water quality in Galway Bay during construction will not affect macrophyte colonisation depth in lagoon habitats in Galway Bay	No

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Typical plant species: Number and m²	Maintain number and extent of listed lagoonal specialists, subject to natural variation	A reduction in water quality in Galway Bay during construction could affect the diversity, number and extent of plant species associated with this habitat type in the cSAC (e.g. Lough Atalia)	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Typical animal species: Number	Maintain listed lagoon specialists, subject to natural variation	A reduction in water quality in Galway Bay during construction could affect the diversity, number and extent of plant species associated with this habitat type in the cSAC (e.g. Lough Atalia)	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Negative indicator species: Number and % cover	Negative indicator species absent or under control	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the control or spread of negative indicator species in lagoon habitats in Galway Bay	No
[1160] Large shallow inlets and bays To maintain the favourable conservation condition of Large shallow inlets and bays in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	The permanent habitat area is stable or increasing, subject to natural processes.	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the area of this habitat type	No
Community extent: Hectares	Maintain the extent of the *Zostera*-dominated community complex and the maërl-dominated community, subject to natural processes	A reduction in water quality in Galway Bay during construction could reduce the extent of these communities within the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Community structure: *Zostera* density - Shoots per m²	Conserve the high quality of *Zostera*-dominated communities, subject to natural processes	A reduction in water quality in Galway Bay during construction could affect the density of these communities within the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Community structure: Biological composition	Conserve the high quality of the maërl-dominated community, subject to natural processes	A reduction in water quality in Galway Bay during construction could affect the quality of these communities within the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Community distribution: Hectares	Conserve the following community types in a natural condition: Intertidal sandy mud community complex; Intertidal sand community complex; Fine to medium sand with bivalves community complex; Sandy mud to mixed sediment community complex; Mixed sediment dominated by *Mytilidae* community complex; Shingle; *Fucoid*-dominated community complex; *Laminaria*-dominated community complex; and Shallow sponge-dominated community complex	A reduction in water quality in Galway Bay during construction could affect the distribution of these communities within the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
[1170] Reefs To maintain the favourable conservation condition of Reefs in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Distribution: Occurrence	The distribution of reefs is stable or increasing, subject to natural processes	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the distribution of reef habitats	No
Habitat area: Hectares	The permanent habitat area is stable, subject to natural processes.	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the area of reef habitat cover	No

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Community extent: Hectares	Maintain the extent of the *Mytilus*-dominated reef community, subject to natural processes	A reduction in water quality in Galway Bay during construction could reduce the extent of these communities within the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Community structure: *Mytilus* density - Individuals per m²	Conserve the high quality of the *Mytilus*-dominated reef community, subject to natural processes	A reduction in water quality in Galway Bay during construction could affect the density of these communities within the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Community structure: Biological composition	Conserve the following community types in a natural condition: *Fucoid*-dominated community complex; *Laminaria*-dominated community complex; and Shallow sponge-dominated community complex	A reduction in water quality in Galway Bay during construction could affect the quality of these communities within the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
[1220] Perennial vegetation of stony banks To maintain the favourable conservation condition of Perennial vegetation of stony banks in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area stable or increasing, subject to natural processes, including erosion and succession	A reduction in water quality in Galway Bay during construction could (at least temporarily) affect the area covered by this habitat	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Habitat distribution: Occurrence	No decline, or change in habitat distribution, subject to natural processes	A reduction in water quality in Galway Bay during construction could (at least temporarily) affect the distribution of this habitat	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Physical structure: functionality and sediment supply: Presence/ absence of physical barriers	Maintain the natural circulation of sediment and organic matter, without any physical obstructions	No The proposed road development will not pose a barrier to the natural circulation of sediment or organic matter	No
Vegetation structure: zonation: Occurrence	Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	A reduction in water quality in Galway Bay during construction could affect vegetation structure	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation composition: typical species and sub-communities: Percentage cover at a representative sample of monitoring stops	Maintain the typical vegetated shingle flora including the range of sub-communities within the different zones. Typical species include Sea sandwort (*Honckenya peploides*), Sea beet (*Beta vulgaris* ssp *maritima*), Rock samphire (*Crithmum maritimum*), Sea mayweed (*Tripleurospermum maritimum*), yellow-horned poppy (*Glaucium flavum*) and sea campion (*Silene uniflora*)	A reduction in water quality in Galway Bay during construction could affect species composition	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
[1310] *Salicornia* and other annuals colonising mud and sand To maintain the favourable conservation condition of Salicornia and other annuals colonizing mud and sand in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area stable or increasing, subject to natural processes,	A reduction in water quality in Galway Bay during construction could result in the loss of habitat area	Measures to maintain water quality in receiving watercourses during construction

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
	including erosion and succession.		**Section 10.4**
Habitat distribution: Occurrence	No decline, or change in habitat distribution, subject to natural processes.	A reduction in water quality in Galway Bay during construction could affect the distribution of this habitat in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Physical structure: sediment supply: Presence/ absence of physical barriers	Maintain/restore, natural circulation of sediments and organic matter, without any physical obstructions	No The proposed road development will not pose a barrier to the natural circulation of sediment or organic matter	No
Physical structure: creeks and pans: Occurrence	Maintain, or where necessary restore creek and pan structure, subject to natural processes, including erosion and succession	No The proposed road development will not affect how the tidal regime/processes interacts with this habitat type	No
Physical structure: flooding regime - Hectares flooded; frequency	Maintain natural tidal regime	No The proposed road development will not affect how the tidal regime/processes interacts with this habitat type	No
Vegetation structure: zonation - Occurrence	Maintain the range of coastal habitats including transitional zones, subject to natural processes including erosion and succession.	A reduction in water quality in Galway Bay during construction could affect vegetation structure	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation structure: vegetation height - Centimetres	Maintain structural variation within sward	A reduction in water quality in Galway Bay during construction could affect the vegetation structure of this habitat in the cSAC	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation structure: vegetation cover - Percentage cover at a representative sample of monitoring stops	Maintain more than 90% of area outside creeks vegetated	A reduction in water quality in Galway Bay during construction could affect the vegetation structure of this habitat in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation composition: typical species and sub-communities - Percentage cover	Maintain the range of species-poor communities with typical species listed in SMP (McCorry and Ryle, 2009)	A reduction in water quality in Galway Bay during construction could affect species composition	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation structure: negative indicator species - *Spartina anglica* - Hectares	There is currently no common cordgrass (*Spartina anglica*) in this cSAC. Prevent establishment of cordgrass	No The proposed road development does not interact directly with the coastal zone and therefore, there is not potential for any interaction with habitat supporting common cordgrass	No
[1330] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) & [1410] Mediterranean salt meadows (*Juncetalia maritimi*) To restore the favourable conservation condition of Mediterranean salt meadows (Juncetalia maritimi) in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area increasing, subject to natural processes, including erosion and succession.	A reduction in water quality in Galway Bay during construction could result in the loss of habitat area in Galway Bay	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Habitat distribution: Occurrence	No decline or change in habitat distribution, subject to natural processes.	A reduction in water quality in Galway Bay during construction could affect the distribution of this habitat in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Physical structure: sediment supply - Presence/ absence of physical barriers	Maintain/restore natural circulation of sediments and	No	No

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
	organic matter, without any physical obstructions	The proposed road development will not pose a barrier to the natural circulation of sediment or organic matter	
Physical structure: creeks and pans - Occurrence	Maintain creek and pan structure, subject to natural processes, including erosion and succession	No The proposed road development will not affect how the tidal regime/processes interacts with this habitat type	No
Physical structure: flooding regime - Hectares flooded; frequency	Maintain natural tidal regime	No The proposed road development will not affect how the tidal regime/processes interacts with this habitat type	No
Vegetation structure: zonation - Occurrence	Maintain range of coastal habitats including transitional zones, subject to natural processes including erosion and succession	A reduction in water quality in Galway Bay during construction could affect vegetation structure	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation structure: vegetation height - Centimetres	Maintain structural variation within sward	A reduction in water quality in Galway Bay during construction could affect the vegetation structure of this habitat in the cSAC	Measures to maintain water quality in receiving watercourses during construction and operation **Section 10.4**
Vegetation structure: vegetation cover - Percentage cover at a representative sample of monitoring stops	Maintain more than 90% area outside creeks vegetated	A reduction in water quality in Galway Bay during construction could affect the vegetation structure of this habitat in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Vegetation composition: typical species and sub-communities - Percentage cover at a	Maintain range of sub-communities with typical species listed in SMP (McCorry and Ryle, 2009)	A reduction in water quality in Galway Bay during construction could affect the vegetation structure of this habitat in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
representative sample of monitoring stops			
Vegetation structure: negative indicator species - *Spartina anglica* - Hectares	There is currently no common cordgrass (*Spartina anglica*) in this cSAC. Prevent establishment of cordgrass	No The proposed road development does not interact directly with the coastal zone and therefore, there is not potential for any interaction with habitat supporting common cordgrass	No
[6210] Semi - natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites) To maintain the favourable conservation condition of Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Habitat area: Hectares	Area stable or increasing, subject to natural processes	Introducing/spreading non-native invasive plant species to Galway Bay Complex cSAC could result in the loss of areas of Calcareous grassland habitat and potentially affect habitat distribution	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Habitat distribution: Occurrence	No decline, subject to natural processes.	*As above for habitat area*	*As above for habitat area*
Vegetation composition: typical species – Number at a representative number of monitoring stops	At least 7 positive indicator species present, including 2 "high quality" species	*As above for habitat area*	*As above for habitat area*
Vegetation composition: negative indicator species – Percentage at a representative number of monitoring stops	Negative indicator species collectively not more than 20% cover, with cover by an individual species not more than 10%.	No The proposed road development will not directly affect Calcareous grassland habitat within Lough Corrib cSAC and therefore, will not affect negative indicator species cover on Calcareous grassland habitat (non-native species as per O'Neill et al., 2013)	No

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Vegetation composition: non-native species – Percentage at a representative number of monitoring stops	Cover of non-native species not more than 1%	Introducing/spreading non-native invasive plant species to Galway Bay Complex cSAC could result in the loss of areas of Calcareous grassland habitat and potentially affect habitat distribution	Measures to control the introduction/ spread of non-native invasive plant species Section 10.7
Vegetation structure: woody species and bracken (*Pteridium aquilinum*) – Percentage at a representative number of monitoring stops	Cover of woody species (except *Juniperus communis*, *Rosa spinosissima*, *Dryas octopetala* and *Helianthemum oelandicum*) and bracken (*Pteridium aquilinum*) not more than 5% cove	No The proposed road development will not directly affect Calcareous grassland habitat within Galway Bay Complex cSAC and therefore, will not increase woody species or bracken cover in Calcareous grassland habitat in Galway Bay Complex cSAC	No
Vegetation composition: broadleaf herb: grass ratio – Percentage at a representative number of monitoring stops	Broadleaf herb component of vegetation between 40 and 90%	Introducing/spreading non-native invasive plant species to Galway Bay Complex cSAC could affect the broadleaved herb to grass ratio of Calcareous grassland habitat areas	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Vegetation structure: sward height – Percentage at a representative number of monitoring stops	At least 30% of sward between 5cm and 40cm tall	Introducing/spreading non-native invasive plant species to Galway Bay Complex cSAC could affect the percentage of Calcareous grassland habitat at a suitable sward height	Measures to control the introduction/ spread of non-native invasive plant species **Section 10.7**
Vegetation structure: litter – Percentage at a representative number of monitoring stops	Litter cover not more than 25%	No The proposed road development will not directly affect Calcareous grassland habitat within Galway Bay Complex cSAC and therefore, will not increase litter cover in Calcareous grassland habitat in Galway Bay Complex cSAC	No
Physical structure: bare soil –	Not more than 10% bare soil	No	No

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Percentage at a representative number of monitoring stops		The proposed road development will not contribute to physical disturbance levels leading to any increase in bare ground in Calcareous grassland habitats in Galway Bay Complex cSAC	
Physical structure: disturbance Square metres	Area showing signs of serious grazing or other disturbance less than 20m²	No The proposed road development will not contribute to, or affect, physical disturbance or increased grazing levels in Calcareous grassland habitats in Galway Bay Complex cSAC	No
[1355] Otter *Lutra lutra* To restore the favourable conservation condition of Otter in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Distribution: Percentage positive survey sites	No significant decline	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the distribution or range of the species in Galway Bay	No
Extent of terrestrial habitat: Hectares	No significant decline. Area mapped and calculated as 262ha above high water mark (HWM); 14ha along river banks/around ponds	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the extent of terrestrial habitat available for Otter in the cSAC	No
Extent of marine habitat: Hectares	No significant decline. Area mapped and calculated as 2040ha	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the extent of marine habitat available for Otter in the cSAC	No
Extent of freshwater (river) habitat: Kilometres	No significant decline. Length mapped and calculated as 4km	No, the proposed road development affecting water quality in Galway Bay during construction will not	No

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
		affect the extent of river habitat available for Otter in the cSAC	
Extent of freshwater (lake/lagoon) habitat: Hectares	No significant decline. Area mapped and calculated as 21ha	No, the proposed road development affecting water quality in Galway Bay during construction will not affect the extent of lake habitat available for Otter in the cSAC	No
Couching sites and holts: Number	No significant decline	The proposed road development affecting water quality in Galway Bay during construction could (at least temporarily) affect usage of holt/couch sites available for Otter in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Fish biomass available: Kilograms	No significant decline	A reduction in water quality in the Bearna Stream catchment or Galway Bay during construction could affect fish populations in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Barriers to connectivity: Number	No significant increase	No The proposed road development does not pose a barrier to Otter movement within the cSAC. However, it may pose a barrier to Otter movement within the Bearna Stream catchment – watercourses that are likely to be used by the Galway Bay Complex cSAC Otter population	Measures to ensure continued passage of Otter throughout watercourses in the Bearna Stream catchment **Section 10.9**

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Mortality risk posed by road traffic	Not defined in any existing conservation objectives document	Although the potential for Otter to gain access to the proposed road carriageway lies outside of the boundary of Galway Bay Complex cSAC there is still the potential for the proposed road development to pose a permanent mortality risk to the Galway Bay Otter population (which are likely to use habitat along the Bearna Stream and the Tonabrocky Stream), which could have long-term effects on the local population	Use of Otter resistant fencing to prevent Otter gaining access to the road carriageway **Section 10.10.2**
[1365] Harbour seal *Phoca vitulina* To maintain the favourable conservation condition of Harbour Seal in Galway Bay Complex cSAC, which is defined by the following list of attributes and targets:			
Access to suitable habitat: Number of artificial barriers	Species range within the site should not be restricted by artificial barriers to site use	No The proposed road development is more than 1km from the coastal zone within the cSAC and poses no risk of restricting the range of Harbour seal in Galway Bay	No
Breeding behaviour: Breeding sites	Conserve breeding sites in a natural condition	A reduction in water quality in Galway Bay during construction could affect the quality/condition of breeding sites in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Moulting behaviour: Moult haul-out sites	Conserve moult haul-out sites in a natural condition	A reduction in water quality in Galway Bay during construction could affect the quality/condition of moult haul-out sites in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Resting behaviour: Resting haul-out sites	Conserve resting haul-out sites in a natural condition	A reduction in water quality in Galway Bay during construction could affect the quality/condition of resting haul-out sites in the cSAC	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

Attributes and measures	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Disturbance: Level of impact	Human activities should occur at levels that do not adversely affect the harbour seal population at the site	No The proposed road development is more than 1km from the coastal zone within the cSAC and poses no risk of disturbance to Harbour seal	No

9.3 Lough Corrib SPA

9.3.1 Special Conservation Interests and Conservation Objectives of Lough Corrib SPA

The SCI bird species, and the overall conservation objective for each, for which Lough Corrib SPA is designated are listed below in **Table 9.24**. Those highlighted (in green) are the SCIs which were recorded within the ZoI of the proposed road development and are therefore, at risk from impacts associated with the proposed road development.

Table 9.24: SCIs of Lough Corrib SPA[46]

SCIs	Conservation Objective
Greenland white-fronted goose *Anser albifrons flavirostris* [A395] – Wintering	To maintain or restore the favourable conservation condition
Gadwall *Anas strepera* [A051] – Wintering	To maintain or restore the favourable conservation condition
Shoveler *Anas clypeata* [A056] – Wintering	To maintain or restore the favourable conservation condition
Pochard *Aythya ferina* [A059] – Wintering	To maintain or restore the favourable conservation condition
Tufted duck *Aythya fuligula* [A061] – Wintering	To maintain or restore the favourable conservation condition
Common scoter *Melanitta nigra* [A065] – Breeding	To maintain or restore the favourable conservation condition
Hen harrier *Circus cyaneus* [A082] – Wintering	To maintain or restore the favourable conservation condition
Coot *Fulica atra* [A125] – Wintering	To maintain or restore the favourable conservation condition
Golden plover *Pluvialis apricaria* [A140] – Wintering	To maintain or restore the favourable conservation condition
Black-headed gull *Chroicocephalus ridibundus* [A179] – Breeding/Wintering	To maintain or restore the favourable conservation condition
Common gull *Larus canus* [A182] – Breeding/Wintering	To maintain or restore the favourable conservation condition
Common tern *Sterna hirundo* [A193] – Breeding	To maintain or restore the favourable conservation condition
Arctic tern *Sterna paradisaea* [A194] – Breeding	To maintain or restore the favourable conservation condition
Wetlands and Waterbirds [A999]	To maintain or restore the favourable conservation condition

A site specific conservation objectives document is not currently available for Lough Corrib SPA. However, in conjunction with considering the generic

[46] NPWS (2015) Conservation objectives for Lough Corrib SPA [004042]. Generic Version 4.0. Department of Arts, Heritage and the Gaeltacht.

conservation objective to "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA", a set of site specific conservation objectives has been compiled for the SCIs of Lough Corrib SPA and used to inform this assessment, based on site specific conservation objectives documents available for other European sites with equivalent SCI species (see **Appendix N**). As a precautionary approach, "restore" is used to define the conservation objective in this assessment. This sets out the attributes, measures and targets that would be expected to define the favourable conservation condition of SCI bird species within Lough Corrib SPA. This approach was recommended by the NPWS (refer to the consultation response from the NPWS in **Section 3.1**).

The specific attributes and targets used to define the conservation objectives of the SCI species are presented in **Table 9.30**.

The baseline populations of the SCIs are taken from the data presented in Table 3.2 of the European sites Standard Data Form for Lough Corrib SPA.[47]

9.3.2 Ecological Baseline

Lough Corrib SPA is a vast site comprising Lough Corrib, most of its islands, and much of the wetland habitat that surrounds the lake margin. The proposed road development does not traverse the Lough Corrib SPA, however, the closest areas of its wetland habitat to the proposed road development are at Tonacurragh and Coolanillaun where there is a wetland mosaic of bog, heath, reed swamp, marsh and wet grassland habitats.

Although this SPA lies outside, and upstream of, the proposed road development, many bird species listed as SCIs of the SPA were recorded at winter bird survey sites across the scheme study area. The habitat types associated with these sites ranged from natural/semi-natural lakes and wetland complexes (Ballindooley Lough, Coolagh Lakes and Lough Inch), the River Corrib, and upland mosaics of bog, heath, wet and acid grasslands, to improved and intensively managed habitats such as agricultural fields and amenity areas within Galway City (e.g. NUIG Sporting Campus).

There were two bird species recorded during the breeding bird surveys which are SCIs of Lough Corrib SPA for their breeding population: Common tern and Black-headed gull. This is generally consistent with the findings of the surveys carried out along the River Corrib corridor in 2005/2006 for the N6 Galway City Outer Bypass Scheme (RPS, 2006), where these species were recorded frequently over the summer months along the river, but in low numbers. The 2005/2006 surveys also recorded another breeding SCI species frequently on the River Corrib during the summer months; Common gull.

The full breeding bird survey results are provided in **Appendix H**. The results of the breeding bird surveys with respect to these species are shown on **Figures 8.1** to **8.2**.

[47] available at http://www.npws.ie/sites/default/files/protected-sites/natura2000/NF004042.pdf

The full results of the winter bird surveys, as they relate to those species listed as SCIs of Lough Corrib SPA and Inner Galway Bay SPA, are provided in **Appendix I**. The winter bird survey sites referred to therein, are shown on **Figure 9**.

9.3.3 Potential Direct and Indirect Impacts

As the proposed road development does not traverse the SPA, none of the SCI species, or their supporting habitats within the SPA, are directly impacted by the proposed road development.

However, there are the following impacts by which the proposed road development could (in the absence of mitigation measures) potentially affect SCI bird species or their supporting wetland habitats within Lough Corrib SPA:

- Habitat degradation as a result of hydrogeological impacts - the proposed road development has the potential to affect the existing hydrogeological regime supporting groundwater dependant wetland habitats (at potential ex-situ sites[48]) which in turn support wintering bird species listed as SCIs of Lough Corrib SPA
- Habitat degradation as a result of hydrological impacts - the proposed road development has the potential to affect water quality in the receiving environment supporting aquatic and wetland habitats (within the SPA and at potential ex-situ sites) which in turn support bird species listed as SCIs of Lough Corrib SPA
- Disturbance/displacement - disturbance during construction and/or operation could result in the displacement of SCI birds from important habitat areas within and outside of the SPA boundary (i.e. at potential ex-situ sites)
- Habitat loss/fragmentation - the proposed road development passes through, and will result in habitat loss in potential "ex-situ" sites where SCI bird species were recorded

[48] The need to consider use of habitat areas outside of an SPA by SCI bird species is set out in Section 3.1 and 5.2 of the *Inner Galway Bay Special Protection Area (Site Code 4031), Conservation Objectives Supporting Document, Version 1* (National Parks & Wildlife Service, 2013d). These areas are termed 'ex-situ' sites and are defined as areas of habitat situated within the immediate hinterland of the SPA, or in areas ecologically connected to it, which support SCI bird species. There is no information or evidence to confirm whether any of the bird species recorded in habitats outside of European sites, which are within the ZoI of the proposed road development, are birds from either Lough Corrib SPA and/or Inner Galway Bay SPA, or are not part of the population from either European site. Therefore, a precautionary approach is being taken in assuming that any habitat areas supporting SCI bird species are potentially 'ex-situ' sites under that definition, and are assessed accordingly.

9.3.4 Examination and Analysis of Potential Direct and Indirect Impacts

9.3.4.1 Habitat degradation as a result of hydrogeological/hydrological impacts

Hydrogeology

In terms of interaction with groundwater, the proposed road development has the potential to affect both groundwater quantity (dewatering and drawdown effects during construction, and drawdown effects during operation as a consequence of road cuttings) and groundwater quality within the receiving environment.

The hydrogeological ZoI of the proposed road development extends beyond the proposed development boundary in many locations, where it has the potential to influence groundwater dependant habitats outside of the proposed development boundary. The only wintering bird survey site supporting SCI listed bird species in the western part of the study area that lies within this extended ZoI is WB07 (An Chloch Scoilte) (see **Figure 9**). At this winter bird site, the hydrogeological ZoI (1.8m between Ch. 1+600 and Ch. 1+950, and 10.6m between Ch. 2+230 and Ch. 2+640) does not extend to affect any groundwater dependant habitat areas (e.g. wet heath) and, therefore, it will not affect the suitability of this peatland/scrub habitat mosaic to continue to support wintering birds. No bird species listed as SCIs of Lough Corrib SPA were recorded at WB07 during the winter bird surveys. More generally, across the western section of the proposed road development, the proposed road development passes through areas of dense scrub and/or bracken, and improved/wet agricultural grasslands. Equally, the effects of the proposed road development in terms of hydrogeological impacts will not affect the suitability of the site to support wintering birds.

Along the eastern part of the proposed road development, only two wetland areas supporting groundwater dependant habitats lie within the unmitigated hydrogeological ZoI: Coolagh Lakes and Ballindooley Lough (refer to Table 5 of **Appendix A** for the zone of influence associated with each of the cuttings).

The proposed road development lies within the same groundwater bodies that supply groundwater to the Coolagh Lakes (Lough Corrib Fen 1 (Menlough) GWB and the Lough Corrib Fen 1 (Lackagh) GWB) – see **Figure 10.2.2** and **Figures 10.3.3** to **10.3.4**) and supports some of the fringing aquatic vegetation (Clare-Corrib GWB – see **Figures 10.3.7** and **10.3.8**). As detailed above in **Section 9.1.4.3** (Lough Corrib cSAC), only the groundwater supply to the Coolagh Lakes (WB04), and the supported wetland habitats, could potentially be affected during the construction of the piers for Menlough Viaduct (although this is highly unlikely to occur) which lie within the Lough Corrib Fen 1 (Menlough) GWB[49]. This site was not frequently used by the bird species listed as SCIs of the SPA, and when recorded the numbers were low (generally between one and five individuals) – see **Appendix I**.

[49] The Western Coolagh Spring is a karst spring within the Lough Corrib Fen 1 (Menlough) GWB and is the main source of groundwater flow to the Coolagh Lakes

Considering this, and that the River Corrib also contributes to the Coolagh Lakes, whilst some degree of effect on water levels and extent might occur, it would not result in the area being unusable or unable to support those wintering bird species recorded there (in those numbers). In any case, mitigation measures are required to prevent such an impact occurring and to ensure the proposed road development poses no risk to groundwater quantity or quality supplying the Coolagh Lakes (see **Section 10.3**). As discussed in both **Appendix A** and **Appendix F**, the proposed road development will not restrict or inhibit existing groundwater flow paths supporting groundwater dependant habitats.

There is a risk, in those sections of the proposed road development underlain by limestone, of accidental spills during construction in areas where the bedrock outcrops, such as those areas where the groundwater has extreme or high vulnerability (Figure 3.01 and 3.02 of **Appendix A**) or where the karst limestone outcrops due to cuttings and excavations. Mitigation measures are therefore required to ensure that groundwater quality is not affected during construction (see **Section 10.3**).

The drainage design of the proposed road development (as described in **Section 2**) will ensure that groundwater quality will be maintained during operation – as outlined in **Appendix A** and **Appendix F**.

Although the drainage design will ensure that groundwater quality will be maintained during operation, it is important that it is inspected to ensure that karst features do not affect the functioning of the infiltration basins during operation. If this is identified during routine inspections of the infiltration basins then mitigation will be required to ensure any issues are addressed so that the infiltration basins continue to function as designed for the operational lifespan of the proposed road development (see **Section 10.3**).

As described in the Hydrogeology Assessment Report in **Appendix A**, Ballindooley Lough is up gradient from the proposed road development in both of the groundwater bodies that supply groundwater to that lake (Clare-Corrib (Ballindooley East) GWB and the Clare-Corrib (Ballindooley West) GWB). Therefore, the proposed road development poses no risk to groundwater quantity or quality supplying Ballindooley Lough.

Hydrology

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a negative impact on water quality in the receiving environment. There is also the potential for construction works to affect water quality in the River Corrib, Coolagh Lakes and Ballindooley Lough; all wetland sites supporting bird species listed as SCIs of Lough Corrib SPA. As discussed in **Section 9.1.4.4** (in relation to Lough Corrib cSAC and the River Corrib and Coolagh Lakes) the hydrological regime supporting the wetland habitats at these sites will not be affected. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching, and could potentially have significant long-term effects. In an extreme scenario, with a pollution event of sufficient magnitude, the marine environment could also be affected.

However, it is extremely unlikely that a pollution event of such a magnitude would occur during construction. Any pollution events that may occur would be expected to be relatively minor in comparison to the dilution factor and assimilative capacity of the River Corrib, or to be any more than temporary in nature, and therefore is unlikely to have any perceptible or far-reaching effects. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and mitigation measures are required to minimise the risk of the proposed road development having any perceptible effect on water quality during construction.

Although Common tern were recorded along the River Corrib corridor during the 2015 breeding bird surveys, and were also recorded along the River Corrib as part of the 2006 surveys for the N6 Galway City Outer Bypass (RPS, 2006), any impact on water quality here will not affect the breeding success of the Common tern population in any way given that it could only affect a relatively small habitat area within the average foraging range for the species (c.15km, which includes the whole of Lough Corrib).

There will be outfall points to surface water features from the proposed road drainage network during operation. However, given the drainage design as described in **Sections 2** above and **10** below, and in **Appendix A**, **Appendix B** and **Appendix C** (which includes attenuation and pollution control elements) the normal operating water quality of the drainage outfalls, even in the unlikely event of a pollution incident, will not result in any perceptible impact on water quality in receiving watercourses. There will not be any drainage discharges to the Coolagh Lakes.

Summary

A summary of the potential hydrogeological/hydrological impacts associated with the proposed road development are presented in **Table 9.25** below.

Table 9.25: Summary of Hydrogeological/Hydrological Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required?
Construction		
Construction works affecting groundwater quantity	No Although the proposed road development has the potential to affect groundwater supply to wetland habitats locally, this will not affect their usage by birds such that any population level effects would occur to the SCI populations	No
Construction works affecting groundwater quality	Yes Affecting the quality of groundwater supporting groundwater dependant habitats could affect the type, quality and extent of suitable habitat available to SCI bird species	Yes To ensure that construction works will not affect groundwater quality in the underlying aquifer **Section 10.3**

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required?
Construction works affecting surface water quality	Yes Affecting the quality of surface water supporting aquatic/wetland/marine habitats and species could affect the type, quality and extent of suitable habitat available to SCI bird species	Yes To ensure that water quality in the receiving environment is not affected during construction **Section 10.4**
Operation		
Groundwater quantity being affected during operation	No The design of the proposed road development will not restrict or inhibit existing groundwater flow paths supporting groundwater dependant habitats used by bird species listed as SCIs of Lough Corrib SPA, However, it is important that they are inspected to ensure that karst features do not affect the functioning of the infiltration basins during operation	Yes To ensure that the infiltration basins continue to function as designed for the operational lifespan of the proposed road development (as outlined in **Section 10.3**)
Groundwater quality being affected during operation	Yes Although the drainage design (as described in Section 6, and Appendices G, H and I) will ensure that groundwater quality will be maintained during operation, it is important that they are inspected to ensure that karst features do not affect the functioning of the infiltration basins during operation	Yes To ensure that the infiltration basins continue to function as designed for the operational lifespan of the proposed road development (as outlined in **Section 10.3**)

9.3.4.2 Disturbance/displacement – within SPA

The SPA boundary is more than 700m from the main construction works associated with the proposed road development, i.e. mainline and tie in with the existing road network. At this distance, no disturbance or displacement effects would be experienced within the SPA during construction. There will also not be any blasting within 800m of Lough Corrib SPA. With the proposed road development more than 700m from the SPA during operation, no disturbance to wintering birds would be experienced. Construction of the proposed outfall for N59 Link Road North drainage from the Bushypark Junction to the River Corrib is c.200m from the SPA at its most north-easterly extent (**Figures 13.2** and **14.2**), and the construction of an access road at Menlough is c.70m from the SPA, and some level of construction disturbance to bird species on the river channel itself, and at the southern end of Coolanillaun, would be expected. However, as these works will be temporary in nature (approximately one month construction period), would only cover a relatively small area of the SPA within the disturbance ZoI (c.9ha), and that bird species would be expected to habituate to the predicted noise levels at a distance of 200-300m, construction related disturbance will not result in any long-term displacement of SCI bird species from habitats within the SPA.

Black-headed gull, Common gull and Common tern are listed as SCIs for their breeding populations[50]. The nearest Black-headed gull breeding site is at Angliham Quarry; c.1.3km to the north of the proposed road development, where 11 of 431 nest sites recorded during the 2007 survey were located. There are many islands in Lough Corrib traditionally used as Common gull breeding sites, and many bays, islands and sections of shoreline in the lake traditionally used as Common tern nest sites. The nearest of these sites was at Walsh's Island, more than 8.5km to the north of the proposed road development. At this distance, the breeding sites would be beyond the ZoI of any disturbance/displacement effects during construction or operation.

Summary

A summary of the potential disturbance/displacement impacts at Lough Corrib SPA associated with the proposed road development are presented in **Table 9.26** below.

Table 9.26: Summary of Disturbance/Displacement Impacts at Lough Corrib SPA

Potential Direct and Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Construction		
Construction works disturbing/displacing SCI bird species within Lough Corrib SPA	No As Lough Corrib SPA is beyond the ZoI of any long-term construction related disturbance	No
Operation		
Disturbing/displacing SCI bird species within Lough Corrib SPA during operation	No As Lough Corrib SPA is beyond the ZoI of any disturbance during operation of the proposed road development	No

Therefore, to the limited extent that there will be disturbance of SCI within the SPA during construction or operation of the proposed road development, this will not result in long-term displacement and will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Lough Corrib SPA (see **Table 9.30**).

[50] The breeding sites of these species in Lough Corrib are described in Hunt & Heffernan (2007)

9.3.4.3 Disturbance/displacement – at potential ex-situ sites

As discussed in **Section 7.8**, only those winter bird, or potential "ex-situ", sites which lie within 300m of the proposed road development, or those that lie within 800m of areas where prolonged blasting activity is likely, are predicted to be subject to some level of prolonged construction related disturbance. Of the 60 winter bird sites surveyed, 19 fall within or partially within this disturbance ZoI; and of those, eight supported bird species listed as SCIs for Lough Corrib SPA: Black-headed gull, Common gull, Common tern, Coot, Golden plover, Hen harrier, Shoveler and Tufted duck. The full results of the winter bird surveys are provided in **Appendix I**.

Greenland white-fronted goose, Gadwall, Pochard, Common scoter, and Arctic tern

Greenland white-fronted goose, Gadwall, Pochard, Common scoter, and Arctic tern were not recorded in any of the winter bird survey sites for the proposed road development, nor were they recorded along the River Corrib corridor during the 2006 surveys undertaken for the N6 Galway City Outer Bypass (RPS, 2006). Therefore, these SCIs are not at risk of any disturbance effects from the construction or operation of the proposed road development. Two of these species are listed as SCIs for their breeding populations, Common scoter and Arctic tern, but the nearest breeding sites are more than 14km and 10km, respectively, from the proposed road development and therefore beyond the disturbance ZoI.

Therefore, any disturbance or displacement associated with construction or operation of the proposed road development at any potential ex-situ sites will not affect the conservation objective attributes and targets supporting the conservation condition of these species in Lough Corrib SPA (see **Table 9.30**).

Shoveler

Shoveler were recorded on, or flying into, only one of the winter bird survey sites in 2014/15: Ballindooley Lough (WB02). They were recorded in five of the seven survey visits in numbers ranging from 10 to 144. A flock of 144 birds is a significant number and is in excess of the SPA's baseline winter population of 90. As would be expected for a diving duck species, the principle habitat used at Ballindooley Lough was the main body of the lake itself, which lies c.300m from the proposed road development at its nearest point.

There are three elements of the proposed road development which have the potential to affect Ballindooley Lough, and any SCI listed species therein, through construction related disturbance: the installation of the fencing to the north of the proposed road development, between Ch. 12+250 and Ch. 12+400, approximately 240m from the lake shore; the cutting east of Lackagh Quarry (which lies c.450m from the lake); and the cutting at Castlegar (c.350m from the lake).

Noise levels associated with installing the fencing would be temporary (a matter of days) and expected to be below 50dB at that distance and therefore, would not displace wintering birds from the lake as a result of noise. Increased human presence may have a temporary disturbance effect in the immediate vicinity; with the majority of wetland habitat unaffected. Neither would affect usage of the lake

by the species in the long-term. Blasting at Ballindooley and Castlegar has the potential to disturb and displace wintering birds using Ballindooley Lough and mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Tufted duck

Tufted duck were recorded at one of the winter bird sites surveyed in 2014/2015: Ballindooley Lough (WB02), where the species was recorded on four occasions over the winter (November, January, February and March). The maximum number recorded was a count of 26 in January 2015, corresponding with what could be <0.5% of the SPA's baseline winter population of 5,521.

As discussed above in relation to Shoveler and construction related disturbance to water birds on the main body of the lake, mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Hen harrier

Hen harrier (a single individual) was recorded in the vicinity of Lough Inch in January 2015. The Lough Inch location is more than 1km from the proposed road development and at that distance will not be subject to any construction or operation disturbance/displacement effects. Internationally important numbers of Hen harrier are also known to communally roost in winter within the SPA[51] and there are records of the species from Tonacurragh, Coolanillaun, Menlough and Angliham (RPS, 2006). None of the winter roost sites are within the construction or operational disturbance ZoI and would not therefore displace Hen harrier.

Therefore, disturbance or displacement of Hen harrier from the SPA or from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Lough Corrib SPA (see **Table 9.30**).

Coot

Coot were recorded at three of the winter bird sites surveyed in 2014/15: Ballindooley Lough (WB02), the Coolagh Lakes (WB04), and along the River Corrib corridor (WB12, and also recorded here in RPS, 2006). Although Coot were regularly recorded at all of these sites, the numbers were low with a maximum of 11 recorded at Ballindooley Lough in February/March 2015 (corresponding with what could be 0.08% of the SPA's baseline winter population of 14,473).

Coot were recorded either on open water or amongst the fringing aquatic vegetation at each of these locations. At each of the winter bird sites these habitats are present within the general construction disturbance ZoI and some level of disturbance/displacement would be expected. However, disturbance would only affect relatively low numbers of Coot in the context of the SPA population. Both

[51] Information from the current version of the Site Synopsis for the SPA (not available on the NPWS website at the time of writing) and from consultation with NPWS staff members – due to the sensitive nature of the locations of Hen harrier roosting sites the winter roost locations were provided in confidence and are not therefore mapped nor are distances to the winter roost sites published.

the construction and operational disturbance ZoI at the Coolagh Lakes and along the River Corrib corridor covers a relatively small area in the context of suitable alternative habitat available for the species locally, and during construction disturbance effects will not displace Coot from those sites. During operation, Coot would not be displaced from habitat within these winter bird sites.

Blasting at Ballindooley and Castlegar has the potential to disturb and displace wintering birds using Ballindooley Lough and mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Golden plover

Golden plover were recorded at two of the winter bird sites surveyed in 2014/15: to the east and west of Lough Inch (WB06 and WB08, respectively). The survey site east of Lough Inch is more than 700m from the proposed road development, a distance well beyond the construction and operational disturbance ZoI at which disturbance or displacement effects would affect usage of the area by Golden plover.

Golden plover were recorded frequently at WB08 (on four out of seven survey visits) but, on all but one occasion when a flock of 73 were recorded (November 2014), in relatively low numbers (maximum of 9 birds, which corresponds with what could be 0.5% of the SPA's baseline winter population of 1,727; the record of 73 would equate to 4.2%). The proposed road development only clips the southernmost edges of this winter bird site, in an area with a relatively high density of residential dwellings for an upland area, far removed (more than 700m away) from the peatlands west of Lough Inch where the birds were observed. At this distance, disturbance or displacement effects associated with either construction or operation of the proposed road development would not affect usage of the area by Golden plover.

Therefore, disturbance or displacement of Golden plover from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Lough Corrib SPA (see **Table 9.30**).

Black-headed gull (breeding and wintering)

Although Black-headed gull were recorded along the River Corrib corridor during the 2015 breeding bird surveys undertaken for the proposed road development, and were also recorded along the River Corrib as part of the 2006 surveys undertaken for the N6 Galway City Outer Bypass (RPS, 2006), any disturbance/displacement of birds as a result of bridge construction works will only be confined to the immediate vicinity of the proposed River Corrib Bridge and will not prevent birds feeding or commuting along the river corridor. Temporary displacement from such a relatively small habitat area during construction will not affect the breeding success of the species in any way. The operation of the proposed road development, particularly given its elevation above the river (c.10m), will not displace birds from the area.

In winter, Black-headed gull were recorded widely across Galway City and its environs (from 39 out of the 60 winter bird sites surveyed in 2014/2015) and in numbers ranging from single individuals to a flock of 130 birds; the average count per surveyed site per month was 20. Those sites within 300m of the proposed road development which recorded the larger flocks of over 40 individuals, were the River Corrib corridor (WB12) and the NUIG Sporting Campus (WB45). Black-headed gull were also frequently recorded along the River Corrib corridor during surveys undertaken in 2006 for the N6 Galway City Outer Bypass (RPS, 2006). Beyond the construction and operational disturbance ZoI there are other sites locally where larger flocks were recorded (>40 individuals), and are likely to be of importance to the local population: several urban parks within Galway City (WB28, WB31, WB38, and WB44) and fields along the northern shore of Oranmore Bay (WB71), where 130 were recorded in October 2014 (the highest single record during the surveys).

Accounting for the fact that along the River Corrib corridor the majority of birds were recorded in the area immediately upstream of the Salmon Weir, the NUIG Sporting Campus is the only one of these winter bird sites likely to be subject to significant disturbance/displacement effects during construction.

Operational displacement will not pose a significant risk at this site given that birds recorded in parks throughout Galway City have habituated to the proximity of existing roads and that the proposed road development would be elevated above ground level through the NUIG Sporting Campus, visually screening habitats used by the gulls from traffic. It was also noted during the surveys at this site, that birds were regularly disturbed and temporarily displaced from playing fields by users of the sports facilities; quickly settling/returning to the same field or relocating to another nearby.

Black-headed gull were recorded in four of the seven survey visits to the NUIG Sporting Campus, with 47 the maximum number recorded on any one visit (February 2015); a number which could represent approximately 23.9% of the SPA's baseline population of 197, and an average of 30 over the survey period which would account for approximately 15.2%. Despite the percentage of the baseline population that could potentially be displaced during construction at NUIG Sporting Campus, it is considered that this impact will not affect numbers, distribution, or the existing population trend for the species in the SPA (current data on the species' population trend in the SPA is not currently published on the NPWS website) given the abundance of alternative suitable habitat, (e.g. amenity grassland) both within the NUIG Sporting Campus and in the wider area (as evidenced by the 39 sites at which the species was recorded throughout Galway City and its environs), and the transient usage by Black-headed gulls of the majority of the surveyed sites used within the N6 Galway City Transport Project scheme study area (Arup, 2016).[52]

Therefore, disturbance or displacement of Black-headed gull from potential ex-situ sites, during construction or operation of the proposed road development, will not

[52] 77% of positive survey sites (i.e. where Black-headed gull were recorded at least once) only had the species present on three or fewer of the seven survey visits; only one surveyed site, the River Corrib corridor, had records of the species from all survey visits

affect the conservation objective attributes and targets supporting the conservation condition of this species in Lough Corrib SPA (see **Table 9.30**).

Common gull

Although Common gull were recorded along the River Corrib corridor during the 2015 breeding bird surveys undertaken for the proposed road development, and were also recorded along the River Corrib as part of the 2006 surveys undertaken for the N6 Galway City Outer Bypass (RPS, 2006), any disturbance/displacement of birds as a result of bridge construction works will be confined to the immediate vicinity of the proposed River Corrib Bridge and will not prevent birds feeding or commuting along the river corridor. Temporary displacement from such a relatively small habitat area during construction will not affect the breeding success of the species in any way. The operation of the proposed road development, particularly given its elevation above the river (c.10m), will not displace birds from the area.

In winter, Common gull were recorded widely across Galway City and its environs (from 27 out of the 60 winter bird sites surveyed in 2014/2015) and in numbers ranging in size from single individuals to a flock of 120 birds. Of the 27 survey sites at which Common gull were recorded, eight are within 300m of the proposed road development. With the exception of the River Corrib (WB12) and the NUIG Sporting Campus (WB45), Common gull were recorded infrequently (on one out of the seven survey visits) and in low numbers (16 or fewer individuals) in affected sites. This is consistent with the trend across all 27 positive sites in the scheme study area where at 23 of those, Common gull were only recorded on one or two of the seven survey visits and at 21 surveyed sites fewer than ten birds were recorded during all survey visits.

Although frequently recorded in the River Corrib survey site (on six out of seven survey visits for this study), and also frequently recorded along the River Corrib corridor during surveys undertaken in 2006 for the N6 Galway City Outer Bypass (RPS, 2006), the larger flocks were recorded on only two occasions. These larger flock records were at locations more than 2km from the proposed River Corrib Bridge, in the area immediately upstream of the Salmon Weir, in September and November 2014 where 48 and 78 birds were recorded, respectively. At this distance, disturbance or displacement effects associated with either construction or operation of the proposed road development would not affect usage of the area by Common gull.

Common gull were less frequently recorded at the NUIG Sporting Campus (on three of the seven survey visits) with only single birds recorded on two occasions, a flock of 21 were recorded in November 2014.

Overall, the potential displacement of relatively significant numbers of Common gull during construction or operation (a record of 21 corresponds with what could be <43.8% of the SPA's baseline winter population of 48) will not affect numbers, distribution, or the existing population trend for the species in the SPA[53] given the transient usage by Common gulls of the majority of the surveyed sites at which they were present, and the abundance of suitable alternative habitat available (i.e. the

[53] Current data on the species' population trend in the SPA is not currently published on the NPWS website

majority of the 27 sites used by the species locally comprised managed amenity grassland or managed agricultural fields along the coastline).

Therefore, disturbance or displacement of Common gull from potential ex-situ sites during construction or operation of the proposed road development will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Lough Corrib SPA (see **Table 9.30**).

Common tern

Although Common tern were recorded along the River Corrib corridor during the 2015 breeding bird surveys, and were also recorded along the River Corrib as part of the 2006 surveys for the N6 Galway City Outer Bypass (RPS, 2006), any disturbance/displacement of birds as a result of bridge construction works will only be confined to the immediate vicinity of the proposed River Corrib Bridge and will not prevent birds feeding or commuting along the river corridor. Temporary displacement from such a relatively small habitat area within the average foraging range for the species (c.15km, which includes the whole of Lough Corrib) during construction will not affect the breeding success of the species in any way. The operation of the proposed road development, particularly given its elevation above the river (c.10m), will not displace birds from the area.

Therefore, disturbance or displacement of Common tern from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Lough Corrib SPA (see **Table 9.30**).

Summary

A summary of the potential disturbance/displacement impacts at potential ex-situ sites associated with the proposed road development are presented in **Table 9.27** below.

Table 9.27: Summary of Disturbance/Displacement Impacts at Potential Ex-situ Sites

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Construction		
General construction works disturbing/displacing SCI bird species at potential ex-situ sites outside of Lough Corrib SPA	No As construction related disturbance will not restrict the extent of habitat available to any SCI species such that any population level effects would occur	No
Long-term blasting at Lackagh Quarry and Castlegar disturbing displacing bird species listed as SCIs of Lough Corrib SPA at Ballindooley Lough	Yes As long-term blasting could displace SCI listed bird species from Ballindooley Lough for	Yes Seasonal restriction to blasting works in the vicinity of Ballindooley Lough to ensure no

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Construction		
	one or more winter seasons; potentially negatively affecting the wintering SPA population	long-term disturbance or displacement **Section 10.8**
Operation		
Disturbing/displacing SCI bird species at potential ex-situ sites outside of Lough Corrib SPA during operation	No As operational disturbance will not restrict the extent of habitat available to any SCI species such that any population level effects would occur	No

9.3.4.4 Habitat loss/fragmentation – at potential ex-situ sites

The proposed road development will result in varying degrees of habitat loss in nine of the winter bird sites where bird species listed as SCIs of Lough Corrib SPA were recorded: WB01, WB02, WB03, WB07, WB08, WB10, WB16, WB23 and WB45.

Overall, the areas of habitat loss are small relative to the extent of each affected winter bird survey site. The habitat types being lost are also common and widespread in the wider locality, in particular the peat/heathland habitats between Bearna and the N59 Moycullen Road, which extend to the north-west into Connemara. Similarly, for birds (as highly mobile species), habitat fragmentation is only likely to be an issue where it would result in the fragmented habitat patches being unviable in the long-term due to their reduced size, and consequently limit the availability of large areas of a given habitat type locally. In most cases the proposed road development clips these winter bird sites along their southern boundary (WB01, WB02, WB03, WB07, WB08, WB10 and WB23) and the effects of habitat fragmentation are minimal, particularly given that for some winter bird sites (e.g. WB01) the habitats represented are only a small proportion of those same habitats in the locality.

Loss of habitat, and any associated habitat fragmentation, at the winter bird sites will not result in a decline in the number and range of habitat areas available locally to bird species listed as SCIs of Lough Corrib SPA and will not therefore, affect the conservation objective attributes and targets supporting the conservation condition of SCI populations in Lough Corrib SPA (see **Table 9.30**).

Summary

A summary of the potential habitat loss and fragmentation impacts at potential ex-situ sites associated with the proposed road development are presented in **Table 9.28** below.

Table 9.28: Summary of Habitat Loss/Fragmentation Impacts at Potential Ex-situ Sites

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Construction/Operation		
Habitat loss and fragmentation at potential ex-situ sites outside of Lough Corrib SPA affecting habitat area available to SCI bird species	No As the scale of habitat loss and fragmentation will not restrict the extent of habitat available to any SCI species such that any population level effects would occur	No

9.3.4.5 Summary

This section presents a summary of the potential impacts on the SCI bird populations of Lough Corrib SPA as a result of the proposed road development and how these impacts relate to affecting the site's conservation objectives.

Table 9.29 below, lists the SCIs of Lough Corrib SPA and how the impacts discussed below relate to each. Those highlighted in green are those SCIs which are present within the ZoI of, and potentially affected by, the proposed road development.

Table 9.29: SCIs of Lough Corrib SPA and Potential Impacts

SCIs	Impact
Greenland white-fronted goose *Anser albifrons flavirostris* [A395] – Wintering	No potential impact – none recorded within ZoI.
Gadwall *Anas strepera* [A051] – Wintering	No potential impact – none recorded within ZoI.
Shoveler *Anas clypeata* [A056] – Wintering	Habitat degradation – hydrology Disturbance/displacement at potential ex-situ sites
Pochard *Aythya ferina* [A059] – Wintering	No potential impact – none recorded within ZoI.
Tufted duck *Aythya fuligula* [A061] – Wintering	Habitat degradation – hydrology Disturbance/displacement at potential ex-situ sites
Common scoter *Melanitta nigra* [A065] – Breeding	No potential impact – none recorded within ZoI.
Hen harrier *Circus cyaneus* [A082] – Wintering	None of the potential impacts will affect the winter roost site(s)
Coot *Fulica atra* [A125] – Wintering	Habitat degradation – hydrogeology at potential ex-situ sites (Coolagh Lakes) Habitat degradation – hydrology Disturbance/displacement at potential ex-situ sites

SCIs	Impact
Golden plover *Pluvialis apricaria* [A140] – Wintering	Habitat degradation – hydrology
Black-headed gull *Chroicocephalus ridibundus* [A179] – Breeding/Wintering	Habitat degradation – hydrogeology at potential ex-situ sites (Coolagh Lakes) Habitat degradation – hydrology Disturbance/displacement at potential ex-situ sites
Common gull *Larus canus* [A182] – Breeding/Wintering	Habitat degradation – hydrology
Common tern *Sterna hirundo* [A193] – Breeding	Habitat degradation – hydrology
Arctic tern *Sterna paradisaea* [A194] – Breeding	No potential impact – none recorded within ZoI.
Wetlands [A999]	Habitat degradation – hydrogeology at potential ex-situ sites Habitat degradation – hydrology

The relationship between, and potential influence of, these impacts with respect to the SCI listed bird species within the ZoI of the proposed road development and the attributes/targets upon which their favourable conservation condition is considered and measured, is considered further below and also presented in **Table 9.30**.

Shoveler [A056]

The proposed road development could affect surface water quality at potential ex-situ sites used by wintering Shoveler during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and extent of wetland habitat available. These impacts could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Long-term blasting in the vicinity of Ballindooley Lough could displace Shoveler from this site for one or more winter seasons. This impact could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Tufted duck [A061]

The proposed road development could affect surface water quality at potential ex-situ sites used by wintering Tufted duck during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and extent of wetland habitat available. These impacts could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Long-term blasting in the vicinity of Ballindooley Lough could displace Tufted duck from this site for one or more winter seasons. This impact could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Coot [A125]

The proposed road development could affect water quality in the River Corrib and groundwater and/or surface water quality at potential ex-situ sites used by wintering Coot during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and extent of wetland habitat available. These impacts could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Long-term blasting in the vicinity of Ballindooley Lough could displace Coot from this site for one or more winter seasons. This impact could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Golden plover [A140]

The proposed road development could affect surface water quality at potential ex-situ sites used by wintering Golden plover during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and extent of wetland habitat available. These impacts could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Black-headed gull [A179]

The proposed road development could affect water quality in the River Corrib and groundwater and/or surface water quality at potential ex-situ sites used by breeding/wintering Black-headed gull during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and extent of wetland habitat available. These impacts could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Long-term blasting in the vicinity of Ballindooley Lough could displace Black-headed gull from this site for one or more winter seasons. This impact could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Common gull [A182]

The proposed road development could affect water quality in the River Corrib and groundwater and/or surface water quality at potential ex-situ sites used by breeding/wintering Golden plover during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and extent of wetland habitat available. These impacts could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Common tern [A193]

The proposed road development could affect water quality in the River Corrib used by breeding Common tern during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and extent of wetland habitat available. These impacts could potentially negatively affect the long-term population trends of the Lough Corrib SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

Wetlands [A999]

The permanent area of wetland habitat could be negatively affected as a result of hydrogeological impacts and/or hydrological impacts.

The proposed road development could affect the groundwater quality at potential ex-situ sites used by wintering bird species listed as SCIs for Lough Corrib SPA. Groundwater quality impacts could affect the type, quality and extent of wetland habitat available to SCI bird species at those ex-situ sites which lie within the hydrogeological ZoI. The design of the proposed road development avoids any long-term impacts to the existing groundwater regime that would affect any of the potential ex-situ sites used by SCI listed wintering birds. However, mitigation measures are required in the event that any groundwater conduits are encountered during construction and to ensure that karst features do not affect the functioning of the infiltration basins during operation.

The proposed road development could affect the quality of surface water in the receiving environment which supports freshwater and wetland habitats, within potential ex-situ sites used by SCI birds species of Lough Corrib SPA (Ballindooley Lough in particular).

Table 9.30: Potential Impacts on the Conservation Objectives of Lough Corrib SPA (Those rows highlighted in green are the attributes potentially affected by the proposed road development)

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Greenland white-fronted goose, Gadwall, Pochard, Common scoter To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Population trend: Percentage change	Long term population trend stable or increasing	No Species are not present within the ZoI of the proposed road development	No
Distribution: Number and range of areas used by waterbirds	No significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation	No Species are not present within the ZoI of the proposed road development	No
Shoveler, Tufted duck To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Population trend: Percentage change	Long term population trend stable or increasing	Construction impacts on the existing hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Distribution: Number and range of areas used by waterbirds	No significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation	Construction impacts on the existing hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**
Coot To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Population trend: Percentage change	Long term population trend stable or increasing	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Distribution: Number and range of areas used by waterbirds	No significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**
Golden Plover To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Population trend: Percentage change	Long term population trend stable or increasing	Construction impacts on the existing hydrological regime supporting wetland habitats at potential ex-situ sites	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Distribution: Number and range of areas used by waterbirds	No significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation	Construction impacts on the existing hydrological regime supporting wetland habitats at potential ex-situ sites	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Hen harrier To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Roost attendance: individual hen harriers: Number	No significant decline	No None of the impacts associated with the proposed road development will result in a decline of Hen harrier numbers at winter roosts in the SPA	No

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Suitable foraging habitat: hectares	No significant decline	No Based on the known records for Hen harrier in the southern part of Lough Corrib, none of the potential impacts associated with the proposed road development will result in a decline of suitable Hen harrier foraging habitat either inside or outside of the SPA	No
Roost site: condition: Area (hectares); structure	The roost site should be maintained in a suitable condition	No None of the potential impacts associated with the proposed road development will affect habitat condition at the winter roost sites	No
Disturbance at the roost site: Level of impact	Human activities should occur at levels that do not adversely affect the Hen Harrier winter roost population	No The proposed road development will not increase disturbance levels at the roost sites and there will be no effects on this attribute/target	No
Black-headed gull To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Population trend: Percentage change	Long term population trend stable or increasing	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Distribution: Number and range of areas used by waterbirds	No significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**
Breeding population abundance: apparently occupied nests (AONs): Number	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Productivity rate: fledged young per breeding pair: Mean number	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Distribution: breeding colonies: Number; location; area (hectares)	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Prey biomass available: Kilogrammes	No significant decline	No	No

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
		None of the impacts associated with the proposed road development will affect prey availability for this species and there will be no effects on this attribute/target	
Barriers to connectivity: Number; location; shape; area (hectares)	No significant increase	No The proposed River Corrib Bridge will not pose a barrier to connectivity along the River Corrib Corridor and therefore there will be no effects on this attribute/target	No
Disturbance at breeding site: Level of impact	Human activities should occur at levels that do not adversely affect the breeding Arctic tern population	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Common gull To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Population trend: Percentage change	Long term population trend stable or increasing	Construction impacts on the existing hydrological regime supporting wetland habitats at potential ex-situ sites	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Distribution: Number and range of areas used by waterbirds	No significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation	Construction impacts on the existing hydrological regime supporting wetland habitats at potential ex-situ sites	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Breeding population abundance:	No significant decline	No	No

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
apparently occupied nests (AONs): Number		As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	
Productivity rate: fledged young per breeding pair: Mean number	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Distribution: breeding colonies: Number; location; area (hectares)	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Prey biomass available: Kilogrammes	No significant decline	No None of the impacts associated with the proposed road development will affect prey availability for this species and there will be no effects on this attribute/target	No
Barriers to connectivity: Number; location; shape; area (hectares)	No significant increase	No The proposed River Corrib Bridge will not pose a barrier to connectivity along the River Corrib Corridor and therefore there will be no effects on this attribute/target	No
Disturbance at breeding site: Level of impact	Human activities should occur at levels that do not adversely	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed	No

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
	affect the breeding Arctic tern population	road development, there will be no effects on this attribute/target	
Common tern To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Breeding population abundance: apparently occupied nests (AONs): Number	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Productivity rate: fledged young per breeding pair: Mean number	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, and foraging areas will not be restricted, there will be no effects on this attribute/target	No
Distribution: breeding colonies: Number; location; area (hectares)	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Prey biomass available: Kilogrammes	No significant decline	Yes Construction impacts on water quality in the River Corrib could affect prey abundance for breeding colonies that forage along the river	Measures to maintain water quality in receiving watercourses during construction **Section 10.4**
Barriers to connectivity:	No significant increase	No The proposed River Corrib Bridge will not pose a barrier to connectivity along the River Corrib	No

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Number; location; shape; area (hectares)		Corridor and therefore there will be no effects on this attribute/target	
Disturbance at breeding site/roosting site: Level of impact	Human activities should occur at levels that do not adversely affect the breeding Arctic tern population or the numbers of terns at post-breeding roosting sites	No As the breeding colonies (more than 8.5km to the north of the proposed River Corrib Bridge) are beyond the ZoI of any of the impacts associated with the proposed road development, and there are no known post-breeding roosting sites within the ZoI, and any disturbance along the River Corrib during construction will be temporary and restricted to the immediate vicinity of the construction works, there will be no effects on this attribute/target	No
Arctic tern To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA:			
Breeding population abundance: apparently occupied nests (AONs): Number	No significant decline	No As the species has not been recorded within the ZoI of the proposed road development, and the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on these attributes/targets	No
Productivity rate: fledged young per breeding pair: Mean number	No significant decline		
Distribution: breeding colonies: Number; location; area (hectares)	No significant decline		
Distribution: roosting areas:	No significant decline		

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Number; location; area (hectares)			
Prey biomass available: Kilogrammes	No significant decline		
Barriers to connectivity: Number; location; shape; area (hectares)	No significant increase		
Disturbance at breeding/roosting site: Level of impact	Human activities should occur at levels that do not adversely affect the breeding Arctic tern population or the numbers of terns at post-breeding roosting sites		
Wetlands To maintain or restore the favourable conservation condition of wetland habitat in Lough Corrib SPA as a resource for the regularly occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:			
Habitat area: Hectares	The permanent area occupied by the wetland habitat should be stable	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

9.4 Inner Galway Bay SPA

9.4.1 Special Conservation Interests and Conservation Objectives of Inner Galway Bay SPA

The SCI bird species for which Inner Galway Bay SPA is designated, and the overarching conservation objective for each, are listed below in **Table 9.31**. Those highlighted (in green) are the SCIs which are within the ZoI of the proposed road development. As Inner Galway Bay SPA lies downstream of the proposed road development, all of the SCI bird species (and the Wetlands & Waterbirds SCI) could potentially be affected via some (or all) of the potential impacts discussed above.

Table 9.31: SCIs of Inner Galway Bay SPA[54]

SCIs	Conservation Objective
Great northern diver *Gavia immer* [A003] – Wintering	To maintain the favourable conservation condition
Cormorant *Phalacrocorax carbo* [A017] – Breeding/Wintering	To maintain the favourable conservation condition
Grey heron *Ardea cinerea* [A028] – Wintering	To maintain the favourable conservation condition
Light-bellied brent goose *Branta bernicla hrota* [A046] – Wintering	To maintain the favourable conservation condition
Wigeon *Anas penelope* [A050] – Wintering	To maintain the favourable conservation condition
Teal *Anas crecca* [A052] – Wintering	To maintain the favourable conservation condition
Shoveler *Anas clypeata* [A056] – Wintering	To maintain the favourable conservation condition
Red-breasted merganser *Mergus serrator* [A069] – Wintering	To maintain the favourable conservation condition
Ringed plover *Charadrius hiaticula* [A137] – Wintering	To maintain the favourable conservation condition
Golden plover *Pluvialis apricaria* [A140] – Wintering	To maintain the favourable conservation condition
Lapwing *Vanellus vanellus* [A142] – Wintering	To maintain the favourable conservation condition
Dunlin *Calidris alpina* [A149] – Wintering	To maintain the favourable conservation condition
Bar-tailed godwit *Limosa lapponica* [A157] – Wintering	To maintain the favourable conservation condition
Curlew *Numenius arquata* [A160] – Wintering	To maintain the favourable conservation condition

[54] NPWS (2013f) Conservation Objectives: Inner Galway Bay SPA 004031. Version 1. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.

SCIs	Conservation Objective
Redshank *Tringa totanus* [A162] – Wintering	To maintain the favourable conservation condition
Turnstone *Arenaria interpres* [A169] – Wintering	To maintain the favourable conservation condition
Black-headed gull *Chroicocephalus ridibundus* [A179] – Wintering	To maintain the favourable conservation condition
Common gull *Larus canus* [A182] – Wintering	To maintain the favourable conservation condition
Sandwich tern *Sterna sandvicensis* [A191] – Breeding	To maintain the favourable conservation condition
Common tern *Sterna hirundo* [A193] – Breeding	To maintain the favourable conservation condition
Wetlands and Waterbirds [A999]	To maintain the favourable conservation condition

In conjunction with considering the generic conservation objective "To maintain or restore the favourable conservation condition of the bird species listed as Special Conservation Interests for this SPA", a site specific conservation objectives document is available for Inner Galway Bay SPA (NPWS, 2013f) which sets out the attributes, measures and targets that define the favourable conservation condition of the SCI species within the European site. Affecting the conservation condition of SCI species would constitute an adverse effect on the integrity of Inner Galway Bay SPA.

The specific attributes and targets used to define the conservation objectives of the SCI species within the ZoI of the proposed road development are presented in **Table 9.37** below.

The baseline populations, and population trends, of the SCIs are taken from the data presented in Table 2.1 of *Inner Galway Bay Special Protection Area (Site Code 4031) Conservation Objectives Supporting Document, Version 1* (National Parks and Wildlife Service, 2013d).

9.4.2 Ecological Baseline

As Inner Galway Bay SPA covers approximately the same area as Galway Bay Complex cSAC, refer to the habitat description above in **Section 9.2.2**. The habitats within the SPA support the SCI bird species, providing nesting, foraging and roosting sites which include open water, intertidal and terrestrial habitats.

As noted above for Lough Corrib SPA, bird species listed as winter SCI species of the SPA were recorded at many of the winter bird survey sites across the scheme study area, the majority of which are remote from the SPA itself.

There were two bird species recorded during the breeding bird surveys which are listed as SCIs of Inner Galway Bay SPA for their breeding population: Common tern (along the River Corrib) and Cormorant (flying overhead in the vicinity of the River Corrib corridor and in the western part of the scheme study area). The full breeding bird survey results are provided in **Appendix H**.

The results of the breeding bird surveys with respect to these species are shown on **Figures 8.1** to **8.2**.

These results are generally consistent with the findings of the surveys carried out along the River Corrib corridor in 2005/2006 for the N6 Galway City Outer Bypass project (RPS, 2006), where these species were recorded frequently over the summer months along the river, but in low numbers.

The full results of the winter bird surveys, as they relate to those species listed as SCIs of Lough Corrib SPA and Inner Galway Bay SPA, are provided in **Appendix I**. The winter bird survey sites referred to therein are shown on **Figure 9**.

9.4.3 Potential Direct and Indirect Impacts

As the proposed road development does not cross the SPA, none of the SCI species, or their supporting habitats within the SPA, are directly impacted by the proposed road development. At its nearest point, the proposed road development is more than 1km from the SPA boundary and therefore, there is no risk of disturbance/displacement of SCI birds from habitats within the SPA.

However, there are the following impacts by which the proposed road development could (in the absence of mitigation measures) potentially affect SCI bird species or their supporting wetland habitats within Inner Galway Bay SPA:

- Habitat degradation as a result of hydrogeological impacts - the proposed road development has the potential to affect the existing hydrogeological regime supporting groundwater dependant wetland habitats (at potential ex-situ sites) which in turn support wintering bird species listed as SCIs of Inner Galway Bay SPA
- Habitat degradation as a result of hydrological impacts - the proposed road development has the potential to affect water quality in receiving watercourses and in Galway Bay supporting aquatic, wetland, estuarine and marine habitats (within the SPA and at potential ex-situ sites) which in turn support bird species listed as SCIs of Lough Corrib SPA
- Disturbance/displacement - disturbance during construction and/or operation could result in the displacement of SCI birds from important habitat areas at potential ex-situ sites
- Habitat loss/fragmentation - the proposed road development passes through, and will result in habitat loss in potential ex-situ sites where SCI bird species were recorded.

9.4.4 Examination and Analysis of Potential Direct and Indirect Impacts

9.4.4.1 Habitat degradation as a result of hydrogeological impacts

As discussed above in relation to Lough Corrib SPA, in terms of interaction with groundwater, the proposed road development has the potential to affect both groundwater quantity (dewatering of the bedrock aquifer and drawdown effects during construction, and drawdown effects during operation as a consequence of road cuttings) and groundwater quality within the receiving environment.

The only wintering bird survey site in the western part of the study area that supports SCI bird species and lies within the hydrogeological ZoI is WB07 (An Chloch Scoilte). At this winter bird site, the hydrogeological ZoI (1.8m between Ch. 1+600 and Ch. 1+950, and 10.6m between Ch. 2+230 and Ch. 2+640) does not extend to affect any groundwater dependant habitat areas (e.g. wet heath) and therefore, it will not affect the suitability of this peatland/scrub habitat mosaic to continue to support wintering birds. More generally, across the western section of the proposed road development, the proposed road development passes through areas of dense scrub and/or bracken, and improved/wet agricultural grasslands. Equally, the effects of the proposed road development in terms of hydrogeological impacts will not affect the suitability of the site to support wintering birds.

Along the eastern part of the proposed road development, only two wetland areas supporting groundwater dependant habitats lie within the unmitigated hydrogeological ZoI: Coolagh Lakes and Ballindooley Lough (refer to Table 5 of **Appendix A** for the zone of influence associated with each of the cuttings).

The proposed road development lies within the same groundwater body that supplies groundwater to the Coolagh Lakes (Lough Corrib Fen 1 (Menlough) GWB and the Lough Corrib Fen 1 (Lackagh) GWB) – see **Figure 10.2.2** and **Figures 10.3.3** to **10.3.4**). As discussed above in **Section 9.1.4.3** (Lough Corrib cSAC), only the groundwater supply to the Coolagh Lakes (WB04) could potentially be affected during the construction of the piers for Menlough Viaduct (although this is highly unlikely to occur). This site was not frequently used by bird species listed as SCIs of the SPA and, when recorded the numbers were low (generally between one and five individuals) – see **Appendix I**. Considering this, and that the River Corrib also contributes to the Coolagh Lakes, whilst some degree of effect on water levels and extent might occur, it would not result in the area being unusable or unable to support those wintering bird species recorded there (and in the numbers recorded). In any case, mitigation measures are included to prevent such an impact occurring and the proposed road development poses no risk to groundwater quantity or quality supplying the Coolagh Lakes (see **Section 10.3**). As discussed in both **Appendix A** and **Appendix F**, the proposed road development will not restrict or inhibit existing groundwater flow paths supporting groundwater dependant habitats.

As described in the Hydrogeology Assessment Report in **Appendix A**, Ballindooley Lough is up gradient from the proposed road development in both groundwater bodies that supply groundwater to that lake (Clare-Corrib

(Ballindooley East) GWB and the Clare-Corrib (Ballindooley West) GWB). Therefore, the proposed road development poses no risk to groundwater quantity or quality supplying Ballindooley Lough.

There is a risk, in those sections of the proposed road development underlain by limestone, of accidental spills during construction in areas where the bedrock outcrops, such as those areas where the groundwater has extreme or high vulnerability (Figure 3.01 and 3.02 of **Appendix A**) or where the karst limestone outcrops due to cuttings and excavations. Mitigation measures are required to ensure that groundwater quality is not affected during construction (see **Section 10.3**).

The drainage design of the proposed road development (as described in **Section 2**) will ensure that groundwater quality will be maintained during operation – as outlined in **Appendix A** and **Appendix F**.

Although the drainage design (as described in **Section 6**, and **Appendices G**, **H** and **I)** will ensure that groundwater quality will be maintained during operation, it is important that infiltration basins are inspected to ensure that karst features do not affect their functioning during operation. If this is identified during routine inspections of the infiltration basins then mitigation is required to ensure any issues are addressed so that they continue to function as designed for the operational lifespan of the proposed road development (see **Section 10.3**)

Summary

A summary of the potential hydrogeological impacts associated with the proposed road development are presented in **Table 9.32** below.

Table 9.32: Summary of Hydrogeological Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Construction		
Construction works affecting groundwater quantity	No Although the proposed road development has the potential to affect groundwater supply to wetland habitats locally, this will not affect their usage by birds such that any population level effects would occur to the SCI populations	No
Construction works affecting groundwater quality	Yes Affecting the quality of groundwater supporting groundwater dependant habitats could affect the type, quality and extend of suitable habitat available to SCI bird species	To ensure that construction works will not affect groundwater quality in the underlying aquifer (**Section 10.3**)

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Operation		
Groundwater quantity being affected during operation	No Although the design of the proposed road development will not restrict or inhibit existing groundwater flow paths supporting groundwater dependant habitats used by bird species listed as SCIs of Inner Galway Bay SPA, it is important that they are inspected to ensure that karst features do not affect the functioning of the infiltration basins during operation	Yes To ensure that the infiltration basins continue to function as designed for the operational lifespan of the proposed road development (as outlined in **Section 10.3**)
Groundwater quality being affected during operation	Yes Although the drainage design (as described in **Section 2**, and **Appendices G**, **H** and **I**) will ensure that groundwater quality will be maintained during operation, it is important that they are inspected to ensure that karst features do not affect the functioning of the infiltration basins during operation	Yes To ensure that the infiltration basins continue to function as designed for the operational lifespan of the proposed road development (as outlined in **Section 10.3**)

9.4.4.2 Habitat degradation as a result of hydrological impacts during construction

During construction, contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water feature has the potential to have a negative impact on water quality in receiving watercourses and consequently downstream in Galway Bay. There is also the potential for construction works to affect water quality in the River Corrib, Coolagh Lakes and Ballindooley Lough; all wetland sites supporting bird species listed as SCIs of Inner Galway Bay SPA. As discussed in **Section 9.1.4.4** (in relation to Lough Corrib cSAC and the River Corrib and Coolagh Lakes) the hydrological regime supporting the wetland habitats at these sites will not be affected. The effects of frequent and/or prolonged pollution events in a river system have the potential to be extensive and far-reaching, and could potentially have significant long-term effects. In an extreme scenario, with a pollution event of sufficient magnitude, the marine environment could also be affected.

However, it is extremely unlikely that a pollution event of such a magnitude would occur during construction. Any pollution events that may occur would be expected to be relatively minor in comparison to the dilution factor and assimilative capacity of a coastal water body the size of Galway Bay, or to be any more than temporary

in nature, and therefore is unlikely to have any perceptible or far-reaching effects within the bay. Nevertheless, a precautionary approach is being taken in assuming a level of risk of water quality impacts and mitigation measures are required to minimise the risk of the proposed road development having any perceptible effect on water quality during construction.

There will be outfall points to surface water features from the proposed road drainage network during operation. However, given the drainage design as described in **Sections 2** and **10**, and in **Appendix A**, **Appendix B** and **Appendix C** (which includes attenuation and pollution control elements) the normal operating water quality of the drainage outfalls, even in the unlikely event of a pollution incident, will not result in any perceptible impact on water quality in receiving watercourses or in Galway Bay. There will not be any drainage discharges to the Coolagh Lakes.

Summary

A summary of the potential direct or indirect impacts to the hydrological regime associated with the proposed road development are presented in **Table 9.33** below.

Table 9.33: Summary of Hydrological Impacts

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Construction		
Construction works affecting surface water quality	Yes Affecting the quality of surface water in the receiving environment in Galway Bay (or at any important ex-situ sites) could potentially affect habitat quality and usage of important habitat areas by SCI species, which in turn could affect the conservation objective to maintain the distribution of areas used by SCI waterbirds	Yes To ensure that water quality in the receiving environment is not affected during construction (**Section 10.4**)

9.4.4.3 Disturbance/displacement – at potential ex-situ sites

As discussed in **Section 7.8**, only those winter bird, or potential "ex-situ", sites which lie within 300m of the proposed road development, or those that lie within 800m of areas where prolonged blasting activity is likely, are predicted to be subject to some level of prolonged construction related disturbance. Of the 60 winter bird sites surveyed, 19 fall within or partially within this disturbance ZoI; and of those, eight supported bird species listed as SCIs for Inner Galway Bay SPA: Cormorant, Grey heron, Dunlin, Wigeon, Teal, Shoveler, Red-breasted merganser, Lapwing, Bar-tailed godwit, Curlew, Redshank, Black-headed gull, Common Gull and Common tern. The full results of the winter bird surveys are provided in **Appendix I**.

Great northern diver

Great northern diver were only recorded at one of the winter bird sites surveyed in 2014/15; an area of coastal grasslands at Ballyloughaun (WB30) bounding the SPA, where a single bird was recorded in January 2015. This location is more than 1.9km from the proposed road development and buffered from it by urban development and the expanse of Merlin Park Woods. At this distance, disturbance or displacement effects associated with either construction or operation of the proposed road development would not affect usage of this area by Great northern diver.

Therefore, disturbance or displacement of Great northern diver from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Cormorant

Cormorant were recorded at six winter bird survey sites across the scheme study area (WB02, WB04, WB07, WB08, WB12, and WB31) but in all instances the numbers recorded were low; generally one or two individuals, with the exception of a record for four in February 2015 along the River Corrib (WB12). Two of these sites, WB07 and WB31, are beyond the general construction disturbance ZoI, within which some level of disturbance effects would be likely. Cormorant were also frequently recorded along the River Corrib corridor during surveys undertaken in 2005/2006 for the N6 Galway City Outer Bypass (RPS, 2006). Records of one or two individuals would correspond with less than 1% of the SPA's baseline winter population of 266. The absence of any suitable breeding habitat (rocky islets, sea stacks, cliffs etc.) within areas affected by the proposed road development, and with the traditional Deer Island breeding site more than 5.5km to the south across Galway Bay, the proposed road development would not have any disturbance related effects on the breeding population. At most winter bird sites, the potential displacement of such small numbers of Cormorant during construction or operation would not affect breeding success, numbers, distribution, or the existing population trend for this species in the SPA (favourable) given the abundance of alternative suitable habitat in the greater Galway City area and hinterland (Cormorants were recorded using habitats ranging from lakes, to rivers, amenity grassland and upland heath).

Ballindooley Lough, however, is an important local site for wintering birds. Blasting at Ballindooley and Castlegar has the potential to disturb and displace wintering birds using Ballindooley Lough and mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Grey heron

Grey heron were recorded from 15 out of the 60 winter bird sites surveyed in 2014/2015 with generally only single individual birds recorded. Notable exceptions were records of 18 and eight Grey heron at two of the coastal sites along the north shore of Oranmore Bay (WB70 and WB71 respectively). However, both locations are more than 1km from the proposed road development and would not be affected

by construction or operation disturbance/displacement. Of the 15 sites at which Grey heron were recorded, only four are within the general construction disturbance ZoI (WB02, WB04, WB08 and WB12) and the majority of records at these sites were for single individual birds. Only one site (WB05) is within the ZoI of Ballagh, where prolonged blasting will be undertaken (for approximately 9 months). At this site only a single Grey heron was recorded, on one occasion.

Given that many of the positive sites only recorded single individuals, that most of the sites at which the species was recorded will not be affected in any way by construction or operational disturbance, the abundance of alternative suitable habitat locally (i.e. the species was recorded from wide range of habitat types including lakes, wetland habitats, upland habitats, and managed grasslands), and the transient usage by Grey heron of the majority of the surveyed sites used the proposed road development will not have any effect on the local population.

Ballindooley Lough, however, is an important local site for wintering birds. Blasting at Ballindooley and Castlegar has the potential to disturb and displace wintering birds from the majority of the habitat at Ballindooley Lough and mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Light-bellied brent goose

Light-bellied brent goose were recorded at three winter bird sites surveyed in 2014/15: Galway Golf Course (WB19), Claddagh/Nimmo's Pier (WB38) and along the north shore of Oranmore Bay (WB71). These sites are removed from the proposed road development by distances of (approximately) 470m, 2.5km, and 1.1km respectively, and in all cases there is a belt of urban development present in the respective buffer zones. At this distance, disturbance or displacement effects associated with either construction or operation of the proposed road development would not affect usage of these areas by Light-bellied brent geese.

There is also a single record for the species along the River Corrib corridor (RPS, 2006) but given the rare occurrence of the species on the River Corrib any construction related disturbance will not affect usage of the River Corrib in the long-term. The operation of the proposed road development, particularly given its elevation above the river (c.10m), will not displace birds from the area.

Therefore, disturbance or displacement of Light-bellied brent goose from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Wigeon

Wigeon were recorded at five winter bird sites surveyed in 2014/15: WB02, WB22, WB31, WB70 and WB71. The coastal survey sites at Lough Atalia (WB22), Renmore (WB31), and along the north shore of Oranmore Bay (WB70 and WB71) are buffered from any disturbance associated with construction or operation by a distance of at least 800m of urban development and the proposed road development would not affect usage of these areas by Wigeon.

Wigeon were also recorded on one occasion at Ballindooley Lough (WB02); 28 birds were recorded in February 2015 which corresponds with what could be 2.4% of the SPA's baseline winter population of 1,168.

Ballindooley Lough is an important local site for wintering birds. Blasting at Ballindooley and Castlegar has the potential to disturb and displace wintering birds using Ballindooley Lough and mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Teal

Teal were recorded at six winter bird sites surveyed in 2014/15: WB02, WB04, WB08, WB10, WB14 and WB71. Only four of these are within 300m of the proposed road development and likely to be subject to some level of disturbance during construction and/or operation: WB02, WB04, WB08 and WB10.

The numbers recorded at WB04, WB08 and WB10 were generally low (<6 birds, or <1% of the SPA's baseline winter population) and Teal were not present regularly throughout the winter period (recorded on 2, 4 and 1 occasions respectively). Considering the low numbers and infrequent use of sites WB04, WB08 and WB10, the potential for significant disturbance/displacement effects is further reduced by virtue of the fact that the proposed road development only passes through small areas of habitat at the margins of each site, leaving the majority of these sites, and many alternative areas of similar suitable habitat in the locality, unaffected.

Teal were recorded on, or flying into, Ballindooley Lough (WB02) during all survey visits in numbers ranging from 3 in October 2014, to 146 in January 2015 (corresponding with between 0.4% and 20.9% of the SPA's baseline winter population). Although on occasion Teal were observed in the drainage ditches surrounding the lough, the principle habitat used by the species in this site was the main body of the lake.

As discussed in **Section 9.3.4.3** (Lough Corrib SPA) in relation to construction related disturbance to water birds at Ballindooley Lough, mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects which could affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Shoveler

The potential disturbance/displacement effects of the proposed road development on potential ex-situ sites for this species has been assessed under Lough Corrib SPA above in **Section 9.3.4.3**. In the case of Inner Galway Bay SPA, the record of 144 Shoveler is in excess of the baseline population of 88.

As discussed in **Section 9.3.4.3** (Lough Corrib SPA) in relation to construction related disturbance to water birds at Ballindooley Lough, mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects which could affect the

conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Red-breasted merganser

Red-breasted merganser were not recorded at any of the winter bird survey sites. There is a single record for the species along the River Corrib corridor recorded during the 2005/2006 surveys undertaken for the N6 Galway City Outer Bypass (RPS, 2006) but given the rare occurrence of the species on the River Corrib any construction related disturbance associated with the proposed River Corrib Bridge would not result in any significant disturbance or displacement effect in relation to this species.

Therefore, disturbance or displacement of Red-breasted merganser from potential ex-situ sites, during the construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Ringed plover

Ringed plover were not recorded at any of the winter bird survey sites and therefore, disturbance or displacement of the species from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Golden plover

The potential disturbance/displacement effects of the proposed road development on potential ex-situ sites for this species has been assessed under Lough Corrib SPA above in **Section 9.3.4.3**.

Based on the assessment in **Section 9.3.4.3**, disturbance or displacement of Golden plover from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Lapwing

Lapwing were recorded at four winter bird survey sites: Ballindooley Lough (WB02), Na Foraí Maola/West of Lough Inch (WB08), Lough Atalia (WB22) and Oranmore Bay (WB71). Only two of these are within the construction or operational disturbance ZoI and likely to be subject to some level of disturbance effect: Ballindooley Lough and the area at Na Foraí Maola/West of Lough Inch. At Ballindooley Lough a flock of 16 and a single individual were recorded on January and March 2015 respectively; at Na Foraí Maola/West of Lough Inch, 17 were recorded in October 2014. Lapwing were also recorded along the River Corrib corridor during surveys carried out in 2006 for the N6 Galway City Outer Bypass (RPS, 2006); however, there was only one large flock recorded on one occasion (123 birds).

Low numbers of Lapwing were generally recorded at affected sites (a count of 17 corresponds with what could be 0.4% of the SPA's baseline population of 3,969), with low frequency of occurrence along the River Corrib corridor (in terms of the species presence and numbers) and transient usage by Lapwing of the other two sites. The proposed road development only affects the margins of Na Foraí Maola/West of Lough Inch winter bird survey sites; minimising the potential for disturbance and avoiding major habitat loss, habitat severance or displacement.

Ballindooley Lough is an important local site for wintering birds. Blasting at Ballindooley and Castlegar has the potential to disturb and displace wintering birds from the majority of the habitat at Ballindooley Lough and mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Dunlin

Dunlin were not recorded at any of the winter bird survey sites. There is a single record for the species along the River Corrib corridor during the 2005/2006 surveys undertaken for the N6 Galway City Outer Bypass (RPS, 2006).

As disturbance would only affect relatively low numbers of Dunlin in the context of the SPA population, the infrequent use of the River Corrib by the species, as both the construction and operational disturbance ZoI covers a relatively small area in the context of suitable alternative habitat available for the species locally, and disturbance will be temporary (limited to the construction period expected to be 18 months), the proposed road development will not affect usage of this site in the long-term.

Therefore, disturbance or displacement of Dunlin from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Bar-tailed godwit

Nine Bar-tailed godwit were recorded at one winter bird survey site, Ballindooley Lough, on a single occasion in February 2015; corresponding with what could be 2% of the SPA's baseline population of 447.

Despite the low numbers and infrequent use of this site by Bar-tailed godwit, Ballindooley Lough is an important local site for wintering birds. Blasting at Ballindooley and Castlegar has the potential to disturb and displace wintering birds from the majority of the habitat at Ballindooley Lough and mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Curlew

Curlew were recorded at 24 of the 60 winter bird sites surveyed in 2014/15 and were also recorded along the River Corrib as part of the 2006 GCOB surveys undertaken for the N6 Galway City Outer Bypass (RPS, 2006). Only six of these sites are within 300m of the proposed road development and likely to be subject to some level of disturbance during construction and/or operation: Ballindooley

Lough (WB02), Na Foraí Maola/West of Lough Inch (WB08), Moycullen Bog NHA at Ballagh (WB10), River Corrib (WB12), Castle Park (WB24) and Galway Racecourse (WB23).

Ballindooley Lough was the only winter bird survey site regularly used by Curlew (recorded in five out of the seven survey visits); although, with the exception of a record of eight from September 2014 the numbers recorded were single, or on one occasion two, individuals. Blasting at Ballindooley and Castlegar has the potential to disturb and displace wintering birds from the majority of the habitat at Ballindooley Lough and mitigation is required to minimise the potential for disturbance/displacement from blasting and to prevent any long-term disturbance or displacement effects.

Curlew were only recorded on two out of seven survey visits to each of the Na Foraí Maola/West of Lough Inch and Moycullen Bog NHA at Ballagh sites; with two individuals in November 2014 at the latter the maximum count. Only the margins of these sites are within the ZoI of disturbance effects.

Along the River Corrib, whilst there was a record of a larger number of Curlew from October 2014 (16, which corresponds with what could be 2.3% of the SPA's baseline winter population of 697), the species was only recorded here on one occasion and in wetlands more than 500m from the proposed road development. Therefore, there will not be any significant disturbance/displacement effects at this site during construction or operation.

At Castlepark, nine Curlew were recorded on one occasion during the surveys (November 2014). However, this recreational area is separated from the proposed road development by a buffer of c.250m of commercial and residential development and the existing N6 and construction works will not cause any displacement of birds at this site.

At the Galway Racecourse winter bird survey site, Curlew were recorded using the playing field amongst the industrial/commercial buildings in Ballybrit Business Park, in the south-west corner of the winter bird survey site. On one of the three survey visits on which the species was present, 37 Curlew were recorded (5.3% of the SPA's baseline winter population). Construction works in the vicinity are either associated with the existing road network or are screened from this field by the surrounding industrial buildings; likewise, disturbance during operation disturbance will be in line with current levels around the existing N6 and the City East Business Park or screened by the same buildings. Therefore, there will not be any significant disturbance/displacement effects at this site during construction or operation.

Given the low numbers generally recorded at affected sites, the majority of sites only had records of one or two birds present (<0.3% of the SPA's baseline winter population), the use by Curlew was generally infrequent, only six of 24 positive sites for Curlew are potentially affected and only marginally in most cases with respect to the recorded locations of Curlew, and the abundance of suitable alternative habitat locally, disturbance is unlikely to affect usage of most sites in the long-term. However, blasting in the vicinity of Ballindooley Lough requires mitigation to prevent any long-term disturbance or displacement effects that might affect the conservation objectives of Inner Galway Bay SPA.

Redshank

Redshank were recorded at six winter bird sites surveyed in 2014/15: WB08, WB12, WB30, WB52, WB70 and WB71. The numbers present were generally low (<9) with the exception of a flock of 47 Redshank recorded in WB71 in January 2015. Only Na Foraí Maola/West of Lough Inch (WB08) and the River Corrib (WB12) sites are within the disturbance ZoI.

However, at these sites birds were only recorded on one and two of the seven survey visits, respectively, with two the maximum number of birds recorded (at WB08 in March 2015); this corresponds with what could be 0.4% of the SPA's baseline winter population of 505. As disturbance would only affect relatively low numbers of Redshank in the context of the SPA population, both the construction and operational disturbance ZoI covers a relatively small area in the context of suitable alternative habitat available for the species locally, and only affects the margins of the site, and that disturbance will be temporary (limited to the construction period expected to be of 3 years), the proposed road development will not affect usage of this site in the long-term.

Therefore, disturbance or displacement of Redshank from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Turnstone

Turnstone were recorded at one winter bird survey site; an area of coastal grasslands at Ballyloughaun (WB30) where five birds were recorded in October 2014. This site is buffered from any disturbance associated with construction or operation by more than 1.5km of urban development. This location is more than 1.9km from the proposed road development and buffered from it by urban development and Merlin Park Woods. At this distance, disturbance or displacement effects associated with either construction or operation of the proposed road development would not affect usage of this area by Turnstone.

Therefore, disturbance or displacement of Turnstone from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Black-headed gull

The potential disturbance/displacement effects of the proposed road development on potential ex-situ sites for this species has been assessed under Lough Corrib SPA above in **Section 9.3.4.3**.

As concluded in **Section 9.3.4.3**, disturbance or displacement of Black-headed gull from potential ex-situ sites during construction or operation of the proposed road development will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Common gull

The potential disturbance/displacement effects of the proposed road development on potential ex-situ sites for this species has been assessed under Lough Corrib SPA above in **Section 9.3.4.3**.

As concluded in **Section 9.3.4.3**, disturbance or displacement of Common gull from potential ex-situ sites, during construction or operation of the proposed road development, will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Inner Galway Bay SPA (see **Table 9.37**).

Sandwich tern

Galway Bay supports important breeding colonies of Sandwich tern on many of its islands (Galway Harbour Company, 2014; and, NPWS, 2005). This species was not recorded as part of the breeding bird surveys carried out in 2015, nor was it recorded along the River Corrib corridor in the 2006 surveys undertaken for the N6 Galway City Outer Bypass (RPS, 2006). As there are no potential ex-situ sites used by this species that will be affected by disturbance during construction or operation of the proposed road development, there will be no effects on the conservation objective attributes and targets supporting the conservation condition of this species in the SPA (see **Table 9.37**).

Common tern

The potential disturbance/displacement effects of the proposed road development at potential ex-situ sites for this species has been assessed under Lough Corrib SPA above in **Section 9.3.4.3**.

As concluded in **Section 9.3.4.3**, disturbance or displacement of Common tern from potential ex-situ sites during construction or operation of the proposed road development will not affect the conservation objective attributes and targets supporting the conservation condition of this species in the SPA (see **Table 9.37**).

Summary

A summary of the potential disturbance/displacement impacts at potential ex-situ sites associated with the proposed road development are presented in **Table 9.34** below.

Table 9.34: Summary of Disturbance/Displacement Impacts at Potential Ex-situ Sites

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Construction		
General construction works disturbing/displacing SCI bird species at potential ex-situ sites outside of Inner Galway Bay SPA	No Construction related disturbance will not restrict the extent of habitat available to any SCI species such that any population level effects would occur	No
Long-term blasting at Lackagh Quarry and Castlegar disturbing displacing bird species listed as SCIs of Inner Galway Bay SPA at Ballindooley Lough	Yes Long-term blasting could displace SCI listed bird species from Ballindooley Lough for one or more winter seasons; potentially negatively affecting the wintering SPA population	Yes Seasonal restriction to blasting works in the vicinity of Ballindooley Lough to ensure no long-term disturbance or displacement (**Section 10.8**)
Operation		
Disturbing/displacing SCI bird species at potential ex-situ sites outside of Inner Galway Bay SPA during operation	No Operational disturbance will not restrict the extent of habitat available to any SCI species such that any population level effects would occur	No

9.4.4.4 Habitat loss/fragmentation – at potential ex-situ sites

The proposed road development will result in varying degrees of habitat loss in eight of the winter bird sites where bird species listed as SCIs of Inner Galway Bay SPA were recorded: WB01, WB02, WB03, WB07, WB08, WB10, WB23 and WB45.

Overall, the areas of habitat loss are small relative to the extent of each affected winter bird survey site. The habitat types being lost are also common and widespread in the wider locality – in particular the peat/heathland habitats between Bearna and the N59 Moycullen Road, which extend to the north-west into Connemara. Similarly, for birds (as highly mobile species), habitat fragmentation is only likely to be an issue where it would result in the fragmented habitat patches being unviable in the long-term due to their reduced size, and consequently limit the availability of large areas of a given habitat type locally. In most cases the proposed road development clips these winter bird sites along their southern boundary (WB01, WB02, WB03, WB07, WB08, WB10 and WB23) and the effects of habitat fragmentation are minimal, particularly given that, for some winter bird sites (e.g. WB01) the habitats represented are only a small proportion of those same habitats in the locality.

Loss of habitat, and any associated habitat fragmentation, at the winter bird sites will not result in a decline in the number and range of habitat areas available locally to bird species listed as SCIs of Inner Galway Bay SPA and will not therefore, affect the ability of the SCI populations to maintain themselves in the long-term.

Summary

A summary of the potential habitat loss and fragmentation impacts at potential ex-situ sites associated with the proposed road development are presented in **Table 9.35** below.

Table 9.35: Summary of Habitat Loss/Fragmentation Impacts at Potential Ex-situ Sites

Potential Direct or Indirect Impacts	Could the proposed road development affect the SCIs?	Are mitigation measures required
Construction/Operation		
Habitat loss and fragmentation at potential ex-situ sites outside of Inner Galway Bay SPA affecting habitat area available to SCI bird species	No As the scale of habitat loss and fragmentation will not restrict the extent of habitat available to any SCI species such that any population level effects would occur	No

9.4.4.5 Summary

This section presents a summary of the potential impacts on the SCI bird populations of Inner Galway Bay SPA as a result of the proposed road development and how these impacts relate to affecting the site's conservation objectives.

Table 9.36 below, lists the SCIs of Inner Galway Bay SPA and how the impacts discussed below relate to each. Those highlighted in green are those SCIs which are present within the ZoI of the proposed road development.

Table 9.36: SCIs of Inner Galway Bay SPA and Potential Impacts

Special Conservation Interests (SCIs)	Impact
Great northern diver *Gavia immer* [A003] – Wintering	Habitat degradation – hydrology within the SPA
Light-bellied brent goose *Branta bernicla hrota* [A046] – Wintering	
Red-breasted merganser *Mergus serrator* [A069] – Wintering	Habitat degradation – hydrology within the SPA and at potential ex-situ sites
Ringed plover *Charadrius hiaticula* [A137] – Wintering	
Golden plover *Pluvialis apricaria* [A140] – Wintering	
Dunlin *Calidris alpina* [A149] – Wintering	
Redshank *Tringa totanus* [A162] – Wintering	

Special Conservation Interests (SCIs)	Impact
Great northern diver *Gavia immer* [A003] – Wintering	Habitat degradation – hydrology within the SPA
Light-bellied brent goose *Branta bernicla hrota* [A046] – Wintering	
Turnstone *Arenaria interpres* [A169] – Wintering	
Common gull *Larus canus* [A182] – Wintering	
Sandwich tern *Sterna sandvicensis* [A191] – Breeding	
Common tern *Sterna hirundo* [A193] – Breeding	
Wigeon *Anas penelope* [A050] – Wintering	Habitat degradation – hydrology within the SPA and at potential ex-situ sites Disturbance/displacement at potential ex-situ sites
Shoveler *Anas clypeata* [A056] – Wintering	
Lapwing *Vanellus vanellus* [A142] – Wintering	
Bar-tailed godwit *Limosa lapponica* [A157] – Wintering	
Curlew *Numenius arquata* [A160] – Wintering	
Cormorant *Phalacrocorax carbo* [A017] – Breeding/Wintering	Habitat degradation – hydrogeology at potential ex-situ sites (Coolagh Lakes) Habitat degradation – hydrology within the SPA and at potential ex-situ sites Disturbance/displacement at potential ex-situ sites
Grey heron *Ardea cinerea* [A028] – Wintering	
Teal *Anas crecca* [A052] – Wintering	
Black-headed gull *Chroicocephalus ridibundus* [A179] – Wintering	
Wetlands [A999]	Habitat degradation – hydrogeology at potential ex-situ sites Habitat degradation – hydrology within the SPA and at potential ex-situ sites

The relationship between, and potential influence of, these impacts with respect to the SCI listed bird species within the ZoI of the proposed road development and the attributes/targets upon which their favourable conservation condition is considered and measured, is considered further below and also presented in **Table 9.37**.

Great northern diver [A003]

The proposed road development could affect water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and/or extent of marine habitat available for this species. These impacts could potentially negatively affect the long-term population trends of the Inner Galway Bay SPA SCI populations through reducing the number and range of areas available to the species within the SPA.

Light-bellied brent goose [A046]

The proposed road development could affect water quality in Galway Bay during construction (even though the risk of any perceptible effect is low) which could affect the type, quality and/or extent of intertidal habitat available for this species. These impacts could potentially negatively affect the long-term population trends

of the Inner Galway Bay SPA SCI populations through reducing the number and range of areas available to the species within the SPA.

Red-breasted merganser [A069], Ringed plover [A137], Golden plover [A140], Dunlin [A149], Redshank [A162], Turnstone [A169], Common gull [A182], Sandwich tern [A191] and Common tern [A193]

The proposed road development could affect water quality in Galway Bay and at potential ex-situ sites used by these species during construction (even though the risk of any perceptible effect is low). This impact could affect the type, quality and/or extent of wetland/intertidal/marine habitat available for this species. These impacts could potentially negatively affect the long-term population trends of the Inner Galway Bay SPA SCI populations through reducing the number and range of areas available to the species within the SPA.

Wigeon [A050], Shoveler [A056], Lapwing [A142], Bar-tailed godwit [A157] and Curlew [A160]

The proposed road development could affect water quality in Galway Bay and at potential ex-situ sites used by these species during construction (even though the risk of any perceptible effect is low). This impact could affect the type, quality and/or extent of wetland/intertidal/marine habitat available for this species. These impacts could potentially negatively affect the long-term population trends of the Inner Galway Bay SPA SCI populations through reducing the number and range of areas available to the species within the SPA.

Long-term blasting in the vicinity of Ballindooley Lough could displace these SCI listed species from this site for one or more winter seasons. This impact could potentially negatively affect the long-term population trends of the Inner Galway Bay SPA populations through reducing the number and range of areas available to them.

Cormorant [A017], Grey heron [A028], Teal [A052] and Black-headed gull [A179]

The proposed road development could affect the existing hydrogeological regime supporting wetland habitats at the Coolagh Lakes which could affect the type, quality and extent of wetland habitat available. These impacts could potentially negatively affect the long-term population trends of the Inner Galway Bay SPA population through reducing the number and range of areas available to the SPAs SCI bird populations.

The proposed road development could affect water quality in Galway Bay and at potential ex-situ sites used by these species during construction (even though the risk of any perceptible effect is low). This impact could affect the type, quality and/or extent of wetland/intertidal/marine habitat available for this species. These impacts could potentially negatively affect the long-term population trends of the Inner Galway Bay SPA SCI populations through reducing the number and range of areas available to the species within the SPA.

Long-term blasting in the vicinity of Ballindooley Lough could displace these SCI listed species from this site for one or more winter seasons. This impact could potentially negatively affect the long-term population trends of the Inner Galway

Bay SPA populations through reducing the number and range of areas available to them.

Wetlands [A999]

The permanent area of wetland habitat could be negatively affected as a result of hydrogeological impacts and/or hydrological impacts.

The proposed road development could affect the groundwater quality at potential ex-situ sites used by wintering bird species listed as SCIs for Inner Galway Bay SPA. Groundwater quality impacts could affect the type, quality and extent of wetland habitat available to SCI bird species at those ex-situ sites which lie within the hydrogeological ZoI. The design of the proposed road development avoids any long-term impacts to the existing groundwater regime that would affect any of the potential ex-situ sites used by SCI listed wintering birds. However, mitigation measures are required in the event that any groundwater conduits are encountered during construction and to ensure that karst features do not affect the functioning of the infiltration basins during operation.

The proposed road development could affect the quality of surface water in the receiving environment which supports the intertidal/marine/wetland habitat available, within Inner Galway Bay SPA or at potential ex-situ sites used by the SCI populations (Ballindooley Lough in particular).

Table 9.37: Potential Impacts on the Conservation Objectives of Inner Galway Bay SPA (Those rows highlighted in green are the attributes potentially affected by the proposed road development)

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Great northern diver, Grey heron, Light-bellied brent goose, Wigeon, Teal, Shoveler, Red-breasted merganser, Ringed plover, Golden plover, Lapwing, Dunlin, Bar-tailed godwit, Curlew, Redshank, Turnstone, Black-headed gull, Common Gull To maintain the favourable conservation condition of these bird species in Inner Galway Bay SPA, which is defined by the following list of attributes and targets:			
Population trend: Percentage change	Long term population trend stable or increasing	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**
Distribution: Number and range of areas used by waterbirds	No significant decrease in the numbers or range of areas used by waterbird species, other than that occurring from natural patterns of variation	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**
Cormorant			

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
To maintain the favourable conservation condition of Cormorant in Inner Galway Bay SPA, which is defined by the following list of attributes and targets:			
Breeding population abundance: apparently occupied nests (AONs): Number	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Productivity rate: Mean number	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, and foraging areas will not be restricted, there will be no effects on this attribute/target	No
Distribution: breeding colonies: Number; location; area (hectares)	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Prey biomass available: Kilogrammes	No significant decline	No None of the impacts associated with the proposed road development will affect prey availability for this species in Lough Corrib and there will be no effects on this attribute/target	No
Barriers to connectivity: Number; location; shape; area (hectares)	No significant increase	No The proposed River Corrib Bridge will not pose a barrier to connectivity along the River Corrib Corridor and therefore there will be no effects on this attribute/target	No

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Disturbance at breeding site: Level of impact	Human activities should occur at levels that do not adversely affect the breeding Arctic tern population	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, and any disturbance along the River Corrib during construction will be temporary and restricted to the immediate vicinity of the construction works, there will be no effects on this attribute/target	No
Population trend: Percentage change	Long term population trend stable or increasing	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**
Distribution: Number and range of areas used by waterbirds	No significant decrease in the numbers or range of areas used by cormorant, other than that occurring from natural patterns of variation	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites Disturbance/displacement of birds at Ballindooley Lough during construction	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4** Seasonal restriction to blasting works in the vicinity of Ballindooley Lough

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
			Section 10.8
Sandwich tern To maintain the favourable conservation condition of Sandwich Tern in Inner Galway Bay SPA, which is defined by the following list of attributes and targets:			
Breeding population abundance: apparently occupied nests (AONs): Number	No significant decline	No As the species has not been recorded within the ZoI of the proposed road development, and the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on these attributes/targets	No
Productivity rate: Mean number	No significant decline		
Distribution: breeding colonies: Number; location; area (hectares)	No significant decline		
Prey biomass available: Kilogrammes	No significant decline		
Barriers to connectivity: Number; location; shape; area (hectares)	No significant increase		
Disturbance at breeding site: Level of impact	Human activities should occur at levels that do not adversely affect the breeding Arctic tern population		
Common tern To maintain the favourable conservation condition of Common Tern in Inner Galway Bay SPA, which is defined by the following list of attributes and targets:			
Breeding population abundance:	No significant decline	No	No

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
apparently occupied nests (AONs): Number		As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	
Productivity rate: fledged young per breeding pair: Mean number	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, and foraging areas will not be restricted, there will be no effects on this attribute/target	No
Distribution: breeding colonies: Number; location; area (hectares)	No significant decline	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, there will be no effects on this attribute/target	No
Prey biomass available: Kilogrammes	No significant decline	No None of the impacts associated with the proposed road development will affect prey availability for this species in Lough Corrib and there will be no effects on this attribute/target	No
Barriers to connectivity: Number; location; shape; area (hectares)	No significant increase	No The proposed River Corrib Bridge will not pose a barrier to connectivity along the River Corrib Corridor and therefore there will be no effects on this attribute/target	No

Attribute and Measure	Target	Potential Direct or Indirect Impacts Requiring Mitigation?	Are mitigation measures required?
Disturbance at breeding site: Level of impact	Human activities should occur at levels that do not adversely affect the breeding Arctic tern population	No As the breeding colonies are beyond the ZoI of any of the impacts associated with the proposed road development, and any disturbance along the River Corrib during construction will be temporary and restricted to the immediate vicinity of the construction works, there will be no effects on this attribute/target	No
Wetlands To maintain the favourable conservation condition of wetland habitat in Inner Galway Bay SPA as a resource for the regularly occurring migratory waterbirds that utilise it. This is defined by the following attribute and target:			
Habitat area: Hectares	The permanent area occupied by the wetland habitat should be stable	Construction/operational impacts on the existing hydrogeological/hydrological regime supporting wetland habitats at potential ex-situ sites	Measures to avoid habitat degradation as a result of potential hydrogeological impacts during construction and operation **Section 10.3** Measures to maintain water quality in receiving watercourses during construction **Section 10.4**

10 Design Requirements and Mitigation Measures

This section presents the mitigation measures required in addition to the design measures which are set out in **Section 2.6** of this NIS and are summarised again below. The design measures have either avoided or reduced the potential for the proposed road development to affect the conservation objectives of the European sites within its ZoI:

- The design of the proposed road development does not include any permanent fencing within Annex I habitats that are located within Lough Corrib cSAC
- The clear-span design of the proposed River Corrib Bridge avoids the loss of instream habitat in the River Corrib, minimises the potential for habitat degradation in the River Corrib (and downstream in Galway Bay) from construction works, and minimises the disturbance to the aquatic QI species of Lough Corrib cSAC
- The drainage design includes attenuation, flow control and pollution treatment to ensure that the risk of affecting either groundwater or surface water quality is minimised as far as is possible
- The design of the proposed road development also ensures that the existing hydrological regime and hydrogeological regime will not be affected (although for the latter, a level of operational inspection is included within the mitigation strategy in **Section 10.3.1.2**)
- The design includes a detailed construction methodology for the proposed Lackagh Tunnel which ensures that it will not affect the structural integrity[55] of the overlying limestone rock (some level of monitoring is included in the mitigation strategy), the existing hydrogeological regime, or have any impacts on Annex I habitats near the western approach to the tunnel as a consequence of the retaining wall specified there
- Lighting is not included along the length of the proposed River Corrib Bridge, and the lighting proposed for the proposed NUIG pitches has been designed, to minimise the level of operational disturbance to aquatic QI species along the River Corrib corridor in Lough Corrib cSAC

However, despite these design measures, mitigation measures are also required, and will be implemented, under supervision of both the Project Ecologist (employed by the Employer) and the Ecological Clerk of Works (employed by the Contractor) to ensure that the proposed road development will not affect the conservation objectives of any of the European sites within its ZoI.

As set out in **Section 9**, the potential impacts associated with the proposed road development that require mitigation are:

[55] Structural Integrity of the mosaic of Limestone pavement and Calcareous grassland is the physical and mechanical geotechnical properties that control the behaviour of the geotechnical Limestone pavement environment

- Habitat loss/fragmentation: Measures to minimise habitat loss in Lough Corrib cSAC and to avoid loss of QI habitats within Lough Corrib cSAC during construction (Lough Corrib cSAC)
- Habitat degradation – tunnelling/excavation: Measures to maintain the structural integrity of Limestone pavement during the construction of the proposed Lackagh Tunnel, and its western approach (Lough Corrib cSAC)
- Habitat degradation – hydrogeology: Measures to avoid habitat degradation as a result of potential hydrogeological impacts (Lough Corrib cSAC, Lough Corrib SPA, Inner Galway Bay SPA)
- Habitat degradation – hydrology: Measures to Protect Water Quality in Receiving Watercourses (Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA, Inner Galway Bay SPA)
- Habitat degradation – air quality: Measures to Control Dust Emissions During Construction (Lough Corrib cSAC)
- Habitat degradation – non-native invasive species: Mitigation measures to avoid the introduction or spread of non-native invasive species to European sites (Lough Corrib cSAC, Galway Bay Complex cSAC)
- Disturbance/displacement: Mitigation measures to avoid/reduce the disturbance/displacement effects of blasting on wintering birds using Ballindooley Lough (Lough Corrib SPA, Inner Galway Bay SPA)
- Barrier effect: Mitigation measures to ensure that the proposed road development does not present a barrier to Otter movement within the Bearna Stream catchment (Galway Bay Complex cSAC)
- Mortality risk: Mitigation measures to avoid mortality of QI species (Lough Corrib cSAC, Galway Bay Complex cSAC)

Integral to this is the Construction Environmental Management Plan (CEMP) which is included in **Appendix C**.

This CEMP summarises the overall environmental management strategy that will be adopted and implemented during the construction phase of the proposed road development. The purpose of the CEMP is to demonstrate how the proposed construction works can be delivered in a logical, sensible and safe sequence with the incorporation of specific environmental control measures relevant to construction works of this nature. The CEMP sets out the mechanism by which environmental protection is to be achieved during the construction phase of the proposed road development. Implementation of the CEMP will ensure disruption and nuisance are kept to a minimum. The CEMP has been prepared in accordance with many industry best practice guidance including:

- TII's Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan
- Construction Industry Research and Information Association (CIRIA) in the UK, Environmental Good Practice on Site Guide, 4th Edition (CIRIA 2015)

The CEMP has been prepared in conjunction with the Environmental Impact Assessment (EIA) Report and Natura Impact Statement (NIS), having regard to consultations with a range of specialists and environmental organisations, in particular, the National Parks and Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI). The CEMP supports the information already provided in the EIA Report and the NIS and must be read in conjunction with the information already provided in the NIS. The details relevant to European Sites are already provided in the NIS.

The information included in the CEMP are presented below:

- General Project Details
- Contact Sheets
- Reference Documents
- Organisational Structure/Duties and Responsibilities
- Environmental Commitments and Environmental Control Measures
- Site Specific Method Statements/Management Plans
    - Construction and Demolition Waste Management Plan
    - Sediment, Erosion and Pollution Control Plan
    - Non-native Invasive Species Management Plan
    - Incident Response Plan
    - Construction Traffic Management Plan
    - Environmental Awareness Training Strategy
    - Communications Strategy
    - Inspections, Auditing and Monitoring Compliance Strategy
    - Final Handover

The CEMP is a working document and will be finalised by the Contractor following appointment and prior to commencing works on site. All of the content provided in this CEMP will be delivered in full by the Contractor and its finalisation by the Contractor will not affect the robustness and adequacy of the information presented and relied upon in the NIS. Some information (such as project details and the schedule of environmental commitments from the NIS) has already been provided in the NIS and is not repeated in this version of the CEMP. However, it will be included in the CEMP which is finalised by the Contractor.

In addition to the items listed above, the following information will also be provided by the Contractor when finalising the CEMP:

- Planning Consent - If planning permission is granted for the proposed road development, the entire contents of the planning consent will be included in the CEMP
- Comprehensively incorporate all Environmental Commitments set out in the Contract documents (in particular the Works Requirements), those presented in the EIA Report and NIS and any additional commitments which may arise as part of the development consent process up to and including the Oral Hearing. The CEMP will include the complete suite of Environmental Commitments

together with the relative specification, evidence and responsibilities of how each commitment will be met

- Relevant Environmental Performance Criteria prescribed in environmental legislation and in Contract documents
- Register of all applicable legislation, including relevant standards, Codes of Practice and Guidelines
- Description of the Environmental Management System of the proposed road development, which shall be devised according to the criteria of ISO 14001:2004 – Environmental Management Systems. The CEMP will be complemented by General Procedures, Work Procedures and Operations Instructions. These documents will be in place within the site administration offices and appropriate site locations during works

The CEMP is a dynamic document and the Contractor will ensure that it remains valid for the duration of the construction period. The CEMP may need to be altered during the lifecycle of the construction period to take account of monitoring results, legislative changes, outcomes of third-party consultations etc. Additional appendices may be added to the CEMP to accommodate monitoring results, permits etc. However, the finalisation of the CEMP by the Contractor will not affect the robustness and adequacy of the information presented here and relied upon in the NIS.

In order to help ensure the successful development, implementation and maintenance of the CEMP, the Contractor will appoint a Site Environmental Manager (SEM). The SEM will possess sufficient training, experience and knowledge appropriate to the nature of the task to be undertaken, a Level Eight qualification recognised by the Higher Education and Training Awards Council (HETAC), or a University equivalent, or other qualifications acceptable to the Employer, in Environmental Science or Environmental Management, or other subjects acceptable to the Employer. In particular, the SEM will require suitably qualified ecological experts, the Project Ecologist (employed by the Employer) and the Ecological Clerk of Works (employed by the Contractor), to oversee ecologically sensitive elements of the construction works, ecological derogation licensing requirements and ecological monitoring. Further details on the roles and responsibilities of the SEM are provided throughout the CEMP document in **Appendix C**.

The key Site Specific Method Statements/Management Plans of relevance to this NIS are described below.

A Construction & Demolition (C&D) Waste Management Plan (WMP) has been prepared as part of the CEMP to ensure that waste arising during the construction and demolition phase of the proposed road development on site will be managed and disposed of in a way that ensures compliance with the provisions of the Waste Management Act, 1996-2011 and associated Regulations (1996-2011) to ensure that optimum levels of reduction, re-use and recycling are achieved and to ensure that waste management does not impact on any European sites.

The Sediment, Erosion and Pollution Control Plan (SEPCP) summarises the procedures and technical practices for implementing effective sediment, erosion

and pollution control through a variety of delivery methods for the construction phase of the proposed road development. The purpose of this SEPCP is to demonstrate at this stage, how the proposed construction works can be delivered in a logical, sensible and safe sequence with the incorporation of specific sediment, erosion and pollution control measures relevant to construction works of this nature. This demonstrates that run-off from the construction site will not impact on any European sites.

A Non-native Invasive Species Management Plan (NISMP) has been prepared to outline the strategy that will be adopted during the construction and operation of the proposed road development in order to manage and prevent the spread of the non-native invasive plant species to any European sites. Refer to **Section 10.7** for further details.

The focus of including all of the stringent measures in this CEMP is on prevention of the incident arising in the first place. However, an Incident Response Plan (IRP) has been prepared to ensure that in the unlikely event of an incident, response efforts are prompt, efficient, and suitable for particular circumstances. The IRP describes the procedures, lines of authority and processes that will be followed to ensure that incident response efforts are prompt, efficient, and suitable for particular circumstances. The IRP details the procedures to be undertaken in the event of the release of any sediment into a watercourse, serious spillage of chemical, fuel or other hazardous wastes (e.g. concrete), non-compliance incident with any permit or license, or other such risks that could lead to a pollution incident, including flood risks.

All of the Contractor's site staff will receive relevant and appropriate training to ensure that they have the appropriate knowledge to successfully implement the CEMP.

The CEMP also outlines the communications strategy which will be adopted during the construction phase which ensures that awareness, education and information sharing procedures are adopted and implemented. Finally, the CEMP outlines the inspections, auditing and monitoring compliance strategy that will be adopted by the Contractor.

In summary, the implementation of the CEMP ensures that any direct or indirect or ex-situ impacts to the conservation objectives supporting the QI habitats and QI/SCI species of Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA or Inner Galway Bay SPA will not arise and will ensure that adverse effects on site integrity are avoided.

10.1 Habitat loss/fragmentation: Measures to minimise habitat loss in Lough Corrib cSAC and to avoid loss of QI habitats within Lough Corrib cSAC during construction

10.1.1 Mitigation Measures

The minimum working area necessary to facilitate the construction of the supporting structures associated with the proposed River Corrib Bridge will be used (**Appendix D**). This area will be clearly delineated and fenced off at the outset of works and maintained for the duration of the construction programme. No works within Lough Corrib cSAC boundary will be undertaken outside of this zone.

This includes a set-back of 10m on the west bank of the River Corrib, and 5m on the east bank, where construction works will generally be limited to the clearance of woody vegetation (with the exception of installing the drainage outfalls to the river), if required to facilitate construction works.

There are some areas of QI Annex I habitat within Lough Corrib cSAC that lie within the proposed development boundary (Limestone pavement and Calcareous grassland). To ensure that these habitat areas will not be affected by construction works they will be fenced off in advance of any construction commencing and will be a "no-construction zone" within which no works will take place. These areas are shown on **Figures 15.1** to **15.5**.

The design of the proposed road development does not include any permanent fencing within Annex I habitats that are located within Lough Corrib cSAC. The current level of grazing associated with those areas of Calcareous grassland and exposed Limestone pavement that will be retained above the proposed Lackagh Tunnel, is limiting scrub encroachment which would affect the quality of those habitats (see **Table 9.17**, under the vegetation composition and structure attributes). The commitment to not erect permanent fencing in this area will also serve to allow the current grazing regime to continue and ensure that the proposed road development will not result in habitat degradation in that regard.

10.2 Habitat degradation – tunnelling/excavation: Measures to maintain the structural integrity of Limestone pavement during the construction of the proposed Lackagh Tunnel (and its western approach)

10.2.1 Mitigation Measures

A detailed construction methodology for the proposed Lackagh Tunnel is provided in **Appendix F**, which includes the following mitigation measures to ensure that construction works do not affect the structural integrity of the limestone bedrock supporting QI habitats on Lough Corrib cSAC:

- The potential direct and indirect impacts to the geotechnical constraints during the construction and operation of Lackagh Tunnel are predominately addressed by the design. The mitigation measures outlined below provide an added factor of safety to ensure that there is no encroachment into the overlying Annex I habitat
- During the construction of Section 1 (Stabilisation of the Lackagh Quarry face) and Section 3 (the wester approach to the tunnel) the supported rock face and retaining walls will be monitored for movement. A geotechnical expert will be appointed, by the contractor and will be present to monitor the rock mass stability during their construction period. In the unlikely event that instability within the rock mass is observed additional support measures will be installed to ensure that there is no impact to the structural integrity of the surface above and the mosaic of Limestone pavement and Calcareous grassland that is in close proximity to the proposed road development. The additional rock support measures comprise ground anchors, rock bolts, rock dowels, rock mesh, shotcrete or a combination of these measures, designed to the relevant design standards and best practice guidance documents. However, based on the conservative design approach it is considered that the risk of instability will be avoided and additional support measures will not be required
- During the operational phase, monitoring of the rock mass stability will continue, the rock and overburden retaining systems in Section 1 (Stabilisation of the Lackagh Quarry face) and Section 3 (the wester approach to the tunnel) will continue to be monitored as part of the TII (Transport Infrastructure Ireland) maintenance schedule. In the extremely unlikely event that instability within the rock mass is observed additional support measures outlined above for the construction phase will be installed to ensure that there is no impact to the structural integrity of the Limestone pavement and to the mosaic of Limestone pavement and Calcareous grassland. However, based on the conservative design approach, the installed composite support system and monitoring during construction it is considered that the risk of instability will be avoided and additional support measures will not be required
- A geotechnical expert will be appointed by the contractor and will be present to monitor the Limestone pavement vibrations during blasting works for the

construction of Section 1 (Stabilisation of the Lackagh Quarry face) and Section 3 (the wester approach to the tunnel). The blast target vibration limit is defined as 20% more conservative, than the conservative design approach vibration limit of 25mm/sec at the Limestone pavement surface which provides an added factor of safety to the construction works to ensure that blasting will not impact the structural integrity of the Limestone pavement environment. The maximum vibration limit of 25mm/sec will not be exceeded. In the unlikely event that the blast target vibration limit at the surface is exceeded blasting works will cease on site until it is understood the basis for the increased vibration. The blast design will then be recalibrated and blasting works will proceed with continued monitoring.

10.3 Habitat degradation – hydrogeology: Measures to avoid habitat degradation as a result of potential hydrogeological impacts

10.3.1 Mitigation Measures

Specific construction mitigation measures are required to mitigate the potential construction impacts which are outlined below. The Construction Industry Research and Information Association (CIRIA) guidance on the control and management of water pollution from construction sites in their publication Control of Water Pollution from Construction Sites, Guidance for Consultants and Contractors (Masters – Williams et al, 2001) will be followed.

Mitigation is detailed below and divided into those standard measures that apply to both the Galway Granite Batholith and the Visean Undifferentiated Limestone and those measures that are specifically designed for karst in the Visean Undifferentiated Limestone.

10.3.1.1 Standard Mitigation Measures

- Mitigation of potential construction impacts will be achieved through the stringent implementation of good construction practice procedures and environmental controls so as minimise the opportunity for contaminated releases of construction runoff as set out in the CEMP (**Appendix C**). Such practices will include adequate bunding for oil containers, wheel washers and dust suppression on site roads, and regular plant maintenance.
- The following measures included in the CEMP will be implemented to control the potential for pollution from accidental spillages on site:
    - Stockpiling of contaminated material is not permitted
    - Good housekeeping (daily site clean-ups, use of disposal bins, etc.) on the site during construction, and the proper use, storage and disposal of these substances and their containers will prevent groundwater contamination
    - For all activities involving the use of potential pollutants or hazardous materials, under the CEMP, the contractor will be required to ensure that material such as concrete, fuels, lubricants and hydraulic fluids will be carefully handled and stored to avoid spillages. Potential pollutants shall

also be adequately secured against vandalism and will be provided with proper containment according to codes of practice. Any spillages will be immediately contained and contaminated soil removed from the site and properly disposed of

- The contractor will be required to implement a contingency plan for pollution emergencies which will be developed by the appointed contractor prior to work commencing and regularly updated, which will identify the actions to be taken in the event of a pollution incident. As recommended in the CIRIA document, the contingency plan for pollution emergencies will include the following:
  - Containment measures
  - Emergency discharge routes
  - List of appropriate equipment and clean-up materials
  - Maintenance schedule for equipment
  - Details of trained staff, location and provision for 24-hour cover
  - Details of staff responsibilities
  - Notification procedures to inform the Environmental Protection Agency (EPA) or environmental department of the Galway County Council
  - Audit and review schedule
  - Telephone numbers of statutory water consultees
  - List of specialist pollution clean-up companies and their telephone numbers

- No direct untreated point discharge of construction runoff to groundwater will be permitted
- Where a pollution incident is detected, construction works will be stopped until the source of the construction pollution has been identified and remedied
- Pollution control facilities and procedures set out in the Sediment, Erosion and Pollution Control Construction Management Plan included in the CEMP will be implemented if required
- The pollution control and treatment facilities will be installed and the monitoring network including instrumentation and procedures established prior to construction activities taking place on the ground in the vicinity of watercourses and sensitive surface and groundwater receptors. It is envisaged that the pollution control facilities will be monitored daily to ensure their continued integrity and desired function

10.3.1.2 Karst Specific Mitigation Measures

In the event of karst being encountered the Karst Protocol shall be implemented. Karst specific mitigation measures are detailed in the Karst Protocol, which is documented in the CEMP (**Appendix C**). Application of the Karst Protocol are summarised below to detail where they will be implemented.

- Where karst features are encountered during construction works these will be assessed by a qualified hydrogeologist. These features will require their extent across the proposed road development to be delineated. In the case of excavations (road cuttings, tunnels, bridge pier excavations) then the karst feature shall be excavated and backfilled with course fill and sealed. This will

prevent runoff draining into the feature and therefore protect against accidental spillage. On this basis, construction runoff will not discharge to a karst pathway and will receive natural attenuation and dilution in the aquifer

- With regard to karst features being intercepted in excavations for earthworks (including viaducts, bridges and tunnels) and infiltration basins, the Karst Protocol preserves the hydraulic connectivity of the feature using granular material to fill but then seals the karst from the excavation using a liner (geotextile and or cement depending on the site specifics) that will prevent linkage between excavation and the karst.
- As per the design, inspection and maintenance will occur during the operation phase to ensure that the appropriate thickness of subsoil remains across the basin surface area. If karst features and potential pathways are found to be present during inspection and maintenance in the infiltration basin, then the Karst Protocol will be implemented to ensure that there are no preferential pathways within the infiltration basin.
- Given the proximity of the proposed road development to the Coolagh Lakes, which are groundwater dependant via karst springs, construction impacts represent a potential source of impact on the water quality of the lake from uncontrolled construction site runoff and potential contamination of the groundwater from construction spillages. There will be no surface water discharges to the Coolagh lakes and all runoff will be treated before being discharged to ground at infiltration basins. Infiltration basins are designed to include settlement to remove sediment and have 2m of subsoil below invert level. All infiltration basins include containment to protect against spillages. Infiltration basins require regular inspection to confirm that no observable subsidence in the infiltration has occurred due to karst. There are no guidelines on the inspection frequency for infiltration basins, however, based on the mitigation measures implemented the risk of subsidence occurring is considered to be low and inspection is recommended on 5-year frequency.
- Pouring of the concrete in excavations (River Corrib Bridge, Menlough Viaduct and Lackagh Tunnel) will only be undertaken when the excavation has been inspected by a qualified hydrogeologist. Inspection of the full depth and extent of each excavation will be undertaken to identify if any significant flow paths, such as the karst enhancement of the bedrock permeability, are present. If no significant flow paths are present, then the hydrogeologist will document accordingly and confirm that there is no risk to groundwater from cement leakage. If significant pathways are present then impacts which may arise from flow along these pathways shall be designed by the hydrogeologist based on the karst mitigation plan, these may comprise of installing a high permeability zone to replace the groundwater pathways which would be removed by the foundations and/or sealing the linkage from excavation to protect the karst. The design of the mitigation measures shall be approved by a qualified hydrogeologist to confirm that there will be no negative impacts to groundwater.

These above standard measures and karst measures will ensure that the risk of pollution of groundwater bodies is controlled and that there will be no impact to groundwater bodies that support GWDTE at European sites.

10.3.1.3 Lackagh Tunnel Mitigation Measures

- A hydrogeologist will be appointed for the construction phase by the contractor and will be present to monitor at all times when the construction activities have the potential to impact on groundwater. If karst is encountered during any excavation the karst feature will be examined by the hydrogeologist so that the extent and pathway can be classified. The feature will then be backfilled with granular material so as to maintain the hydraulic connectivity of the pathway and it will be sealed from the excavation to avoid potential impact to the groundwater recharge pattern and flow paths to GWDTE.
- Temporary bund walls are included in the design at the eastern tunnel portal as a measure to be implemented if extreme high groundwater conditions occur (>15m OD) during construction. This measure will prevent water with potentially high suspended solids that is ponded in the quarry from entering the tunnel during construction.
- To ensure that groundwater is not impacted by pollution during the construction phase, the following mitigation measures will be implemented as detailed in the CEMP:
    - A temporary barrier will be installed at the eastern portal when groundwater flooding occurs in the quarry to prevent runoff entering the tunnel from the quarry
    - All runoff or discharges will be managed as detailed in the CEMP so as to not discharge without being first treated
    - All liquid fuel or chemicals stored on site will be bunded within an area of sufficient capacity in order to contain 110% capacity

10.4 Habitat degradation – hydrology: Measures to Protect Water Quality in Receiving Watercourses

10.4.1 Mitigation Measures

The mitigation measures described below and in the CEMP (**Appendix C**) will be implemented to ensure that construction of the proposed road development will not affect water quality in receiving watercourses. These mitigation measures will be achieved through the stringent implementation of good construction practice procedures and environmental controls so as minimise the opportunity for contaminated releases of construction water. The mitigation measures are as follows:

- Potential construction impacts in the form of sediment impact and spillages to receiving watercourses and groundwater bodies will be mitigated through the use of temporary and the permanent proposed sedimentation ponds and wetland systems with all construction site runoff being passed through such facilities prior to discharge. The provision of continuous double silt fences and temporary settlement ponds in proximity to watercourses will mitigate the potential of construction site runoff pollution during the construction phase

- No direct untreated point discharge of construction runoff to watercourses or groundwater bodies will be permitted
- Construction runoff post settlement treatment shall be discharged to an undisturbed vegetated buffer zone, as opposed to a direct discharge to a watercourse
- The regular monitoring of downstream receptor water quality for sediments and hydrocarbons and the inspection of the pollution control facilities will be carried out during construction works
- Where a pollution incident is detected, construction works will be stopped until the source of the construction pollution has been identified and remedied
- The pollution control and treatment facilities, set out in the Sediment, Erosion and Pollution Control Construction Management Plan section of the CEMP, will be installed and the monitoring network including instrumentation and procedures established prior to construction activities taking place on the ground in the vicinity of watercourses and sensitive surface and groundwater receptors. The pollution control facilities will be monitored daily to ensure their continued integrity and desired function
- Construction site runoff discharging to watercourses and in particular the sediment concentrations will meet the surface water regulations. Continuous monitoring of sediment concentrations in the receiving water, during construction activities near watercourses, will be carried out to ensure compliance and respond immediately to pollution events
- The Site Environmental Manager (SEM) will be responsible for ensuring the successful finalisation, implementation and maintenance of the detailed Sediment, Erosion and Pollution Control Plan and the Incident Response Plan

Key elements of the Sediment, Erosion and Pollution Control Plan are described in the CEMP as follows:

- Section 8.3.1 describes the general control measures
- Section 8.3.2 outlines the requirements for and of the SEM
- Section 8.3.3 describes the control measures associated with excavating and processing earthworks, materials transportation, beneficial reuse sites for earthworks materials, and temporary material stockpiles
- Section 8.3.4 describes the control measures associated with construction of structures and working with concrete
- Section 8.3.5 describes the control measures associated with watercourse crossings and in-stream works which includes main watercourses, minor watercourses and drains, and stream diversions and realignments
- Section 8.3.6 describes the control measures associated with the protection of groundwater
- Section 8.3.7 describes the control measures associated with construction compounds and machinery refuelling, lubrication and/or maintenance sites

- Section 8.3.8 describes out the monitoring and audit requirements for both pre-construction and construction
- Section 8.3.9 outlines the emergency procedures (which will link in with the Incident Response Plan)

These measures are based on the following best practice guidelines to ensure that water bodies are adequately protected during construction work:

- Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (Inland Fisheries Ireland, 2016)
- Central Fisheries Board Channels and Challenges – The Enhancement of Salmonid Rivers
- CIRIA – Guideline Document C648 Control of Water Pollution from Linear Construction Projects, technical guidance
- CIRIA – Guideline Document C793 The SuDS Manual
- CIRIA – Guideline Document C624 Development and flood risk – guidance for the construction industry
- CIRIA (C649) Control of water pollution from linear construction projects, site guide (2006)
- CIRIA (C532) Control of water pollution from construction sites, guidance for consultants and contractors (2001)
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (NRA, 2005)

10.5 Habitat degradation – air quality: Measures to Control Dust Emissions During Construction

10.5.1 Mitigation Measures

General

All the mitigation measures outlined below have been developed based on the following guidance:

- Guidelines for the Treatment of Air Quality during the Planning and Construction of National Roads Schemes, Transport Infrastructure Ireland, 2011
- Guidance on the assessment of dust from demolition and construction, Institute of Air Quality Management, 2014

In order to ensure that any potential direct or indirect dust impacts will not affect vegetation within Lough Corrib cSAC in the vicinity of the construction works, the contractor will implement the following measures during construction of the proposed road development.

- Hard surface roads will be swept to remove mud and aggregate materials from their surface while any un-surfaced roads will be restricted to essential site traffic only apart from the contractor's car park which will be hardcore
- Any road that has the potential to give rise to fugitive dust will be regularly watered, during dry and/or windy conditions
- Vehicles using site roads will have their speed restricted, and this speed restriction will be enforced rigidly. On any un-surfaced site road, this will be 20 km/h, and on hard surfaced roads as site management dictates
- Wheel washing facilities will be provided for any vehicle exiting site in order to ensure that mud and other wastes are not tracked onto public roads, these will be located at least 50m away from Annex I habitats within a European site
- Material handling systems and site stockpiling of materials will be located at least 50m away from Annex I habitats within a European site. Potentially dusty surfaces will be dampened during dry conditions
- During movement of materials both on and off-site, trucks will be stringently covered with tarpaulin at all times. Before entrance onto public roads, trucks will be adequately inspected to reduce the potential for dust emissions

These procedures will be strictly monitored and assessed on a daily basis. In the event that elevated levels of dust are noted to occur outside the site boundary, satisfactory procedures will be implemented to rectify the problem before the resumption of construction operations.

Noise barriers in the form of hoarding will be provided around the construction sites. These will also have the effect of reducing off-site dust effects.

Specific to Lough Corrib cSAC

A 2m high dust screen will surround construction works at all locations within or adjacent to Lough Corrib cSAC to contain dust emissions generated during construction.

10.6 Habitat degradation – shading

10.6.1 Mitigation Measures

The proposed road development will not affect the QI or SCI species of any European sites as a result of any shading impacts and therefore, mitigation measures are not required.

10.7 Habitat degradation – non-native invasive plant species: Mitigation measures to avoid the introduction or spread of non-native invasive plant species to European sites

10.7.1 Mitigation Measures

A non-native invasive species management plan has been prepared for the proposed road development which will ensure that the spread of non-native invasive plant species does not arise during construction and that non-native invasive plant species are not introduced to any European site during construction. The plan sets out the strategy for identifying, controlling and managing the spread of non-native invasive plant species during construction.

The preparation and implementation of the management measures set out in this plan have been informed by legislation and by best practice guidance documents such as:

- *Guidelines on the Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (National Roads Authority, 2010)
- *Managing Japanese Knotweed on Development Sites (version 3, amended in 2013): The Knotweed Code of Practice* (Environment Agency, 2013)
- *Managing Invasive Non-native Plants in or near Freshwater* (Environment Agency, 2010)
- *Best Practice Management Guidelines Japanese knotweed Fallopia japonica*, Invasive Species Ireland (2015)

The non-native invasive species management plan will be updated by the Contractor in advance of construction works commencing. This will ensure that the baseline is up to date with respect to both the locations, extent and species types that must be removed from the construction site (and which may not be limited to those three that have been recorded to date) and controlled such that they are not introduced or spread within any European sites.

Non-native invasive plant species have been identified at a number of locations within the proposed development boundary. The strategy to control and manage these specific infested areas during construction is presented in the plan. Furthermore, mitigation measures to prevent the spread of all non-native invasive

plant species in all areas within the proposed development boundary during construction are detailed in the plan and include the following:

Advance treatment

Depending on the timescale for the construction of the proposed road development it may be possible to contain the spread of some plant species prior to the onset of construction on the site via an advance treatment contract. The implementation of advance treatment will require permission from landowners to access and treat the infested areas.

As part of the advance works contract, the Contractor will be required to update and implement the recommendations of this management plan prior to advance treatment commencing. The purpose of the advance treatment plan will be to:

- Identify the extent of the infestation on the site
- Ensure further growth and spread of the plant on the site does not occur
- Ensure the plant is not spread to other sites either adjacent to the infested site or through transportation of contaminated soil to another site
- Identify the best method for managing and controlling the non-native invasive plant species on the site with regard to the future proposed site works and construction methods
- Communicate the plan to all site operatives to ensure success of the plan
- Document and record the treatment and management methods carried out on site for future reference (for use during main construction contract, future site owners, site users, avoid litigation etc.)
- The advance treatment plan shall be completed by a qualified ecologist

Pre-construction survey

As species may have spread, or their distribution may have changed, between the habitat surveys carried out for the EIA Report and NIS, the advance treatment contract, and the commencement of the main construction works, the implementation of this plan will require a pre-construction re-survey by a suitably qualified person within the proposed development boundary. In accordance with the TII guidance this survey will produce accurate 1:5,000 scale mapping for the precise location of non-native invasive plant species. The pre-construction surveys will be undertaken by suitable experts with competence in identifying the species concerned having regard to any seasonal constraint.

Site hygiene

Maintaining site hygiene at all times in an area where non-native invasive species are present is essential to prevent further spread. It is also necessary on sites where non-native invasive species are not present but where there is risk of contaminated material being brought to site, for example, site machinery being used on multiple site, construction staff travelling between infested and not infested sites. Preventative biosecurity control measures will be taken to ensure that further spread does not arise. These measures include:

- Identify, fence off and clearly signpost and mark out infested areas prior to and during construction works. Avoid using machinery with tracks in infested areas
- Clearly identify and mark out areas where infested soil is to be stockpiled on site and cannot be within 50m of any watercourse or within a flood zone
- Create designated entry and exit points for operators on foot and for small mobile equipment
- Installation of a dedicated footwear and vehicular wheel wash down facility into a contained area within the site
- If soil is imported to the site for landscaping, infilling or embankments, the Contractor shall gain documentation from suppliers to confirm that it is free from non-native invasive species
- Ensure all site users are aware of measures to be taken and alert them to the presence of the plan

Treatment methods

Areas identified as requiring specific treatment will be demarcated and the designated control measures implemented at the earliest possible stage to reduce the risk of spread along the proposed road development or beyond the landtake.

There are a number of management options that may be implemented to control and prevent the spread of non-native invasive plant species. It is also noted that it may not be possible to completely remove the non-native invasive plant species before or during the construction phase. However, treatment methods can still be implemented (such as root barrier membranes) to ensure that further spread does not arise.

Those involved in the application of herbicides/pesticides must be competent to do so and, consequently, must have sufficient training, experience and knowledge in the area of herbicides/pesticides application. It is important that all staff involved in the application of herbicides/pesticides have received appropriate training, which may include achieving competency certification in the safe use of herbicides/pesticides through a National Proficiency Tests Council registered assessment centre or achieving an appropriate FETAC award in this area.

The type of treatment chosen will depend on site conditions (such as proximity to a watercourse/surrounding habitats/ proximity residential dwellings, health and safety and traffic concerns) and the type and extent of infestation. Rather a combined method of different treatments will be chosen on a site by site basis and with regard to sensitive receptors in immediate environs.

The implementation of the management measures set out in this plan ensures that any direct, indirect or ex-situ impacts to habitats and species within European sites will not arise and will ensure that adverse effects on the integrity of a European site are avoided.

Refer to Section 9 of the CEMP in **Appendix C** for further details.

10.8 Disturbance/displacement: Mitigation measures to avoid/reduce the disturbance/displacement effects of blasting on wintering birds using Ballindooley Lough

10.8.1 Mitigation Measures

Construction noise will be kept to a minimum in accordance with BS 5228 (2009).

The contract documents will specify that the contractor, undertaking the construction of the works, will be obliged to take specific noise abatement measures and will comply with the best practice outlined in British Standard BS 5228 – 1: 2009 +A1 2014: *Code of practice for noise and vibration control on construction and open sites – Noise* and the NRA (now TII) guidelines *Good Practice Guideline for the Treatment of Noise during the planning of National Road Schemes* (NRA 2014).

Blasting associated with the eastern approach to Lackagh Quarry (Ch. 11+800 to Ch. 12+100) will be carried out between the months of April to September (inclusive) to minimise the exposure of wintering birds at Ballindooley Lough to blasting-related disturbance. This restriction is included in the Schedule of Commitments which will be implemented by the contractor.

Blasting associated with the cutting at Castlegar (Ch. 12+550 to Ch. 13+650) will take approximately nine months to complete, with an estimated five blast events per week. To minimise the exposure of wintering birds at Ballindooley Lough to blasting-related disturbance, all of those nine months must be in the April to September period (inclusive) within consecutive years.

10.9 Barrier effect

10.9.1 Mitigation Measures

To avoid the culverts on the Bearna Stream (C04/01) and on the Tonabrocky Stream (C04/02) presenting a barrier to Otter movement, Otter passage facilities will be provided at culverts C04/01 (Ch. 4+100) and C04/02 (Ch. 4+950), These will consist of either raised ledges within structures, or separate dry 600mm pipes installed adjacent to the culverts. Mammal underpasses will be constructed in accordance with the *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (National Roads Authority, 2008c).

10.10 Mortality risk: Mitigation measures to avoid mortality of QI species

10.10.1 Mitigation Measures to ensure that construction materials are not introduced into the River Corrib

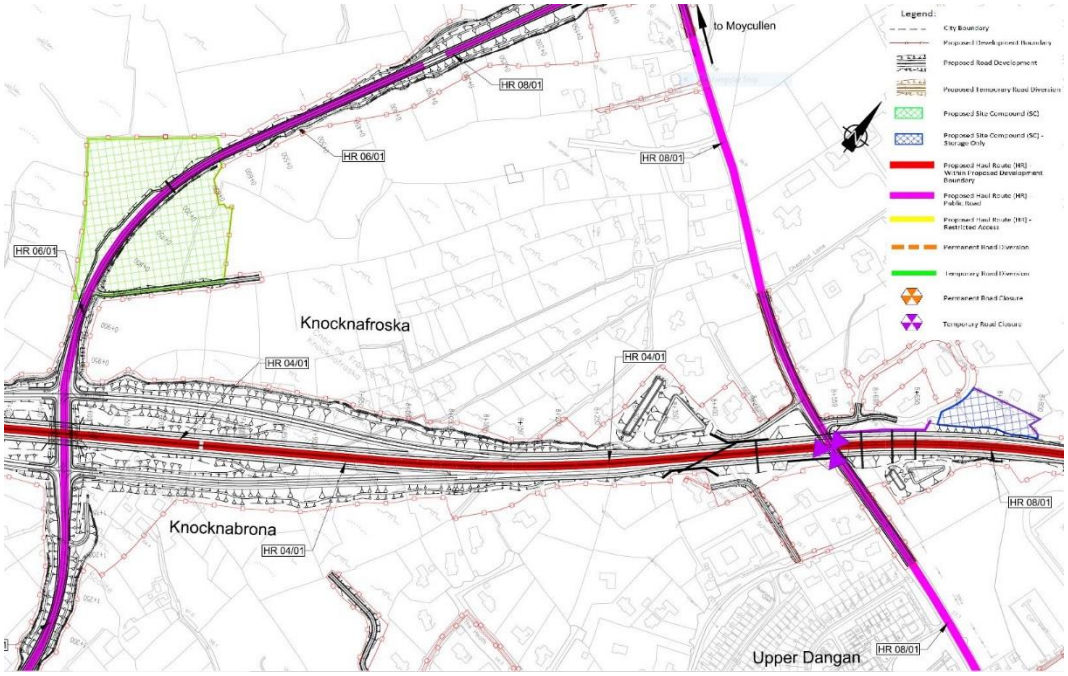
A detailed construction methodology has been prepared for the construction of the proposed River Corrib Bridge. The construction methodology ensures that the risk of accidentally introducing construction materials to the River Corrib during the bridge construction will be avoided, and the risk of accidental spillages into the River Corrib minimised. This ensures that construction works associated with the proposed River Corrib Bridge and any associated works within the drainage catchment of the River Corrib do not affect the conservation objectives of Lough Corrib cSAC.

The following measures will be implemented:

- During construction of the bridge deck the platform of the travelling framework used for construction will have netting suspended beneath to contain the construction materials
- Mitigation measures to control and treat site run off to ensure that the conservation objectives of Lough Corrib cSAC are not affected due to a reduction in water quality in the River Corrib are described in **Section 10.4** above. These include:
    - Working areas in proximity to the River Corrib shall be set back a minimum of 5m from the edge of the river in accordance with the requirements of Inland Fisheries Ireland (IFI). Drainage ponds and interceptor ditches will be constructed in advance of embankment and bridge construction to collect, treat and discharge all surface water runoff during construction
    - Construction run-off will need to be considered for the construction area around the River Corrib Bridge due to its proximity to the River Corrib. Protection of this water body from construction runoff and silt load shall be carried out through the use of reserved grassed buffer areas, timber fencing with silt fences, earthen berms or similar approved to provide adequate treatments of site runoff waters before reaching the watercourse. Protection from silt load may also be carried out through the use of the wetlands and attenuation ponds adjacent to the River Corrib on either river bank. It is possible that a combination of these methods could be used. For further site sediment and pollution control refer to Section 8 Sediment, Erosion and Pollution Control Plan of the CEMP in **Appendix C**. This plan sets out the strategy for ensuring that sediment, erosion and pollution generation is minimised and controlled. In particular that plan sets out particular requirements in relation to the location of construction compounds, stockpiling, concreting activities, working in proximity to watercourses (including the River Corrib) to ensure that impacts are minimised
    - Site access for the western river bank will be provided by the haul route, HR 08/01, via N59 Moycullen Road, as shown in **Figure 2.2** of the NIS and replicated below in **Plate 10.1**. The site compound, SC 08/01, for the River

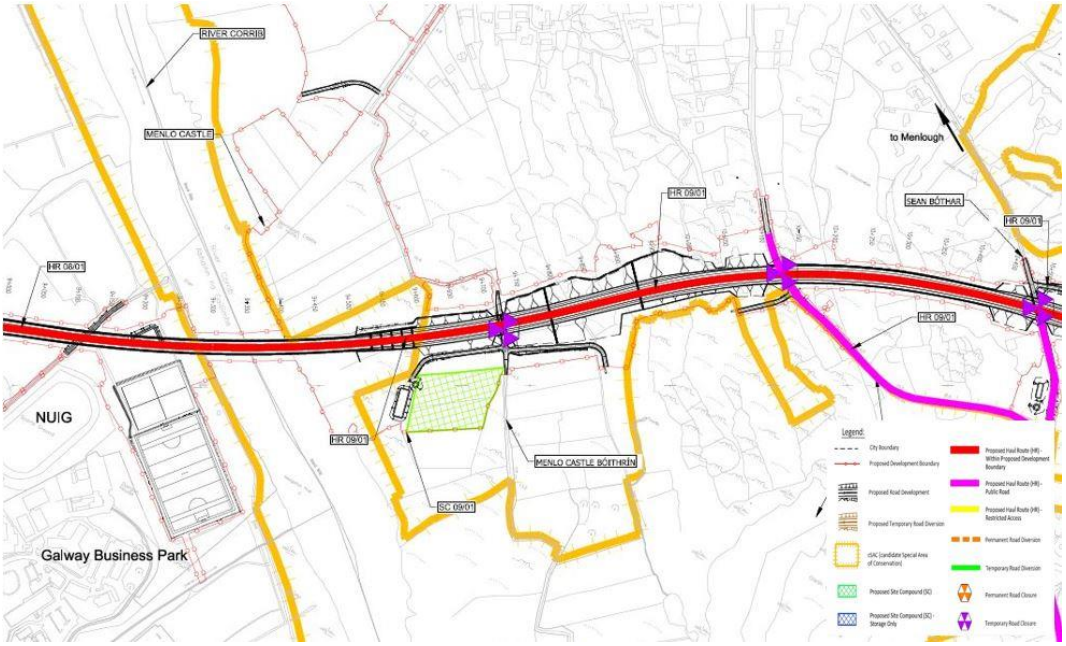
Corrib Bridge on the western river bank is located to the north of the proposed road development adjacent to hockey pitch, as shown in in **Plate 10.1** below. This site compound may only be used for storage of equipment and materials

Plate 10.1: River Corrib Western Bank Access and Site Compound



Site access for the eastern river bank will be provided by the haul route, HR 09/01, via Bóthar Nua, as shown in **Plate 10.2** below. The site compound, SC 09/01, for the River Corrib Bridge on the eastern river bank is located to the south of the proposed road development, as shown in **Plate 10.2** below. In addition, Lackagh Quarry site compound, SC 11/01, may also be used for storage and larger works requirements such as rock crushing etc.

Plate 10.2: River Corrib Eastern Bank Access and Site Compound



Refer to Section 8 of the CEMP in **Appendix C** for further details in relation to the Sediment, Erosion and Pollution Control Plan. Refer to **Appendix D** for further details on the construction methodology for the River Corrib.

10.10.2 Mitigation measures to remove the risk of Otter being killed/injured due to collisions with road traffic

To avoid Otter road casualties on the Bearna Stream and the Tonabrocky Stream, Otter passage facilities will be provided at culverts C04/01 (Ch. 4+100) and C04/02 (Ch. 4+950), These will consist of either raised ledges within structures, or separate dry 600mm pipes installed adjacent to the culverts. Mammal underpasses will be constructed in accordance with the *Guidelines for the Treatment of Otters prior to the Construction of National Road Schemes* (National Roads Authority, 2008c).

Mammal fencing will be installed along the proposed development boundary between Ch. 4+050 and Ch. 4+200, between Ch. 4+825 and Ch. 5+300, and between Ch. 9+750 and Ch. 10+040 (**Figure 6**) to prevent Otter accessing the road carriageway and to guide Otters to the mammal underpasses. Between Ch. 9+750 and Ch. 10+040, mammal fencing will not be required along the south-eastern edge of the road carriageway where the proposed retaining wall is greater than 2m in height, as this will prevent Otter accessing the proposed road carriageway. Mammal-resistant fencing will be installed in accordance with the specification detailed in TII's Standard Construction Detail for mammal resistant fencing (CC-SCD-00320/00319).

The retaining wall next to the proposed attenuation/infiltration ponds between the River Corrib and Ch. 9+600 is also greater than 2m in height and will prevent Otter accessing the proposed road carriageway.

10.11 Summary

This section presents a summary of how the mitigation measures proposed in relation to the proposed road development relate back to protecting the conservation objectives of the European sites and their QIs/SCIs.

Table 10.1 below outlines which of the European sites QIs/SCIs the various mitigation measures are designed to protect. This links back to the following tables in **Section 9** which detail how the specific attributes and targets of the conservation objectives will be protected by the mitigation measures:

- Lough Corrib cSAC – **Table 9.17**
- Galway Bay Complex cSAC – **Table 9.24**
- Lough Corrib SPA – **Table 9.31**
- Inner Galway Bay SPA – **Table 9.38**

Lough Corrib cSAC

In relation to Lough Corrib cSAC, the suite of mitigation measures relating to the protection of the receiving hydrological environment and the containment of construction materials during construction of the proposed River Corrib Bridge are designed to protect the aquatic QI species: the Freshwater pearl mussel, Sea lamprey, Brook lamprey, Atlantic salmon and Otter. The mammal fencing has also been provided to protect Otter from the mortality risk posed the proposed road development.

Hard water lakes, Molinia meadows, Cladium fen and Alkaline fen will be protected by the mitigation measures relating to the receiving hydrological and hydrogeological environments. The non-native invasive species management plan has been developed to protect *Molinia* meadows, *Cladium* fen and Alkaline fen from habitat degradation through the introduction/spread on non-native invasive plant species.

The areas of Calcareous grassland and Limestone pavement that surround the proposed road development in the Menlough/Coolough area, and that lie above the proposed Lackagh Tunnel, will be protected through the implementation of the mitigation measures to minimise habitat loss and avoid direct impacts on these habitats within Lough Corrib cSAC, measures to maintain the structural integrity of Limestone pavement during the construction of the proposed Lackagh Tunnel, measures to control dust during construction and to control non-native invasive plant species.

Galway Bay Complex cSAC

The coastal and marine habitats in Galway Bay will be protected by the mitigation measures relating to the protection of the receiving hydrological environment. The control of non-native invasive plant species will protect any areas of Calcareous grassland [*6210/6210] habitat downstream of the proposed road development. The Harbour seal and Otter will also be protected by the hydrological mitigation measures. Mitigation measures to ensure that the proposed road development does not pose a barrier to Otter movement in the Bearna Stream catchment, or does not

pose a mortality risk to Otter, are also included to protect Otter in Galway Bay Complex cSAC.

Lough Corrib SPA & Inner Galway Bay SPA

The mitigation measures to protect the receiving hydrological and hydrogeological environment and to avoid/reduce the disturbance/displacement effects of blasting on wintering birds using Ballindooley Lough, are designed to protect the SCI bird populations of Lough Corrib SPA and Inner Galway Bay SPA (and the wetland habitat that support them).

Table 10.1: Summary of Mitigation Measures and how they relate back to protecting the QIs/SCIs and conservation objectives of Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA and Inner Galway bay SPA

Green highlighted cells show which QIs/SCIs the proposed mitigation strategies are designed to protect

	Mitigation Measures (Section References)									
European site and QIs/SCIs	**10.1**	**10.2**	**10.3**	**10.4**	**10.5**	**10.7**	**10.8**	**10.9**	**10.10.1**	**10.10.2**
Lough Corrib cSAC										
[3140] Hard oligo - mesotrophic waters with benthic vegetation of *Chara* spp.										
[6210] Semi - natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites)										
[6410] *Molinia* meadows on calcareous, peaty or clayey-silt laden soils (*Molinion caeruleae*)										
[*7210] Calcareous fens with *Cladium mariscus* and species of the *Caricion davallianae*										
[7230] Alkaline fens										
[8240] Limestone pavements *										
[1029] Freshwater Pearl Mussel - *Margaritifera margaritifera*										
[1095] Sea Lamprey - *Petromyzon marinus*										
[1096] Brook Lamprey - *Lampetra planeri*										
[1106] Atlantic Salmon - *Salmo salar* (only in fresh water)										
[1355] Otter *Lutra lutra*										
Galway Bay Complex cSAC										
[1140] Mudflats and sandflats not covered by seawater at low tide										
[1150] Coastal lagoons*										
[1160] Large shallow inlets and bays										

	Mitigation Measures (Section References)									
European site and QIs/SCIs	**10.1**	**10.2**	**10.3**	**10.4**	**10.5**	**10.7**	**10.8**	**10.9**	**10.10.1**	**10.10.2**
[1170] Reefs				■						
[1220] Perennial vegetation of stony banks				■						
[1310] *Salicornia* and other annuals colonising mud and sand				■						
[1330] Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)				■						
[1410] Mediterranean salt meadows (Juncetalia maritimi)				■						
[6210] Semi - natural dry grasslands and scrubland facies on calcareous substrates (*Festuco Brometalia*) (*important orchid sites)						■				
[1355] Otter *Lutra lutra*				■				■		■
[1365] Harbour seal *Phoca vitulina*				■						
Lough Corrib SPA										
Shoveler, Tufted duck				■			■			
Coot			■	■			■			
Golden Plover				■						
Black-headed gull			■	■			■			
Common gull				■						
Common tern				■						
Wetlands			■	■						
Inner Galway Bay SPA										
Great northern diver, Grey heron, Light-bellied brent goose, Wigeon, Teal, Shoveler, Red-breasted merganser, Ringed plover, Golden plover, Lapwing, Dunlin, Bar-tailed godwit, Curlew, Redshank, Turnstone, Black-headed gull, Common Gull, Cormorant			■	■			■			
Wetlands			■	■						

11 Residual Impacts

This section presents the residual impacts associated with the proposed road development and discusses how the mitigation measures proposed in **Section 10** will ensure that the potential impacts associated with the proposed road development will not affect the conservation objectives of the European sites in question, and will not adversely affect the integrity of those sites.

For more details on the specifics of how the potential impacts associated with the proposed road development relate to the QIs/SCIs and conservation objectives of each European site in question, the mitigation measures, and the specific attributes and targets relating to those conservation objectives, refer to the following Tables in **Section 9**:

- Lough Corrib cSAC – **Table 9.17** in **Section 9.1.4.10**
- Galway Bay Complex cSAC – **Table 9.24** in **Section 9.2.4.10**
- Lough Corrib SPA – **Table 9.31** in **Section 9.3.4.10**
- Inner Galway Bay SPA – **Table 9.38** in **Section 9.4.4.10**

11.1 Lough Corrib cSAC

11.1.1 Habitat loss/fragmentation

None of the c.2ha of habitat area lost within Lough Corrib cSAC correspond with any Annex I habitat types; none are QIs of Lough Corrib cSAC and they do not provide a supporting role to any QI habitats within Lough Corrib cSAC, nor to the site's QI species. The loss of any habitat areas outside of Lough Corrib cSAC will not have any indirect impacts on QI habitats, or habitats supporting QI species, due to the absence of any impact pathways (**Section 9.1.4.1**) – i.e. the habitats lost outside of the European site do not provide a supporting role to any QI habitats within Lough Corrib cSAC, nor to QI species.

There are some areas of Annex I QI habitat within the proposed development boundary but outside of the footprint of the proposed road development (Limestone pavement [*8240] and Calcareous grassland [6210]), however, these will not be lost as the mitigation strategy prohibits construction works in these areas and, in the case of the Limestone pavement and Calcareous grassland above the proposed Lackagh Tunnel, the grazing regime will not be restricted (**Section 10.1**).

These mitigation measures will be implemented through the CEMP by the contractor during construction and will ensure that Annex I habitats within Lough Corrib cSAC are not directly impacted.

Bankside and riparian habitat loss, or modification, associated with construction of the proposed road development, will not impact upon breeding or resting places or affect the populations of Otter, Atlantic salmon, Sea lamprey or Brook lamprey in Lough Corrib cSAC and no mitigation measures are required.

Therefore, any habitat loss associated with the proposed road development will not affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats and species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

A summary of the residual habitat loss/fragmentation impacts associated with the proposed road development is presented in **Table 11.1** below.

Table 11.1: Summary of Residual Habitat Loss/Fragmentation Impacts

Potential Direct or Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required?**	**Are there any residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC?**
Construction			
Loss of QI habitat or loss of non-QI habitat types that have a supporting role in maintaining the conservation status of QI habitats	Yes Although the proposed road development will not result in the loss of any area of QI Annex I habitats within Lough Corrib cSAC; nor will it result in the loss of any habitats that support the QI habitats there are areas of Limestone pavement [*8240] and Calcareous grassland [6210] habitat within Lough Corrib cSAC that lie within the proposed development boundary yet outside of the footprint of the road carriageway which could be directly impacted. Restricting grazing from calcareous grassland habitat above the proposed Lackagh Tunnel could result in habitat area loss through scrub encroachment.	Yes Construction works will not be permitted within these areas to avoid any loss of Annex I habitat within Lough Corrib cSAC. A permanent fence will also not be erected in areas of habitat to be retained. In terms of the areas of Calcareous grassland and Limestone pavement above the proposed Lackagh Tunnel, the absence of a permanent fenceline will not affect grazing access to these habitat areas. **Section 10.1** (and **Figures 15.1** to **15.5** for locations of restricted areas)	No

11.1.2 Habitat degradation – tunnelling/excavation

Considering the construction methodology and mitigation measures described in **Section 10.2**, the construction of the Lackagh Tunnel, works in Lackagh Quarry, or any associated excavations along the Western Approach to the tunnel, will not affect the structural integrity[56] of the rock mass supporting the overlying or adjoining QI habitats within Lough Corrib cSAC (i.e. namely Limestone pavement and Calcareous grassland) during the construction or operational phases of the proposed road development.

These mitigation measures will be implemented through the schedule of commitments by the contractor (which will be included within the CEMP) during construction and will ensure that structural impacts to the rock mass do not occur.

Therefore, neither the construction nor operation of the Lackagh Tunnel and approaches will affect the structural integrity of the rock mass supporting QI habitats in Lough Corrib cSAC or affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats and species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

A summary of the residual impacts associated with construction of the proposed Lackagh Tunnel is presented in **Table 11.2** below.

Table 11.2: Summary of Residual Impacts Associated with Constructing the Lackagh Tunnel

Potential Direct or Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required?**	**Are there any residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC?**
Construction			
Tunnelling and excavations at the proposed Lackagh Tunnel affecting the structural integrity of surface-level habitats: [*8240] [6210]	Yes, if construction works resulted in a collapse/subsidence of the rock mass above the tunnel resulting in the loss of QI Limestone pavement/Calcareous grassland habitat area within the cSAC above	Yes Monitoring of rock slopes during tunnel construction and during operation, and monitoring of blasting locally to ensure there is no risk to the structural integrity of the rock mass supporting the QI habitats in the cSAC above **Section 10.2**	No

[56] Structural Integrity of the mosaic of Limestone pavement and Calcareous grassland is the physical and mechanical geotechnical properties that control the behaviour of the geotechnical Limestone pavement environment

11.1.3 Habitat degradation – hydrogeology

Considering the design measures associated with the proposed road development, groundwater supply supporting groundwater dependant habitats in Lough Corrib cSAC will not be affected during operation such that any effects on QI habitats, or habitats supporting QI species, would occur.

However, there is a risk of the proposed road development affecting groundwater supply to the Coolagh lakes during construction of the Menlough Viaduct, and affecting groundwater quality during construction and/or operation.

Mitigation measures will be implemented to control and treat site run-off during construction and to ensure that the drainage system and infiltration basins function as designed over the life of the proposed road development (**Section 10.3**). The karst protocol set out in the CEMP will also be used in the event of karst being encountered.

These mitigation measures will be implemented through the CEMP by the contractor during construction (construction pollution risk) and by Galway County Council/TII over the operational lifespan of the proposed road development (maintenance) and will ensure that hydrogeological impacts do not occur.

Therefore, habitat degradation as a result of impacts on the existing groundwater regime will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats and species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

A summary of the residual hydrogeological impacts associated with the proposed road development is presented in **Table 11.3** below.

Table 11.3: Summary of Residual Hydrogeological Impacts

Potential Direct and Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required?**	**Are there any residual direct and indirect impacts that could adversely affect the integrity of Lough Corrib cSAC?**
Construction			
Construction works affecting groundwater quantity that supports QI wetland habitats: e.g. Coolagh Lakes	The installation of the supporting piers of the proposed Menlough Viaduct has the potential to interact with groundwater conduits and potentially affect groundwater flow locally with the Lough Corrib Fen 1 (Menlough) GWB –	Yes To ensure that groundwater flow paths are not impacted by construction works **Section 10.**3	No

Potential Direct and Indirect Impacts	Could the conservation objectives be affected? see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives	Are mitigation measures required?	Are there any residual direct and indirect impacts that could adversely affect the integrity of Lough Corrib cSAC?
	which in turn could affect groundwater supply to the Western Coolagh Spring that contributes to the Coolagh Lakes, supporting QI wetland habitats in the cSAC		
Construction works affecting groundwater quality	Yes Affecting the quality of groundwater supporting groundwater dependant habitats in Lough Corrib cSAC could affect the distribution, extent, diversity and area of QI wetland habitats	Yes, to ensure that site runoff is controlled and treated during construction to avoid polluting groundwater bodies **Section 10.3**	No
Operation			
Groundwater quantity being affected during operation	Yes Although the design of the proposed road development will not restrict or inhibit existing groundwater flow paths supporting groundwater dependant habitats in Lough Corrib cSAC, it is important that the appropriate level of subsoil remains below the infiltration basins	Yes The karst protocol will be implemented, if karst features and potential pathways are found to be present during inspection and maintenance in the infiltration basin **Section 10.3**	No
Groundwater quality being affected during operation	Yes The drainage design (as described in Section 6, and Appendices G, H and I) will ensure that groundwater quality will be maintained during operation. However, it is important that the appropriate level of subsoil remains	Yes The karst protocol will be implemented, if karst features and potential pathways are found to be present during inspection and maintenance in the infiltration basin **Section 10.3**	No

Potential Direct and Indirect Impacts	Could the conservation objectives be affected? see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives	Are mitigation measures required?	Are there any residual direct and indirect impacts that could adversely affect the integrity of Lough Corrib cSAC?
	beneath the infiltration basins to ensure their continued functioning.		

11.1.4 Habitat degradation – hydrology

Considering the design measures associated with the proposed road development, it will not affect the functioning of the existing hydrological regime that supports QI habitats and species in Lough Corrib cSAC, either during construction or operation of the proposed road development.

However, there remains a risk of the proposed road development affecting surface water quality during construction, due to accidental pollution, and/or during operation as the drainage system must be maintained to function correctly. Mitigation measures will be implemented to control and treat site run-off during construction and to ensure that the drainage system functions as designed over the life of the proposed road development (**Section 10.4**).

These mitigation measures will be implemented through the CEMP by the contractor during construction (construction pollution risk) and by Galway County Council/TII over the operational lifespan of the proposed road development (maintenance) and will ensure that hydrological impacts do not occur.

Therefore, habitat degradation as a result of impacts on the existing hydrological regime will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats or species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

A summary of the residual hydrological impacts associated with the proposed road development is presented in **Table 11.4** below.

Table 11.4: Summary of Hydrological Impacts

Potential Direct or Indirect Impacts	Could the conservation objectives be affected? see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives	Are mitigation measures required	Are there any direct or indirect residual impacts that could adversely affect the integrity of Lough Corrib cSAC?
Construction			
Construction works affecting surface water quality	Yes Affecting the quality of surface water supporting aquatic/wetland habitats and species could affect the quality and extent of those habitats and the aquatic species they support	Yes, to ensure that site runoff is controlled and treated during construction to avoid polluting the surface water drainage network **Section 10.4**	No

11.1.5 Habitat degradation – air quality

Considering the design of the proposed road development, the predicted levels of pollutants that will be generated during operation and their restricted ZoI, and the proximity of the road carriageway to Lough Corrib cSAC, there will not be any air quality effects on QI habitats or species in Lough Corrib cSAC during the operation of the proposed road development.

However, dust generated during construction has the potential to negatively affect vegetation and habitats within Lough Corrib cSAC where the proposed road development crosses the cSAC boundary, or lies in close proximity to it. Mitigation measures will be implemented to contain dust emissions during construction (**Section 10.5**).

These mitigation measures will be implemented through the CEMP by the contractor during construction and will ensure that dust related air quality impacts do not occur.

Therefore, habitat degradation as a result of air quality impacts will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats or species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

A summary of the residual air quality impacts associated with the proposed road development is presented in **Table 11.5** below.

Table 11.5: Summary of Residual Air Quality Impacts

Potential Direct or Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required?**	**Are there any residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC?**
Construction			
Dust generated during construction works within, or in close proximity to, Lough Corrib cSAC affecting the extent, diversity or structure of habitats within Lough Corrib cSAC in the vicinity of the proposed road development	Yes, as dust deposition could affect the extent, diversity or structure of habitats within Lough Corrib cSAC	Yes, to control dust levels generated by construction works **Section 10.5**	No

11.1.6 Habitat degradation – Shading

The habitats within Lough Corrib cSAC that are affected by shading from the proposed road development are not QI habitats and nor do they provide a supporting role to any other QI habitats within Lough Corrib cSAC. The shading effects predicted will be minor and localised and will also not have any direct or indirect impact upon the site's QI species (Otter, Atlantic salmon, Brook lamprey and Sea lamprey); i.e. would not compromise any habitat used by these species within Lough Corrib cSAC.

Therefore, habitat degradation as a result of shading impacts will not affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats or species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

11.1.7 Habitat degradation – non-native invasive species

Non-native invasive plant species have been recorded along, or in close proximity to the proposed road development and construction works and/or operational maintenance works have the potential to accidentally cause their introduction/spread to habitat areas within Lough Corrib cSAC; potentially affecting plant species composition, diversity and abundance in affected habitats.

Mitigation measures are included in the Non-Native Invasive Species Management Plan section of the CEMP to treat and control non-native invasive plant species within the proposed development boundary (**Section 10.7**).

These mitigation measures will be implemented through the CEMP by the contractor during construction and by Galway County Council/TII over the operational lifespan of the proposed road development and will ensure that non-native invasive plant species are not spread within or introduced to Lough Corrib cSAC.

Therefore, habitat degradation as a result of introducing/spreading non-native plant species will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats or species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

A summary of the residual impacts associated with non-native invasive plant species is presented in **Table 11.6** below.

Table 11.6: Summary of Residual Non-native Invasive Species Impacts

Potential Direct and Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required?**	**Are there any residual direct and indirect impacts that could adversely affect the integrity of Lough Corrib cSAC?**
Construction/Operation			
Introducing or spreading non-native invasive species to habitats within Lough Corrib cSAC	Yes. Introducing/spreading non-native invasive plant species could affect the distribution, extent, diversity and area of QI habitats or habitat areas supporting QI species	Yes, to ensure that non-native invasive plant species are not introduced to, or spread within, Lough Corrib cSAC **Section 10.7**	No

11.1.8 Disturbance/displacement

The proposed road development will not result in any long-term disturbance or displacement of Otter, Atlantic salmon, Brook lamprey or Sea lamprey during construction or operation.

Therefore, disturbance will not affect the conservation objective attributes and targets supporting the conservation condition of the QI species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

11.1.9 Barrier effect

Considering the design measures associated with the proposed road development, it will not result in a barrier to the movement of aquatic species in Lough Corrib cSAC, during construction or operational phases of the proposed road development.

Therefore, a barrier effect impact will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the QI species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

11.1.10 Mortality risk

The design of the proposed road development limits the mortality risk to the QI species of Lough Corrib cSAC (Otter, Atlantic salmon, Brook lamprey and Sea lamprey) by clear-spanning the River Corrib and its floodplain.

However, some level of mortality risk is posed by the possibility of accidentally dropping construction materials into the River Corrib during construction of the proposed River Corrib Bridge and by the possibility of Otter gaining access to the proposed road carriageway.

Mitigation measures will be implemented to contain construction materials during construction of the River Corrib Bridge and to install Otter resistant fencing in high risk areas to prevent Otter gaining access to the proposed road carriageway (**Section 10.10.2**).

These mitigation measures have been implemented through the design of the proposed road development and will be by the implementation of the CEMP by the contractor during construction and will ensure that there is no mortality risk to the QI species of Lough Corrib cSAC.

Therefore, the mortality of QI species will not occur or affect the conservation objective attributes and targets supporting the conservation condition of those QI species of Lough Corrib cSAC (see **Table 9.17**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC.

A summary of the residual impacts associated with the mortality risk posed by the proposed road development is presented in **Table 11.7** below.

Table 11.7: Summary of Residual Mortality Risk Impacts

Potential Direct or Indirect Impacts	Could the conservation objectives be affected? see Table 9.17 for more details on links to QIs and specific attributes and targets of the conservation objectives	Are mitigation measures required?	Are there any residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib cSAC?
Construction			
Accidentally dropping construction materials into the River Corrib during construction of the proposed River Corrib Bridge could result in the mortality of aquatic QI species: Otter Atlantic salmon Sea lamprey Brook lamprey	Yes Mortality of QI species could affect populations numbers – although given the low risk and temporary nature of works above the river, this is unlikely to result in any population level effects	Yes, a detailed construction methodology which includes netting beneath the works area for the bridge deck to ensure that constructions materials are not accidentally dropped into the River Corrib **Section 10.10.1**	No
Operation			
Mortality/road traffic collision risk to Otter	Yes, operation of the proposed road development presents a permanent risk of Otter mortality due to road traffic collisions and could have long-term effects on the Otter population of Lough Corrib cSAC	Yes, the provision of mammal fencing to ensure that Otter cannot gain access to the proposed road carriageway **Section 10.10.2**	No

11.1.11 Conclusion of Assessment for Lough Corrib cSAC

None of the potential direct or indirect impacts associated with the proposed road development will affect the conservation objectives of any of the QI habitats or species of Lough Corrib cSAC. Mitigation measures are included to ensure the retention and protection of QI habitats (**Section 10.1**), to ensure that the structural integrity[57] of the rock mass supporting habitats within Lough Corrib cSAC is not affected during construction of the Lackagh Tunnel (**Section 10.2**), to ensure the protection of the receiving hydrogeological and hydrological environments (**Sections 10.3** and **10.4**), to contain dust generated during construction (**Section 10.5**), to prevent the introduction/spread of non-native invasive plant species to Lough Corrib cSAC (**Section 10.7**), and to ensure that the proposed road

[57] Structural Integrity of the rockmass that supports the mosaic of Limestone pavement and Calcareous grassland is the physical and mechanical geotechnical properties that control the behaviour of the geotechnical Limestone pavement environment

development does not present a barrier to Otter movement or a mortality risk to the Otter population of Lough Corrib cSAC (**Section 10.9** and **Section 10.10.2**, respectively). Refer to **Table 9.17** and **Table 10.1** for how these mitigation measures relate back to the QIs and conservation objectives of Lough Corrib cSAC.

Following an examination, analysis and evaluation in light of best scientific knowledge of all relevant information in respect of the QI habitats and species of Lough Corrib cSAC within the ZoI of the proposed road development, the potential impacts and mitigation measures, and whether or not the predicted impacts would affect the conservation objectives that support the conservation condition for the QIs concerned, it has been concluded that the proposed road development does not pose a risk of adversely affecting (either directly or indirectly) the integrity of Lough Corrib cSAC and there is no reasonable scientific doubt with the conclusion.

11.2 Galway Bay Complex cSAC

11.2.1 Habitat degradation – hydrology

The proposed road development will not affect the functioning of the existing hydrological or tidal regime that supports QI habitats and species in Galway Bay cSAC, either during construction or operation.

However, the risk of the proposed road development affecting surface water quality during construction requires mitigation, to ensure that the drainage system continues to function as designed (**Section 10.4**).

These mitigation measures will be implemented through the CEMP by the contractor during construction and by Galway County Council/TII over the lifespan of the proposed road development and will ensure that hydrogeological impacts do not occur.

Therefore, habitat degradation as a result of impacts on the existing hydrological regime will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats or species of Galway Bay Complex cSAC (see **Table 9.24**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Galway Bay Complex cSAC.

A summary of the residual hydrological impacts associated with the proposed road development is presented in **Table 11.8** below.

Table 11.8: Summary of Residual Hydrological Impacts

Potential Direct or Indirect Impacts	Could the conservation objectives be affected? see Table 9.24 for more details on links to QIs and specific attributes and targets of the conservation objectives	Are mitigation measures required?	Are there any residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay Complex cSAC?
Construction			
Construction works affecting surface water quality	Yes Affecting the quality of surface water discharging to the marine environment could affect the associated aquatic/coastal/marine habitats and species	Yes, to ensure that site runoff is controlled and treated during construction to avoid polluting the receiving surface water drainage network and marine environment **Section 10.4**	No

11.2.2 Habitat degradation – non-native invasive plant species

Non-native invasive plant species have been recorded along, or in close proximity to the proposed road development and construction works and or operational maintenance works have the potential to accidentally cause their introduction/spread to habitat areas within Galway Bay Complex cSAC; potentially affecting plant species composition, diversity and abundance in affected habitats.

Mitigation measures are included in the Non-Native Invasive Species Management Plan section of the CEMP to treat and control non-native invasive plant species within the proposed development boundary (**Section 10.7**).

These mitigation measures will be implemented through the implementation of the CEMP by the contractor during construction and by Galway County Council over the operational lifespan of the proposed road development and will ensure that non-native invasive plant species are not spread within or introduced to Galway Bay Complex cSAC.

Therefore, habitat degradation as a result of introducing/spreading non-native plant species will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the QI habitats or species of Galway Bay Complex cSAC (see **Table 9.24**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Galway Bay Complex cSAC.

A summary of the residual impacts associated with non-native invasive plant species is presented in **Table 11.9** below.

Table 11.9: Summary of Residual Non-native Invasive Species Impacts

Potential Direct and Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.24 for more details on links to QIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required?**	**Are there any residual direct and indirect impacts that could adversely affect the integrity of Galway Bay Complex cSAC?**
Construction/Operation			
Introducing or spreading non-native invasive species to habitats within Galway Bay Complex cSAC	Yes. Introducing/spreading non-native invasive plant species could affect the distribution, extent, diversity and area of QI habitats or habitat areas supporting QI species	Yes, to ensure that non-native invasive plant species are not introduced to, or spread within, Galway Bay Complex cSAC **Section 10.7**	No

11.2.3 Barrier effect

The potential for the proposed road development to present a barrier to the movement of Otter throughout the Bearna Stream catchment requires mitigation to ensure that the culverts on the Bearna Stream and the Tonabrocky Stream remain passable by Otter at all times (**Section 10.9**).

The use of the mitigation measures will ensure a barrier effect impact will not occur or affect the conservation objective attributes and targets supporting the conservation condition of Galway Bay Complex cSAC's Otter population (see **Table 9.24**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Galway Bay Complex cSAC.

A summary of the residual barrier effect impacts associated with the proposed road development is presented in **Table 11.10** below.

Table 11.10: Summary of Residual Barrier Effect Impacts

Potential Direct or Indirect Impacts	Could the conservation objectives be affected? see Table 9.24 for more details on links to QIs and specific attributes and targets of the conservation objectives	Are mitigation measures required?	Are there any residual direct or indirect impacts that could adversely affect the integrity of Galway Bay Complex cSAC?
Operation			
Barrier effect to Otter movement throughout the Bearna Stream catchment	Yes Operation of the proposed road development may present barrier to Otter movement that could affect the Otter population of Galway Bay Complex cSAC	Yes To ensure that Otter movements are not restricted in the Bearna Stream catchment (as outlined in **Section 10.9**)	No

11.2.4 Mortality risk

The proposed road development presents a permanent risk of Otter mortality along the Bearna Stream and the Tonabrocky Stream due to road traffic collisions. Mitigation measures will be implemented to install Otter resistant fencing in the vicinity of the culverts on the Bearna Stream and the Tonabrocky Stream, at which Otter passage facilities are being provided (**Section 10.10.2**). These mitigation measures will ensure that there is no mortality risk to the Otter population of Galway Bay Complex cSAC.

Therefore, the mortality of Otter will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the Otter population of Galway Bay Complex cSAC (see **Table 9.24**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Galway Bay Complex cSAC.

A summary of the residual impacts associated with the mortality risk posed by the proposed road development is presented in **Table 11.11** below.

Table 11.11: Summary of Residual Mortality Risk Impacts

Potential Direct or Indirect Impacts	Could the conservation objectives be affected? see Table 9.24 for more details on links to QIs and specific attributes and targets of the conservation objectives	Are mitigation measures required?	Are there any residual direct or indirect impacts that could adversely affect the integrity of Galway Bay Complex cSAC?
Operation			
Mortality/road traffic collision risk to Otter	Yes Operation of the proposed road development present a permanent risk of Otter mortality due to road traffic collisions and could have long-term effects on the Otter population of Galway Bay Complex cSAC	Yes To ensure that Otter cannot gain access to the road carriageway (as outlined in **Section 10.10.2**)	No

11.2.5 Conclusion of Assessment for Galway Bay Complex cSAC

None of the potential direct or indirect impacts associated with the proposed road development will affect the conservation objectives of any of the QI habitats or species of Galway Bay Complex cSAC. Mitigation measures are included to ensure that the proposed road development does not affect water quality in Galway Bay (**Section 10.4**), does not introduce non-native invasive plant species to Galway Bay Complex cSAC (**Section 10.7**), and does not present a barrier to Otter movement or a mortality risk to the Otter population of Galway Bay Complex cSAC (**Section 10.9** and **Section 10.10.2**, respectively). Refer to **Table 9.24** and **Table 10.1** for how these mitigation measures relate back to the QIs and conservation objectives of Galway Bay Complex cSAC.

Following an examination, analysis and evaluation, in light of best scientific knowledge of all relevant information in respect of the QI habitats and species of Galway Bay Complex cSAC within the ZoI of the proposed road development, the potential impacts and mitigation measures, and whether or not the predicted impacts would affect the conservation objectives that support the conservation condition for the QIs concerned, it has been concluded that the proposed road development does not pose any risk (either directly or indirectly) of adversely affecting the integrity of Galway Bay Complex cSAC and there is no reasonable scientific doubt with this conclusion

11.3 Lough Corrib SPA

11.3.1 Habitat degradation – hydrogeology/hydrology

Groundwater supply to groundwater dependant habitats will not be affected during construction or operation such that any population level effects would occur as a consequence of the limited habitat effects associated with the proposed road development.

However, the risk of the proposed road development affecting groundwater quality during construction requires mitigation, as it does during operation, to ensure that the drainage system continues to function as designed (**Section 10.3**).

The proposed road development will not affect the functioning of the existing hydrological regime that supports sites used by SCI listed bird species, either during construction or operation.

However, the risk of the proposed road development affecting surface water quality during construction requires mitigation (**Section 10.4**).

These mitigation measures will be implemented through the CEMP by the contractor during construction (pollution control) and by Galway County Council/TII over the operational lifespan of the proposed road development (maintenance) and will ensure that hydrogeological/hydrological impacts do not occur.

Therefore, habitat degradation as a result of potential impacts on the existing groundwater or surface water regimes will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the SCI species of Lough Corrib SPA (see **Table 9.31**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib SPA.

A summary of the residual hydrogeological/hydrological impacts associated with the proposed road development is presented in **Table 11.12** below.

Table 11.12: Summary of Residual Hydrogeological/Hydrological Impacts

Potential Direct or Indirect Impacts	Could the conservation objectives be affected? see Table 9.31 for more details on links to SCIs and specific attributes and targets of the conservation objectives	Are mitigation measures required?	Are there any residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib SPA?
Construction			
Construction works affecting groundwater quality	Affecting the quality of groundwater supporting groundwater dependant habitats could affect the type, quality and extend of suitable habitat available to SCI bird species	Yes **Section 10.3**	No
Construction works affecting surface water quality	Affecting the quality of surface water supporting aquatic/wetland/marine habitats and species could affect the quality and extent of those habitats and the aquatic species they support	Yes **Section 10.4**	No
Operation			
Groundwater quantity being affected during operation	The design of the proposed road development will not restrict or inhibit existing groundwater flow paths supporting groundwater dependant habitats used by bird species listed as SCIs of Lough Corrib SPA. However, it is important that the appropriate level of subsoil remains beneath the infiltration basins to ensure their continued functioning	Yes The karst protocol will be implemented, if karst features and potential pathways are found to be present during inspection and maintenance in the infiltration basin **Section 10.3**	No
Groundwater quality being affected during operation	The drainage design (as described in Section 2, and Appendices G, H and I) will ensure that groundwater quality will be maintained during operation. However, it is important that the appropriate level of subsoil remains beneath the infiltration basins to ensure their continued functioning	Yes The karst protocol will be implemented, if karst features and potential pathways are found to be present during inspection and maintenance in the infiltration basin **Section 10.3**	No

As the proposed road development poses no risk of hydrogeological or hydrological effects to wetland habitats, either within the SPA or at potential ex-situ sites, it will not affect the conservation objective attributes and targets supporting the conservation condition of any of the SCI species of Lough Corrib SPA in that regard (see **Table 9.31**).

11.3.2 Disturbance/displacement – within SPA

Lough Corrib SPA is beyond the ZoI of any long-term construction or operation related disturbance associated with the proposed road development. As a result, there is no potential for any impacts on the conservation objectives of Lough Corrib SPA to arise via this impact and no mitigation measures are required.

Therefore, to the limited extent that there may be disturbance of SCI birds from habitats within the SPA during construction or operation of the proposed road development, this will not result in long-term displacement and will not affect the conservation objective attributes and targets supporting the conservation condition of this species in Lough Corrib SPA (see **Table 9.31**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib SPA.

11.3.3 Disturbance/displacement – potential ex-situ sites

In general, neither construction or operational disturbance will restrict the extent of habitat available to any SCI species such that any population level effects would occur. However, at Ballindooley Lough prolonged blasting was assessed as having the potential to displace SCI listed bird species from Ballindooley Lough if frequent and prolonged blasting occurs over multiple winter seasons; potentially negatively affecting the wintering SPA population.

A seasonal restriction to prohibit/limit blasting here during the winter period will restrict and spread out blasting activity in the vicinity of Ballindooley Lough such that it will only occur in the vicinity of Ballindooley Lough for a short period over two winter seasons, at most. This will either result in the majority of blasting in this area being carried out in a single winter season (e.g. a single period of 12-16 weeks during one winter and a second, much shorter, 2-4 week period during the second) or more evenly spread over both winters. This will ensure that there are no long-term disturbance or displacement effects to wintering birds at Ballindooley Lough as a consequence of blasting (**Section 10.8**).

This mitigation measure will be implemented through the CEMP by the contractor during construction and will ensure that disturbance/displacement impacts do not occur.

Therefore, to the limited extent that there may be disturbance of SCI birds from habitats within the SPA during construction or operation of the proposed road development, this will not result in long-term displacement and will not affect the conservation objective attributes and targets supporting the conservation condition of the SCI species of Lough Corrib SPA (see **Table 9.31**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib SPA.

A summary of the residual disturbance/displacement impacts at potential ex-situ sites associated with the proposed road development is presented in **Table 11.13** below.

Table 11.13: Summary of Residual Disturbance/Displacement Impacts at Potential Ex-situ Sites

Potential Direct or Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.31 for more details on links to SCIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required**	**Are there any residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib SPA?**
Construction			
Long-term blasting at Lackagh Quarry and Castlegar disturbing displacing bird species listed as SCIs of Lough Corrib SPA at Ballindooley Lough	Yes, as long-term blasting could displace SCI listed bird species from Ballindooley Lough for one or more winter seasons; potentially negatively affecting the wintering SPA population	Yes Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**	No

11.3.4 Habitat loss/fragmentation – potential ex-situ sites

The scale of habitat loss and fragmentation will not restrict the extent of habitat available to any SCI species, such that any population level effects would occur. As a result, there is no potential for any impacts on the conservation objectives of Lough Corrib SPA to arise via this impact and no mitigation measures are required.

Therefore, any habitat loss associated with the proposed road development will not affect the conservation objective attributes and targets supporting the conservation condition of the SCI species of Lough Corrib SPA (see **Table 9.31**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Lough Corrib SPA.

11.3.5 Conclusion of Assessment for Lough Corrib SPA

None of the potential direct or indirect impacts associated with the proposed road development will affect the conservation objectives of any SCI species. Mitigation measures are included to ensure that the proposed road development does not affect the receiving hydrogeological or hydrological environments (**Sections 10.3** and **10.4**) and will not result in any long-term disturbance/displacement effects at Ballindooley Lough (**Section 10.8**). Refer to **Table 9.31** and **Table 10.1** for how these mitigation measures relate back to the SCIs and conservation objectives of Lough Corrib SPA.

Of the potential impacts to SCI bird species associated with the proposed road development, effects on hydrogeology, disturbance and habitat loss all overlap spatially with respect to their ZoI and the potential ex-situ sites considered in this assessment. As above, under the relevant sections, the habitat areas within affected potential ex-situ sites are only a small proportion of available habitat locally and therefore habitat loss/degradation effects (where they occur) will not have any population level effects. With respect to disturbance/displacement, the construction ZoI is temporary and the operational ZoI is not predicted to have any long-term effects much beyond the proposed development boundary. Therefore, even when combined, the overall effect on use of these potential ex-situ sites by bird species listed as SCIs of Lough Corrib SPA will not affect their range or reduce habitat area such that the local populations would not be able to sustain itself long-term.

The proposed road development will also not inhibit any efforts to restore favourable conservation status, where this might form part of the conservation objectives in the future.

Following an examination, analysis and evaluation in light of the best scientific knowledge, of all relevant information in respect of all of the SCI bird species, and the supporting habitats, of Lough Corrib SPA within the ZoI of the proposed road development, the potential impacts and mitigation measures, and whether or not the predicted impacts would affect the conservation objectives that support the conservation condition for the SCIs concerned, it has been concluded that the proposed road development poses no risk (either directly or indirectly) of adversely affecting the integrity of Lough Corrib SPA and there is no reasonable scientific doubt about this conclusion

11.4 Inner Galway Bay SPA

11.4.1 Habitat degradation – hydrogeology

Groundwater supply to groundwater dependant habitats will not be affected during construction or operation such that any population level effects would occur as a consequence of the limited habitat effects associated with the proposed road development.

However, the risk of the proposed road development affecting groundwater quality during construction requires mitigation, as it does during operation, to ensure that the drainage system continues to function as designed (**Section 10.3**).

These mitigation measures will be implemented through the implementation of the CEMP by the contractor during construction (pollution control) and by Galway County Council/TII over the operational lifespan of the proposed road development (maintenance) and will ensure that hydrogeological impacts do not occur.

Therefore, in light of the best scientific knowledge, habitat degradation as a result of impacts on the existing groundwater regime will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the SCI species of Inner Galway Bay SPA (see **Table 9.38**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay SPA.

A summary of the residual hydrogeological impacts associated with the proposed road development is presented in **Table 11.14** below.

Table 11.14: Summary of Residual Hydrogeological Impacts

Potential Direct or Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.38 for more details on links to SCIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required**	**Are there any residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay SPA?**
Construction			
Construction works affecting groundwater quality	Affecting the quality of groundwater supporting groundwater dependant habitats could affect the type, quality and extend of suitable habitat available to SCI bird species	Yes, to ensure that site runoff is controlled and treated during construction to avoid polluting groundwater bodies	No

Potential Direct or Indirect Impacts	Could the conservation objectives be affected? see Table 9.38 for more details on links to SCIs and specific attributes and targets of the conservation objectives	Are mitigation measures required	Are there any residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay SPA?
Operation			
Groundwater quantity being affected during operation	The design of the proposed road development will not restrict or inhibit existing groundwater flow paths supporting groundwater dependant habitats used by bird species listed as SCIs of Lough Corrib SPA. However, it is important that the appropriate level of subsoil remains beneath the infiltration basins to ensure their continued functioning.	Yes The karst protocol will be implemented, if karst features and potential pathways are found to be present during inspection and maintenance in the infiltration basin **Section 10.3**	No
Groundwater quality being affected during operation	The drainage design (as described in Section 2, and Appendices G, H and I) will ensure that groundwater quality will be maintained during operation. However, it is important that the appropriate level of subsoil remains beneath the infiltration basins to ensure their continued functioning.	Yes The karst protocol will be implemented, if karst features and potential pathways are found to be present during inspection and maintenance in the infiltration basin **Section 10.3**	No

11.4.2 Habitat degradation – hydrology

The proposed road development will not affect the functioning of the existing hydrological regime that supports sites used by SCI listed bird species, either during construction or operation.

However, the risk of the proposed road development affecting surface water quality during construction requires mitigation, as it does during operation, to ensure that the drainage system continues to function as designed (**Section 10.4**).

These mitigation measures will be implemented through the implementation of the CEMP by the contractor during construction (pollution control) and by Galway County Council/TII over the operational lifespan of the proposed road development (maintenance) and will ensure that hydrological impacts do not occur.

Therefore, habitat degradation as a result of impacts on the existing surface water regime will not occur or affect the conservation objective attributes and targets supporting the conservation condition of the SCI species of Inner Galway Bay SPA (see **Table 9.38**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay SPA.

A summary of the residual hydrological impacts associated with the proposed road development is presented in **Table 11.15** below.

Table 11.15: Summary of Residual Hydrological Impacts

Potential Direct or Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.38 for more details on links to SCIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required**	**Are there any residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay SPA?**
Construction			
Construction works affecting surface water quality	Affecting the quality of surface water in the receiving environment in Galway Bay (or at any important ex-situ sites) could potentially affect habitat quality and usage of important habitat areas by SCI species, which in turn could affect the conservation objective to maintain the distribution of areas used by SCI waterbirds	Yes, to ensure that site runoff is controlled and treated during construction to avoid polluting the surface water drainage network	No

11.4.3 Disturbance/displacement – potential ex-situ sites

In general, neither construction or operational disturbance will restrict the extent of habitat available to any SCI species such that any population level effects would occur. However, at Ballindooley Lough prolonged blasting was assessed as having the potential to displace SCI listed bird species from Ballindooley Lough; potentially negatively affecting the wintering SPA population. A seasonal restriction to prohibit/limit blasting here during the winter period will be implemented to ensure that there are no long-term disturbance or displacement effects to wintering birds at Ballindooley Lough as a consequence of blasting (**Section 10.8**).

This mitigation measure will be implemented through the implementation of the CEMP by the contractor during construction and will ensure that disturbance/displacement impacts do not occur.

Therefore, to the limited extent that there may be disturbance of SCI birds from habitats within the SPA during construction or operation of the proposed road development, this will not result in long-term displacement and will not affect the conservation objective attributes and targets supporting the conservation condition of the SCI species of Inner Galway Bay SPA (see **Table 9.38**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay SPA.

A summary of the residual disturbance/displacement impacts at potential ex-situ sites associated with the proposed road development is presented in **Table 11.16** below.

Table 11.16: Summary of Residual Disturbance/Displacement Impacts at Potential Ex-situ Sites

Potential Direct or Indirect Impacts	**Could the conservation objectives be affected?** **see Table 9.38 for more details on links to SCIs and specific attributes and targets of the conservation objectives**	**Are mitigation measures required**	**Are there any residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay SPA?**
Construction			
Long-term blasting at Lackagh Quarry and Castlegar disturbing displacing bird species listed as SCIs of Lough Corrib SPA at Ballindooley Lough	Yes, as long-term blasting could displace SCI listed bird species from Ballindooley Lough for one or more winter seasons; potentially negatively affecting the wintering SPA population	Yes Seasonal restriction to blasting works in the vicinity of Ballindooley Lough **Section 10.8**	No

11.4.4 Habitat loss/fragmentation – potential ex-situ sites

The scale of habitat loss and fragmentation will not restrict the extent of habitat available to any SCI species, such that any population level effects would occur. As a result, there is no potential for any impacts on the conservation objectives of Inner Galway Bay SPA to arise via this impact and no mitigation measures are required.

Therefore, any habitat loss associated with the proposed road development will not affect the conservation objective attributes and targets supporting the conservation condition of the SCI species of Inner Galway Bay SPA (see **Table 9.38**). Therefore, there are no residual direct or indirect impacts that could adversely affect the integrity of Inner Galway Bay SPA.

11.4.5 Conclusion of Assessment for Inner Galway Bay SPA

None of the potential direct or indirect impacts associated with the proposed road development will affect the conservation objectives of any SCI species. Mitigation measures are included to ensure that the proposed road development does not affect the receiving hydrogeological or hydrological environments (**Sections 10.3** and **10.4**) and will not result in any long-term disturbance/displacement effects at Ballindooley Lough (**Section 10.8**). Refer to **Table 9.31** and **Table 10.1** for how these mitigation measures relate back to the SCIs and conservation objectives of Inner Galway Bay SPA.

Of the potential impacts to SCI bird species associated with the proposed road development, effects on hydrogeology, disturbance and habitat loss all overlap spatially with respect to their ZoI and the potential ex-situ sites considered in this assessment. As above, under the relevant sections, the habitat areas within affected potential ex-situ sites are only a small proportion of available habitat locally and therefore habitat loss/degradation effects (where they occur) will not have any population level effects. With respect to disturbance/displacement, the construction ZoI is temporary and the operational ZoI is not predicted to have any long-term effects much beyond the proposed development boundary. Therefore, even combined, the overall effect on use of these potential ex-situ sites by bird species listed as SCIs of Inner Galway Bay SPA will not affect their range or reduce habitat area such that the local populations would not be able to sustain itself long-term.

The proposed road development will also not inhibit any efforts to restore favourable conservation status, where this might form part of the conservation objectives in the future.

Following an examination, analysis and evaluation in light of best scientific knowledge of all relevant information in respect of all of the SCI bird species and supporting habitats of Inner Galway Bay SPA within the ZoI of the proposed road development, the potential impacts and mitigation measures, and whether or not the predicted impacts would affect the conservation objectives that support the conservation condition for the SCIs concerned, it has been concluded that the proposed road development poses no risk (either directly or indirectly) of adversely affecting the integrity of Inner Galway Bay SPA and there is no reasonable scientific doubt about this conclusion

12 Potential for In Combination Effects

This section of the report presents the assessment carried out to examine whether any other plans or projects have the potential to act in combination with the proposed road development to have a significant effect on any of the four European sites within its ZoI: Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA and Inner Galway Bay SPA. All other European sites fall beyond the ZoI of the proposed road development. Therefore, there is no potential for any other plans or projects to act in combination with the proposed road development to adversely affect the integrity of any other European sites.

The protective policies and objectives from the land use plans referred to in this section are included in **Appendix O**.

12.1 Analysis of Potential In Combination Effects

The In combination assessment involved first identifying those plans and projects which have the potential to impact on Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA and Inner Galway Bay SPA. Those plans or projects with the potential to impact upon these European sites are any national, regional and local land use plans or any existing or proposed projects that could potentially affect the ecological environment within the ZoI of the proposed road development. These are presented below in **Table 12. 1**.

Table 12.1: Land Use Plans and Projects Considered for the In Combination Assessment

National Plans
Climate Action and Low-Carbon Development – National Policy Position Ireland
National Spatial Strategy for Ireland 2002–2020
Project Ireland 2040 – Building Ireland's Future[58]
Smarter Travel a Sustainable Transport Future 2009-2020
Foodwise 2025
Ireland's Rural Development Programme 2014-2020
Wild Atlantic Way Operational Programme 2015-2019
Pollution Reduction Plans and Programme
Regional Plans
Regional Planning Guidelines for the West Region 2010-2022
West Catchment Flood Risk Assessment and Management (CFRAMS) Stud
River Basin Management Plan for the Western River Basin District in Ireland (2009-2015)
The River Basin Management Plan for Ireland (2018-2021) – draft for public consultation

[58] Together the National Development Plan and the Nation Planning Framework are referred to as Project Ireland 2040: Building Ireland's Future

County/Local Plans
Galway County Development Plan 2015-2021
Galway City Council Development Plan 2017-2023
Clare County Development Plan 2017-2023
Mayo County Development Plan 2014-2020[59]
Gaeltacht Local Area Plan 2008-2018
Údarás na Gaeltachta's Strategic Plan 2014–2017
Bearna Local Area Plan 2007-2017
Draft Ardaun Local Area Plan 2018-2024
Galway City Local Economic and Community Plan 2015-2021
Athenry Local Area Plan 2012-2018
Gort Local Area Plan 2013-2019
Headford Local Area Plan 2015-2021
Loughrea Local Area Plan 2012-2018
Maigh Cuilinn Local Area Plan 2013-2019
Oranmore Local Area Plan 2012-2018
Tuam Local Area Plan 2011-2017
Projects/Strategies
Vision 2020 NUI Galway Strategic Plan 2015–2020
Galway Transport Strategy (GTS)
M17 Galway to Tuam Road Project
N18 Oranmore to Gort Road Project
N17 Tuam Bypass
M6 Motorway
M6 (M17/M18) Motorway Service Area
N59 Clifden to Maam Cross Road Project
N59 Maam Cross to Oughterard Road Project
N59 Maigh Cuilinn (Moycullen) Bypass Road Project
Galway to Dublin Cycleway
Connemara Greenway (from Galway City to Clifden))
Galway to Spiddal Greenway (Bearna to Spiddal Cycleway)
R336 Bearna to Scríb via Ros an Mhíl Upgrade/Improvements
Sáilín to Silverstrand Coastal Protection Scheme
Salthill Coastal Protection Works (Blackrock to Galway Golf Club)
Proposed Galway Harbour Port Extension
Water supply schemes
Wastewater Treatment Works (Public and Private)

The potential cumulative impacts on Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA and Inner Galway Bay SPA from the proposed road development in combination with the plans and projects listed above were identified and assessed. This assessment is presented below in **Table 12.2**.

[59] The Local Area Plans for the towns of Ballinrobe, Ballyhaunis and Claremorris have been integrated into the *Mayo County Development Plan 2014-2020*.

Table 12.2: In combination assessment

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
Climate Action and Low-Carbon Development – National Policy Position Ireland This policy position recognises the threat of climate change; anticipates and supports mobilisation of a comprehensive international response to climate change, and global transition to a low-carbon future; recognises the challenges and opportunities of the broad transition agenda for society; and aims, as a fundamental national objective, to achieve transition to a competitive, low carbon, climate-resilient and environmentally sustainable economy by 2050.	No potential impact pathways to these European sites	No in combination impact There are no specific spatial references in this policy document and therefore, no specific link (in terms of potential impact pathways) between it and any of the four European sites within the Zone of Influence (ZoI) of the proposed road development. It does however, state that key to considering the on-going evolution of national climate policy include are the obligations of the State under EU law (e.g. the EU Habitats Directive), and the promotion of sustainable development. Considering that, this policy position poses no identifiable risk of resulting in adverse effects on the integrity of any European sites.
National Spatial Strategy for Ireland 2002–2020 The National Spatial Strategy (NSS) sets out the national strategy for development which includes transport, the strategic energy network, housing, economic development and environmental quality. Galway is identified as a Gateway in the NSS (engines of regional and national	There is the potential that any developments implemented under the NSS could affect any of these European sites. The NSS does not propose any specific development projects with any specific spatial reference and the potential impact pathways cannot be defined. However, any future developments implemented through the NSS have the potential to lie within these European sites, or	No in combination impact The NSS is given effect at a regional level by the RDP and projects to meet its aims will be implemented locally by the relevant local authority and must comply with the statutory planning requirements, and must be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). In the context of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA these land use plans are the

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
growth) which seeks to improve transport linkages along the western corridor extending from Cork to Derry (via Limerick, Galway and Sligo) and also a corridor west/north-west of Galway City to Connemara and Mayo.	be situated in a location where these European sites may be within their ZoI.	Galway County Development Plan 2015-2021 (as varied), the Galway City Council Development Plan 2017-2023 (as varied), the Clare County Development Plan 2017-2022 and the Mayo County Development Plan 2014-2020. All of these plans contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. This assessment has identified those land use plans that have the potential to act in combination with the proposed road development to affect European sites, given their spatial jurisdiction (see discussions on the relevant land use plans in the sections below). Considering the environmental protection policies included within those land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, the NSS poses no identifiable risk of resulting in adverse effects on the integrity of any European sites in combination with the proposed road development.
Project Ireland 2040 – Building Ireland's Future High-level strategic plan to guide future growth and development in Ireland.	Although a high-level strategic plan, the NPF makes reference to delivering projects in Galway City such as the N6 GCRR, amongst others. Therefore, there is the potential that developments implemented under the NPF could affect any of these European sites.	The Department of Housing, Planning and Local Government carried out an AA of the NPF which concluded that, considering the environmental protection measures incorporated into Strategy, it would not adversely affect the integrity of any European sites. The NPF is given effect at a regional level by the RDP and projects to meet its aims will be implemented locally by the relevant local authority and must comply with the statutory planning requirements, and must be in accordance with the objectives and policies of the relevant land use plans

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		(Development Plans, Local Area Plans etc.). In the context of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA these land use plans are the Galway County Development Plan 2015-2021 (as varied), the Galway City Council Development Plan 2017-2023 (as varied), the Clare County Development Plan 2017-2022 and the Mayo County Development Plan 2014-2020. All of these land use plans contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in Appendix O. This assessment has identified those land use plans that have the potential to act in combination with the proposed road development to affect European sites, given their spatial jurisdiction (see discussions on the relevant land use plans in the sections below). Considering the environmental protection policies included within the NPF, and in the county and local level land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, the NPF poses no identifiable risk of resulting in adverse effects on the integrity of any European sites in combination with the proposed road development.
Smarter Travel a Sustainable Transport Future 2009-2020 Smarter Travel is a government policy document outlining a strategy related to sustainable transport. It sets out actions to	There is the potential that any developments implemented under Smarter Travel could affect any of these European sites. Smarter Travel does not propose or support any specific development	No in combination impact Any projects required to achieve the objectives of smarter travel will be implemented locally by the relevant local authority and must comply with the statutory planning requirements, and those of the relevant land use plans (Development Plans, Local Area

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
reduce overall travel demand, to maximise the efficiency of the transport network, to reduce reliance on fossil fuels, to reduce transport emissions, and to improve accessibility to transport.	proposals in identified locations and the potential impact pathways cannot be defined. However, any future developments implemented through Smarter Travel have the potential to lie within these European sites, or be situated in a location where these European sites may be within their ZoI.	Plans etc.). In the context of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA the overarching land use plans are the Galway County Development Plan 2015-2021, the Galway City Council Development Plan 2017-2023, the Clare County Development Plan 2017-2022 and the Mayo County Development Plan 2014-2020. All of these land use plans contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. This assessment has identified those land use plans that have the potential to act in combination with the proposed road development to affect European sites, given their spatial jurisdiction (see discussions on the relevant land use plans in the sections below). Considering the environmental protection policies included within those land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, Smarter Travel poses no identifiable risk of resulting in adverse effects on the integrity of any European sites in combination with the proposed road development
Foodwise 2025 Food Wise 2025, the Report of the 2025 Agri. Food Strategy Committee, sets out a cohesive, strategic plan for the sustainable growth and development of agri-food sector over the next decade.	According to the Natura Impact Statement for Foodwise 2025 (Philip Farrelly & Co, 2015), there were 11 proposed actions that had potential to adversely affect the integrity of European sites. These were related to potential impact pathways related to the seafood sector, the beef sector, tillage, and forestry. Land use change or the	No in combination impact The application of the statutory management requirements, the safeguards (and monitoring scheme) included within the Green, Low Carbon Agri. Environment Scheme (GLAS), and the licencing and permitting procedures in the forestry and seafood sectors were assessed as fully addressing the potential direct and indirect impacts identified. This assessment, and the AA

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	intensification of agriculture (along with any associated agricultural infrastructure developments) could affect the conservation objectives principally through habitat loss, habitat degradation or the displacement of species.	Determination, concluded that Foodwise 2025 will not adversely affect the integrity of any European sites, either alone or in combination with any other plans or projects. Furthermore, any specific development or projects that might be required to deliver this strategy must comply with the statutory planning requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). In the context of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA the overarching land use plans are the Galway County Development Plan 2015-2021, the Galway City Council Development Plan 2017-2023, the Clare County Development Plan 2017-2022 and the Mayo County Development Plan 2014-2020. All of these land use plans contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the environmental protection policies included within the overarching County Development Plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, the proposed road development in combination with Foodwise 2025 will not have an adverse effect on the integrity of any European sites.
Ireland's Rural Development Programme 2014-2020	The RDP does not propose any specific developments/projects with any specific spatial	No in combination impact Any specific development or projects that might be required to deliver this programme must comply with the statutory planning

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The Rural Development Programme (RDP) is part of the Common Agricultural Policy (CAP), a common set of objectives, principles and rules through which the European Union (EU) co-ordinates support for European agriculture through various measures.	reference in relation to European sites and the potential impact pathways cannot be defined. However, there are potential impact pathways in so far as many measures undertaken through the RDP could impact upon any of these European sites and land use change or the intensification of agriculture (along with any associated agricultural infrastructure developments) could affect the conservation objectives principally through habitat loss, habitat degradation or the displacement of species.	requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). In the context of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA the overarching land use plans are the Galway County Development Plan 2015-2021, the Galway City Council Development Plan 2017-2023, the Clare County Development Plan 2017-2022 and the Mayo County Development Plan 2014-2020. All of these land use plans contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. This assessment has identified those land use plans that have the potential to act in combination with the proposed road development to affect European sites, given their spatial jurisdiction (see discussions on the relevant land use plans in the sections below). Considering the environmental protection policies included within those land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, the proposed road development in combination with Ireland's Rural Development Programme 2014-2020 will not have an adverse effect on the integrity of any European sites
Wild Atlantic Way Operational Programme 2015-2019 The Wild Atlantic Way is a long-distance touring route, stretching along the Atlantic	The Wild Atlantic Way includes the existing road network around the coastline of Galway Bay and intersects with the proposed road development at the R336 and therefore, there are potential impact	No in combination impact According to the conclusions of its Natura Impact Report (CASS Ltd., 2015b), in considering the mitigation measures proposed, the Wild Atlantic Way Operational Programme 2015-2019 will not

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coast from Donegal to West Cork. The overall aim of the project is to develop a route that will achieve greater visibility for the west coast of Ireland in overseas tourist markets.	pathways which could result in habitat loss, habitat degradation and/or increased disturbance or displacement of species along the coastline.	adversely affect the integrity of any European sites, either alone or in combination with any other plans or projects. Furthermore, any specific development or projects that might be required to deliver this programme must comply with the statutory planning requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). In the context of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA the overarching land use plans are the Galway County Development Plan 2015-2021, the Galway City Council Development Plan 2017-2023, the Clare County Development Plan 2017-2022 and the Mayo County Development Plan 2014-2020. All of these land use plans contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. This assessment has identified those land use plans that have the potential to act in combination with the proposed road development to affect European sites, given their spatial jurisdiction (see discussions on the relevant land use plans in the sections below). Considering the environmental protection policies included within those land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, the proposed road development, in combination with the Wild Atlantic Way Operational Programme 2015-2019,

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		will not have an adverse effect on the integrity of any European sites.
Pollution Reduction Plans and Programme These include plans and programmes to reduce pollution in both surface waters and groundwater. They include national action plan, IPPC programme, local authority discharge authorisation programmes, groundwater and surface water pollution reduction programmes, shellfish waters pollution reduction programmes, bathing waters management plans, waste management plans, freshwater pearl mussel sub-basin plans, groundwater protection schemes, eel and salmon fishery conservation plans.	The purpose of these plans and programmes is to reduce surface water, groundwater and marine pollution levels and therefore, they will contribute towards maintaining or restoring the conservation condition of the European sites within their ZoI. Therefore, there are no potential impact pathways by which they could adversely affect the integrity of any European sites.	No in combination impact No potential for in combination impacts with the proposed road development as such plans or programmes are intended to improve the quality of the ecological environment within their ZoI.
Regional Planning Guidelines for the West Region 2010–2022 The Regional Planning Guidelines for the West Region 2010–2022 (RPGs) set out the regional strategy for settlement, transport infrastructure, tourism, rural enterprise, and energy infrastructure.	Many of the infrastructure projects specifically supported by the RPGs, or those that may be implemented in achieving its objectives, are or may be located within (or adjacent to) European sites. Many will also have potential impact pathways connecting them to European sites. There is therefore the potential for the RPGs to affect the conservation objectives supporting the	No in combination impact Appendix 4 of the RPGs set out the requirements for Local Authority land use plans and permitting development in the context of protecting European sites. The RPGs are given effect and implemented at a local level by the relevant local authority and must comply with the statutory planning requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). In the context of Lough Corrib cSAC,

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	integrity of those European sites also within the ZoI of the proposed road development.	Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA the overarching land use plans are the Galway County Development Plan 2015-2021, the Galway City Council Development Plan 2017-2023, the Clare County Development Plan 2017-2022 and the Mayo County Development Plan 2014-2020. All of these land use plans contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the environmental protection policies included within the RPGs and the Local Authority land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites in isolation, the proposed road development in combination with the RPGs, will not have an adverse effect on the integrity of any European sites.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
West Catchment Flood Risk Assessment and Management Study (CFRAMS) These studies include the following elements within the west catchment: 1. Flood Risk Reviews (FRRs) 2. Inception reporting 3. Data collection 4. Hydrological assessments 5. Hydraulic modelling 6. Flood risk mapping 7. Public consultations 8. Flood Risk Management Plans (FRMPs) 9. Flood Consequence Assessments (FCAs)	The West CFRAM Study will ultimately result in the development of catchment based flood risk management plans. These may propose flood risk management measures which, through various potential impact pathways, could affect the conservation objectives supporting QI/SCI habitats and species of Lough Corrib cSAC/SPA in the River Corrib catchment. This could be through pollution risks during construction works and/or changes to the functioning of the existing hydrological regime.	No in combination impact Any flood risk management measures or projects that might be recommended as part of the West CFRAM Study must comply with the statutory planning requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). This assessment has identified those land use plans that have the potential to act in combination with the proposed road development to affect European sites, given their spatial jurisdiction (see discussions on the relevant land use plans in the sections below). Considering the environmental protection policies included within those land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, the proposed road development in combination with the West CFRAM Study will not have an adverse effect on the integrity of any European sites.
River Basin Management Plan for the Western River Basin District in Ireland (2009-2015) **The River Basin Management Plan for Ireland (2018-2021) – draft for public consultation** This River Basin Management Plan for the Western River Basin District (covering the period 2009 to 2015), or the draft River	The purpose of the River Basin Management Plan is to reduce pollution levels, restore good water quality status and prevent deterioration in water quality in the river basin. Therefore, they will contribute towards maintaining or restoring the conservation condition of the European sites within their ZoI and there are no potential impact pathways by which they could adversely affect the integrity of any European sites.	No in combination impact No potential for in combination impacts as it will have a positive impact on water quality in the River Corrib catchment and in Galway Bay and therefore, will not have an adverse effect on the integrity of any European sites in combination with the proposed road development.

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Basin Management Plan for Ireland (2018-2021), aims to protect all waters within the district and, where necessary, improve waters and achieve sustainable water use. Waters include rivers, canals, lakes, reservoirs, groundwaters, protected areas (including wetlands and other water-dependent ecosystems), estuaries (transitional) and coastal waters.		
Galway County Development Plan 2015-2021	The proposed road development lies partly within the functional area of the Galway County Development Plan 2015-2021 and many of the objectives and policies therein, have the potential to act in combination with the proposed road development, through a variety of potential impact pathways, to affect European sites. The most likely of these is a reduction in water quality in the River Corrib catchment and in Galway Bay affecting the conservation objectives supporting aquatic habitats and species in Lough Corrib cSAC, Galway Bay Complex cSAC and Inner Galway Bay SPA. There are other potential impact pathways associated with the Bearna area but these are assessed	No in combination impact Variation No. 1 to the Galway County Development Plan 2015-2021, which integrated the Galway Transport Strategy (GTS) into the development plan[60], was adopted in April 2017. The AA Determination for that variation concluded that, in considering the mitigation measures included within the strategy, Variation No. 1 to the Galway County Development Plan 2015-2021 will not adversely affect the integrity of any European sites, either alone or in combination with any other plans or projects. The proposed Variation No. 2 (a) and 2 (b) to the Galway County Development Plan 2015-2021, seeks to integrate the *Bearna Local Area Plan 2007 –2017* (2(a)) and the *Gaeltacht Local Area Plan 2008-2018* (2(b)) into the development plan.

[60] As the GTS falls within the jurisdiction of four land use plans, the *Galway County Development Plan 2015-2021*, the *Galway City Council Development Plan 2017-2023*, the *Bearna Local Area Plan 2007 – 2017* and the *Gaeltacht Local Area Plan 2008-2018*, it is assessed separately below.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	separately below under the *Bearna Local Area Plan 2007–2017*.	The Appropriate Assessment Screening report prepared for Variation No. 2(a) concluded that it is not likely to have a significant effect on any European sites. The NIS prepared for Variation No. 2(b) concluded that, in considering the mitigation measures incorporated into the plan, the proposed variation will not adversely affect the integrity of any European sites, either alone or in combination with any other plans or projects. As, at the time of writing, neither variation has been adopted, both the existing *Bearna Local Area Plan 2007–2017* and the *Gaeltacht Local Area Plan 2008-2018* are assessed separately below for completeness. The Galway County Development Plan 2015-2021 contains objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the protective environmental policies contained within the Galway County Development Plan 2015-2021, and that alone the proposed road development will not adversely affect the integrity of any European sites, this land use plan will not act in combination with the proposed road development to adversely affect the integrity of any European sites.
Galway City Council Development Plan 2017-2023 (including variations)	The proposed road development lies within the functional area of the Galway City Council Development Plan 2017-2023 and many of the objectives and policies therein, may have the	No in combination impact As assessed in **Section 9**, the proposed road development will not adversely affect the integrity of any European site in isolation. Therefore, the potential for in combination effects to arise are

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	potential to act in combination with the proposed road development, by a number of potential impact pathways, to affect European sites. Many of the policies and objectives will lead to development projects across the city which could result in habitat loss, habitat degradation, increased levels of disturbance/displacement of species, and/or introduce barriers to species movement. Any or all of these could affect the conservation objectives supporting the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA. Key to considering how future development could affect these European sites are the land use zonings (which determine where, and what type of, development is most likely take place) and specific projects included within the Plan which will, are likely to be, or may be located either within or in close proximity to European sites.	limited to those effects the proposed road development will have on the receiving environment that are measurable in some way, but themselves will not affect the conservation objectives of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA: • a reduction in water quality (or quantity) in rivers/streams draining to the River Corrib and Galway Bay affecting the conservation objectives supporting aquatic habitats and species in Lough Corrib cSAC, Galway Bay Complex cSAC and Inner Galway Bay SPA • a reduction in air quality in Lough Corrib cSAC – given that the ZoI of air quality effects is confined to the area immediately adjacent to the road carriageway, the potential for in combination effects with the proposed road development is limited to where it crosses, or is in close proximity, to the cSAC • disturbance/displacement of aquatic species in the River Corrib and to wintering birds that are listed as SCIs of Lough Corrib SPA or Inner Galway Bay SPA using lands within the Galway City boundary <u>Land Use Zoning Objectives</u> There are three land use zonings covering lands between the River Corrib and the N84 Headford Road; the area within which the proposed road development interacts directly with Lough Corrib cSAC in some way. Lands within and adjacent to Lough Corrib

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		cSAC at the NUIG Sporting Campus are zoned Recreation and Amenity and future development could include buildings, car parking and public utilities which contribute to the Community zoning of the university. This area also includes an indicative cycle greenway which represents an element of the GTS (the Galway to Oughterard Greenway) and this is assessed under the GTS heading below. Lands between the River Corrib and An Bóthar Nua are zoned Agriculture and High Amenity to provide for the development of agriculture and protect areas of visual importance and/or areas of high amenity. This could include development of outdoor recreation facilities and public utilities. Of note on the zoning map in this area is a recreational/amenity greenway along the eastern bank of the River Corrib between Galway City and Menlough Village. Lands between An Bóthar Nua and the N84 Headford Road are mainly zoned Agricultural, save from some residentially zoned lands along the N84 Headford Road. The agricultural zoning restricts use to agriculture with sustainable recreation/amenity uses and limited residential development also permitted. Some of the roads around Menlough are also denoted for road improvements on the zoning map; including that portion of An Bóthar Nua that crosses Lough Corrib cSAC north-east of Coolagh Lakes. In these areas, and generally across the city, future development will require additional water supply, require adequate waste water treatment and surface water drainage infrastructure to protect water quality in the River Corrib and Galway Bay. The Plan

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		includes policies to address these issues (Policy 9.6, Policy 9.7, Policy 9.8 and Policy 9.9). There is also a protective policy related to air quality (Policy 9.10). Considering the restrictions imposed by land use zonings on any potential future developments in these areas, and that the conservation objectives of QI habitats will not be affected by the proposed road development in relation to air quality (within what is a very restricted air quality ZoI), any future development will not act in combination with the proposed road development to affect the conservation objectives of Lough Corrib cSAC in that regard. There is no known link between the SCI listed wintering birds recorded across the winter bird sites and the SPA populations of Lough Corrib SPA or Inner Galway Bay SPA. However, for the purposes of the NIS assessment a precautionary approach was taken in assuming such a link existed in considering effects to wintering birds at winter bird sites where the species is listed as an SCI for either Lough Corrib cSAC and/or Inner Galway Bay SPA (see **Section 9.3** and **Section 9.4** of the NIS). The winter bird sites comprised amenity grasslands, agricultural fields, wetland habitats, or areas of heath/bog. Within the Galway City boundary these are predominantly zoned Recreational Amenity, Agriculture or Agriculture and High Amenity; which is consistent with their current use. Low numbers of SCI listed bird species were generally recorded at the winter bird sites and, in most cases, were recorded infrequently. Of all the winter bird sites, Ballindooley Lough supported Shoveler and Teal frequently over the winter period, and in relatively significant numbers on occasion, when compared with

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		the baseline SPA population numbers (see **Section 9.3** under Shoveler, and **Section 9.4** under Shoveler and Teal). In isolation, the proposed road development will not have any population level effects as a result of disturbance/displacement, either during construction or operation. With Ballindooley Lough zoned Agriculture and High Amenity there is the potential for long-term disturbance/displacement effects. However, with the proposed road development not affecting the lake, an In combination effect would not arise. Elsewhere across the city, considering the restricted development that would be permitted in these areas due to the land use zonings, the low number of SCI listed bird species generally recorded and their infrequent use of most of the winter bird sites, the minimal effect of any operational disturbance from road traffic in these winter bird sites, and the abundance of alternative suitable habitat to support wintering birds locally, future development is not likely to act in combination with the proposed road development to affect the SPA SCI bird populations. Coastal sites may be affected more by future development in terms of disturbance, displacement and habitat loss, but the proposed road development will not contribute to any effects here as it is remote from the coastal zone in the vicinity of Inner Galway Bay SPA. Overall, the Plan contains policies to protect European sites (SPAs in the context of bird species) and specifically to protect and conserve all species (which includes birds, and wherever they occur). These are presented in **Appendix O**. Therefore, any future development will not act in combination with the proposed road

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		development to affect the conservation objectives of Lough Corrib SPA or Inner Galway SPA in that regard. <u>Specific Plan Level Projects</u> The Galway City Council Development Plan 2017-2023 includes support for the following elements which will, are likely to be, or may be located either within or in close proximity to European sites: the Galway Transport Strategy (GTS), Sáilín to Silverstrand Coastal Protection Scheme, Salthill Coastal Protection Works (Blackrock to Galway Golf Club) and the Proposed Galway Harbour Port Extension. Each of these are assessed individually in this table. Despite the fact that some of these projects will, or are likely to, adversely affect the integrity of Galway Bay Complex cSAC and Inner Galway Bay SPA (Sáilín to Silverstrand Coastal Protection Scheme, Salthill Coastal Protection Works and the Proposed Galway Harbour Port Extension), they will not act in combination with the proposed road development in that regard. The GTS does not pose any risk of adversely affecting the integrity of any European sites. **Conclusion** The Galway City Council Development Plan 2017-2023 contains objectives and policies to ensure the protection of European sites from any future projects or development within the plan area. These are presented in **Appendix O**. Considering the protective environmental policies contained within the Galway City Council Development Plan 2017-2023, and that

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		alone the proposed road development will not adversely affect the integrity of any European sites, this land use plan will not act in combination with the proposed road development to adversely affect the integrity of any European sites.
Clare County Development Plan 2017-2023	The Clare County Development Plan 2017-2023 lies beyond the ZoI of the proposed road development. It does however, have the potential to act in combination with the proposed road development by the following potential impact pathway: to affect water quality in Galway Bay via the surface water network or the coastal/marine environment. A reduction in water quality in Galway Bay could consequently affect some of the conservation objectives supporting the QI/SCI species of Galway Bay Complex cSAC and/or Inner Galway Bay SPA.	No in combination impact The Clare County Development Plan 2017-2023 contains objectives and policies to ensure the protection of European sites and surface water quality from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the protective environmental policies contained within the Clare County Development Plan 2017-2023, and that alone the proposed road development will not adversely affect the integrity of any European sites, this land use plan will not act in combination with the proposed road development to adversely affect the integrity of any European sites.
Mayo County Development Plan 2014-2020	The Mayo County Development Plan 2014-2020 lies beyond the ZoI of the proposed road development. It does however, have the potential to act in combination with the proposed road development by the following potential impact pathway: to affect water quality in either the River Corrib and/or Galway Bay via the surface water	No in combination impact The Mayo County Development Plan 2014-2020 contains objectives and policies to ensure the protection of European sites and surface water quality from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the protective environmental policies contained within the Mayo County Development Plan 2014-2020, and that alone the proposed road development will not adversely affect the integrity of any European sites, there is no risk of this land use

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	network[61]. A reduction in water quality could consequently affect some of the conservation objectives supporting the QI/SCI species of Lough Corrib cSAC, Galway Bay Complex cSAC and Inner Galway Bay SPA. As Lough Corrib SPA lies upstream of the proposed road development, none of these land use plans could act in combination with it to affect that European site.	plan acting in combination with the proposed road development to adversely affect the integrity of any European sites.
Gaeltacht Local Area Plan 2008-2018	The strategy set out in the Gaeltacht Local Area Plan 2008-2018 includes support for transport projects, providing housing, water supply and treatment, flood risk management, developing tourism and economic development. Specific locations and projects are supported, many of which are located where they may likely to adversely affect the integrity of European sites, via a variety of potential impact pathways. These projects include the N6 Galway City Outer Bypass (2006) and the R336 Bearna to Scríob Road Project. The N6 Galway City Outer Bypass (2006) has been refused permission, and therefore,	No in combination impact The Gaeltacht Local Area Plan 2008-2018 does however, include objectives and policies to protect European sites and water quality in the receiving environment. These include Objectives O.S.D 3, O.S.D. 5, O.H.E. 1, O.H.E. 2, O.H.E. 4, O.H.E. 5, O.H.E. 6, and Policies P.W.1, P.W. 2, P.S. 3, P.B. 5, P.B. 8, P.B. 11, P.B. 14, P.B. 15, P.B. 16, and P.B. 19. Furthermore, any specific development or projects that might be implemented to achieve the objectives set out in the Gaeltacht Local Area Plan 2008-2018 must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the Galway County Development Plan 2015-2021 and the Galway City Council Development Plan

[61] The Local Area Plans for the towns of Ballinrobe, Ballyhaunis and Claremorris have been integrated into the *Mayo County Development Plan 2014-2020*. As these towns are located within the River Corrib catchment, their associated plans have the potential to act in combination with the proposed road development.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	does not have a status at this time. The proposed road development has superseded the N6 Galway City Outer Bypass (2006) project. Any future upgrade or improvement of the R336 Road Project is discussed separately below. Three of the districts covered within the Gaeltacht Local Area Plan 2008-2018 have a potential impact pathway connecting them with European sites which are also within the ZoI of the proposed road development: • District B: Duiche Sheoigheach – this district either includes, or is immediately adjacent to, Lough Corrib cSAC/Lough Corrib SPA along the northern shores of Lough Corrib. The River Corrib catchment drains to Galway Bay Complex cSAC and Inner Galway Bay SPA. • District D: Cois Fharraige – this district lies partly within the River Corrib catchment in the Moycullen area (e.g. includes the Knockbane and Kip Rivers) and therefore, drains to Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA. • District F: Imeall Na Cathrach/An Eachréidh – this district includes large areas of Lough Corrib cSAC and Lough Corrib SPA around	2017-2023 (District F) to protect European sites (see **Appendix O**). Considering the mitigation measures included within the Gaeltacht Local Area Plan 2008-2018, the environmental protection policies included within the Galway County Development Plan 2015-2021 and the Galway City Council Development Plan 2017-2023, and that alone the proposed road development will not adversely affect the integrity of any European sites in its own right, the Gaeltacht Local Area Plan 2008-2018 will not act in combination with the proposed road development to have an adverse effects on the integrity of any European sites.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	the southern shores of Lough Corrib, to the north of the proposed road development. The River Corrib catchment drains to Galway Bay Complex cSAC and Inner Galway Bay SPA. Districts B and F are remote from the ZoI of the proposed road development. However, as per the proposed road development they lie within the River Corrib catchment and therefore, any projects undertaken within those districts could act in combination to affect water quality in the River Corrib downstream of the proposed road development and in Galway Bay. As well as draining to Lough Corrib cSAC/SPA, District D includes that portion of the proposed development west of Bearna Woods. Surface water in this area drains to Galway Bay and therefore, projects in this area could act in combination with the proposed road development to affect water quality in Galway Bay Complex cSAC and Inner Galway Bay SPA. Affecting water quality in the River Corrib catchment or in Galway Bay could affect the conservation objectives of these European sites that support the QI habitats and QI/SCI species.	

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
Údarás na Gaeltachta Strategic Plan 2014-2017	The Údarás na Gaeltachta Strategic Plan 2014–2017 seeks to provide support to the Irish speaking community, develop skills and employment, promote the arts, to achieve sustainable economic, social and cultural development including reference to coastal resources, tourism and infrastructure provision. The Údarás na Gaeltachta Strategic Plan 2014–2017 does not propose or support any specific development proposals in identified locations and the potential impact pathways cannot be defined. However, any future developments implemented in the Galway area have the potential to lie within these European sites, or be situated in a location where these European sites may be within their ZoI.	No in combination impact Any projects required to achieve the objectives of the Údarás na Gaeltachta Strategic Plan 2014–2017 will be implemented locally by the relevant local authority and must comply with the statutory planning requirements, and those of the relevant land use plans (Development Plans, Local Area Plans etc.). In the context of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA the overarching land use plans are the Galway County Development Plan 2015-2021, the Galway City Council Development Plan 2017-2023, the Clare County Development Plan 2017-2022 and the Mayo County Development Plan 2014-2020. All of these land use plans contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. This assessment has identified those land use plans that have the potential to act in-combination with the proposed road development to affect European sites, given their spatial jurisdiction (see discussions on the relevant land use plans in the sections below). Considering the environmental protection policies included within those land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, Údarás na Gaeltachta Strategic Plan 2014–2017 poses no identifiable risk of resulting in adverse effects on the integrity of any European sites in-combination with the proposed road development

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
Draft Ardaun Local Area Plan 2018-2024	The area covered by the Draft Ardaun LAP is remote from any European sites with no potential for direct impacts. However, there is the potential for developments associated with the Ardaun LAP to affect groundwater quality, to increase loading at the Mutton Island WwTP, and to displace wintering birds that may form part of the SCI populations of nearby SPAs from habitat areas here.	No in combination impact As examined in the *Ardaun Local Area Plan Appropriate Assessment Screening Report* (Atkins, 2017): • In relation to groundwater pollution – "the policies and objectives of the LAP include the requirement that development proposals identify how the principles of SuDS will be applied to manage surface water discharges in accordance with Galway City Council requirements and include measures to ensure the protection of groundwater quality. To support the application of SuDS and the management of surface water discharge hydrogeological studies will be required to be undertaken by a suitably qualified person with hydro-geological expertise for any proposed development within the LAP area.". This will ensure that development will not affect groundwater quality. • In relation to groundwater pollution from wastewater and waste water treatment capacity at Mutton Island WwTP – A sewage connection will be provided from the Ardaun area to Mutton Island WwTP. "Policy 9.7 Water Services of the City Development Plan 2017-2023 states that the City Council will ensure adequate treatment capacity to cater for the future needs of the city, in partnership with Irish Water. This will be carried out in advance of any development within the LAP lands". Phase 1 of the Ardaun LAP development can be accommodated within the existing WwTP capacity and a drainage area plan will be prepared in advance of Phase 2

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		development to ensure that adequate treatment capacity is available. • There is abundant alternative habitat available locally for Black-headed gull – the only SCI species of nearby SPAs known to use habitats in the Ardaun area (which is based upon the wintering bird survey data collated for the proposed road development) The conclusion from Ardaun Local Area Plan Appropriate Assessment Screening Report (Atkins, 2017) was that "an appropriate assessment is not required, as it can be excluded, based on objective scientific information, that the proposed Ardaun LAP, individually or in combination with other plans or projects, will not have a significant effect on any European sites in light of their conservation objectives". Considering the above, the environmental protection policies included within the Galway City Council Development Plan 2017-2023, and that alone the proposed road development will not adversely affect the integrity of any European sites in its own right, the Draft Ardaun LAP 2018-2024 will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites.
Bearna Local Area Plan 2007–2017	Along its eastern edge, the Bearna Local Area Plan 2007–2017 lies immediately adjacent to Galway Bay Complex cSAC and Inner Galway Bay SPA. Developments that may be progressed under the Plan have the potential to affect habitats in Bearna	No in combination impact Within Bearna, future development will require adequate water supply, waste water treatment and surface water drainage infrastructure to protect water quality in Galway Bay. The Plan

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	Woods, Rusheen Bay and Galway Bay via a variety of potential impact pathways. The Plan also includes the N6 Galway City Outer Bypass (2006) (which was refused planning permission by An Bord Pleanála has been superseded by the proposed road development) and the R336 Bearna to Scríob upgrade/improvements. The N6 Galway City Outer Bypass (2006) has been refused permission by An Bord Pleanála and therefore, does not have a status at this time. The proposed road development has superseded the N6 Galway City Outer Bypass (2006) project. The R336 upgrade/improvements are discussed separately below. Impacts could arise as a consequence of affecting the existing hydrogeological regime, affecting water quality in receiving watercourses and/or Galway Bay, introducing non-native invasive species to habitats within the European sites, and/or developing/promoting tourism and recreational facilities (e.g. Objectives LU3 and CF3) putting pressure on habitat areas and species within Galway Bay Complex cSAC and Inner Galway Bay SPA (e.g. Bearna Woods and Rusheen Bay). The only likely pathways by which the proposed road development could act in combination with the Bearna Local Area Plan	includes policies to address these issues (Policy 2.8.2A, Policy 2.8.2B and Policy 2.8.2D). There is no direct link between the SCI listed wintering birds recorded across the winter bird sites surrounding Bearna and the SPA populations of Lough Corrib SPA or Inner Galway Bay SPA. The winter bird sites comprised areas of heath/bog. Within the boundary of the Bearna Local Area Plan 2007–2017 these areas are zoned Rural Fringe. This zoning could result in increased habitat loss and/or disturbance/displacement of wintering birds from these habitat areas. Considering the low number of SCI listed bird species generally recorded and their infrequent use of winter bird sites in this area, the minimal effect of any operational disturbance from road traffic in these winter bird sites, and the abundance of alternative suitable habitat to support wintering birds locally (which is beyond the influence of any future development associated with the LAP, future development is not likely to act in combination with the proposed road development to affect the SPA SCI bird populations. The Bearna Local Area Plan 2007–2017 does include objectives and policies to protect European sites. These include: Objectives NH5, NH6, NH7, NH8, NH10, NH12, NH13, NH14, NH15, NH18, NH23, NH24, NH25, NH26, NH27, NH29, NH30, NH36 and NH37. Considering the mitigation measures included within the Bearna Local Area Plan 2007-2017, the environmental protection policies included within the Galway County Development Plan 2015-2021, and that alone the proposed road development will not adversely

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	2007–2017 to affect the conservation objectives of European sites, is through affecting water quality in receiving watercourses and in Galway Bay, and disturbance/displacement of wintering birds that are listed as SCIs of Lough Corrib SPA or Inner Galway Bay SPA using lands within the LAP boundary. Furthermore, any specific development or projects that might be implemented to deliver the actions set out in the Bearna Local Area Plan 2007–2017 must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the Galway County Development Plan 2015-2021 to protect European sites (see **Appendix O**).	affect the integrity of any European sites, the Bearna Local Area Plan 2007–2017 will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites.
Galway City Local Economic and Community Plan 2015-2021 The Galway City Local Economic and Community Plan 2015-2021 is a socio-economic strategy for Galway City which sets out a series of actions related to developing and promoting Galway City as a creative and innovative hub, and developing and promoting equality, inclusivity, sustainability and health and well-being.	The only projects or plans mentioned in this plan are to build a new library and support the implantation of a transport management plan. The new library objective is not location specific and the Galway Transport Strategy fulfils the role of the transport management plan. The location for a new library could potentially be sited in a location where it might affect a European site, either through such potential impact pathways as habitat loss, habitat degradation or species displacement.	No in combination impact Any specific development or projects that might be implemented to deliver the actions set out in the Galway City Local Economic and Community Plan 2015-2021must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the Galway City Council Development Plan 2017-2023 to protect European sites (see **Appendix O**). Considering the mitigation measures included within the GTS, the environmental protection policies included within the Galway City Council Development Plan 2017-2023, and that alone the

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	The mitigation measures that are included within the GTS fully address the potential direct and indirect impacts that might arise from the projects to be implemented through that strategy and ensures that the GTS would not have adverse effects on any European sites (see separate discussion below on the GTS, under that heading). Aside from the GTS, there is no specific link (in terms of potential impact pathways) between the Galway City Local Economic and Community Plan 2015-2021 and any of the four European sites within the Zone of Influence (ZoI) of the proposed road development.	proposed road development will not adversely affect the integrity of any European sites in its own right, the Galway City Local Economic and Community Plan 2015-2021 will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites.
Athenry Local Area Plan 2012-2018 **Gort Local Area Plan 2013-2019** **Headford Local Area Plan 2015-2021** **Loughrea Local Area Plan 2011-2018** **Maigh Cuilinn Local Area Plan 2013-2019** **Oranmore Local Area Plan 2012–2018** **Tuam Local Area Plan 2011-2017**	These land use plans all lie beyond the ZoI of the proposed road development. They do however, have the potential to act in combination with the proposed road development via the following potential impact pathway: to affect water quality in either the River Corrib and/or Galway Bay via the surface water network. A reduction in water quality could consequently affect some of the conservation objectives supporting the QI/SCI species of Lough Corrib cSAC, Galway Bay Complex cSAC and Inner Galway Bay SPA. As Lough Corrib SPA lies upstream of the proposed road development, none of these land use plans	No in combination impact Each of these Plans includes policies and objectives to protect European sites: **Athenry Local Area Plan 2012-2018** Objectives DS3, DS5, UI2, UI6, UI13, NH1, NH4, NH6 and NH7, and Policy UI2 **Gort Local Area Plan 2013-2019** Objectives DS3, DS5, UI1, UI2, UI4, UI5, UI6, UI7, UI10, UI11, UI13, UI14, NH1, NH2, NH4, NH6 and NH7, and Policies UI1, UI4 and NH1 **Headford Local Area Plan 2015-2021**

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	could act in combination with it to affect that European site.	Objectives DS 3, DS 5, UI 3, UI 5, WQ 1, WQ 2, FL 9, NH 1, NH 2, NH 6, NH 7, NH 8 and NH 10, and Policies UI 1, WQ 1 and NH 1 **Loughrea Local Area Plan 2011-2018** Objectives DS3, DS5, LU9, UI2, UI4, UI5, UI6, UI9, NH1, NH2, NH6, DM Guideline UI 2, and Policies UI3 and NH1 **Maigh Cuilinn Local Area Plan 2013-2019** Objectives LU 8, NH 1, NH 2, NH 5, NH 6, NH 7, NH 9, NH 11, NH 13, UI 1, UI 4, UI 5, UI 6, UI 7, UI 10, UI 12, UI 12 (b) and UI 13, DM Guideline UI 2 and UI 2, and Policies NH 1 and UI 3 **Oranmore Local Area Plan 2012–2018** Objectives DS 3, DS 5, LU 9, NH 1, NH 2, NH 5, NH 6, NH 7, NH 12, DS 7, UI 1, UI 3, UI 4, UI 5, UI 7, UI 8, UI 15, and Policies DS 1, NH 1, UI 1, UI 2, **Tuam Local Area Plan 2011-2017** Objectives NH4, NH5, NH6, NH7, NH9, NH15, NH 16, NH18, WS4, WS6, and Policies NH5, NH13, NH14, WS1 and WS4. Local Area Plans are required to be consistent with the relevant County Development Plan/City Development Plan and therefore, any project proposed within an LAP area is also subject to the protective objectives and policies therein. These are presented in **Appendix O**. Considering the protective environmental policies contained within the overarching Galway County Development Plan 2015-2021 and the Galway City Council Development Plan 2017-2023,

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		there is no risk of these land use plans acting in combination with the proposed road development to adversely affect the integrity of any European sites.
Vision 2020 NUI Galway Strategic Plan 2015–2020 **(NUI Galway Masterplan)**	The ongoing expansion and upgrade of both the education buildings and amenity facilities at NUIG may increase pressure on the ecological environment along the River Corrib corridor and could adversely affect the integrity of Lough Corrib cSAC through the following potential impacts: habitat loss, habitat degradation and/or disturbance or displacement of species within Lough Corrib cSAC.	No in combination impact Although habitat loss and degradation type effects are a possibility, the most likely increased pressure on the QIs of Lough Corrib cSAC in this area, and particularly at the NUIG Sporting Campus, is disturbance/displacement of Otter due to increased human presence and potentially due to increased provision of artificial lighting. Although there is likely to be increased disturbance during construction, this will be temporary and will not affect any of the conservation objectives supporting Otter in the Lough Corrib cSAC. The proposed road development will not be lit across this area. During operation, with the road unlit and elevated above the river corridor there is no potential for any in combination effects with regard to disturbance levels. There were wintering birds present at the NUIG Sporting Campus which are listed as SCI species for Lough Corrib SPA and Inner Galway Bay SPA. However, any future provision of more amenity grassland areas would likely enhance this area for the bird species concerned; as it was these amenity grassland areas that were favoured by species such as Black-headed gull). The proposed road development will not have any long-term effects on Lough Corrib cSAC; nor will it have any long-term population level effects on the SCI wintering bird of Lough Corrib SPA or Inner Galway Bay SPA.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		Of the potential habitat degradation effects, the enrichment of wetland habitats as a consequence of increased nutrient loading poses the greatest risk. The NUI Galway Masterplan includes for reconfiguring and creating new playing pitches adjacent to the boundary of Lough Corrib cSAC at Dangan. Nutrients associated with fertiliser application have the potential to runoff/leach into sensitive wetland habitats with the potential to affect species richness and the vegetation composition. The proposed road development will not result in the loss of any QI Annex I habitat, or habitat supporting any QI Annex I habitats, within Lough Corrib. It also does not pose any risk of degrading wetland habitats within the European site, nor will it pose a risk of enriching wetland habitats through nutrient inputs. Furthermore, any future development or projects associated with the university campus must comply with the statutory planning requirements, and be in accordance with the objectives and policies of the Galway City Council Development Plan 2017-2023. The Galway City Council Development Plan 2017-2023 contain objectives and policies to ensure the protection of European sites from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the environmental protection policies included within the overarching Galway City Council Development Plan 2017-2023, and that alone the proposed road development will not adversely affect the integrity of any European sites, any future development at the NUIG campus poses no risk of resulting in

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		adverse effects on the integrity of any European sites in combination with the proposed road development
Galway Transport Strategy The GTS consists of a number of project elements, generated by a series of guiding principles, strategic objectives and strategic aims under an overall vision "to create a connected city region driven by smarter mobility", to form a coherent and integrated transport strategy for Galway City and its environs. The GTS encompasses all modes of transport, and includes an implementation strategy over the short, medium and long term.	The proposed road development forms part of the Galway Transport Strategy (GTS). Aside from the N6 Galway City Ring Road Project, the GTS includes project elements which have the potential to affect the conservation objectives of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA[62] through potential impacts such as habitat loss, habitat degradation and/or species disturbance/displacement. These are: • the Bearna Greenway • the Galway to Dublin Cycleway (Galway City to Oranmore) • the Galway to Oughterard Greenway • the Public Transport Network • the Non-Greenway Cycle Network • the Pedestrian Network	No in combination impact The mitigation measures that are included within the GTS fully address the potential direct and indirect impacts that might arise from the projects to be implemented through that strategy and ensures that the GTS would not have adverse effects on any European sites. Furthermore, any specific development or projects that might be required to deliver the strategy must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the Galway County Development Plan 2015-2021 and the Galway City Council Development Plan 2017-2023 to protect European sites (**Appendix O**). Considering the mitigation measures included within the GTS, the environmental protection policies included within the Galway County Development Plan 2015-2021 and the Galway City Council Development Plan 2017-2023, and that alone the proposed road development will not adversely affect the integrity of any European sites in its own right, the GTS will not act in

62 The following European sites were also within the ZoI of the GTS but as they are beyond the ZoI of the proposed road development, there is no potential for the GTS to act in combination with the proposed road development to affect their conservation objectives: Ross Lake and Woods cSAC, Cregganna Marsh SPA, Rahasane Turlough SAC, Rahasane Turlough SPA, Castletaylor Complex cSAC, Kiltiernan Turlough cSAC and Lough Fingall Complex cSAC.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		combination with the proposed road development to have an adverse effect on the integrity of any European sites.
Galway County Walking and Cycling Strategy 2013 The Galway County Walking and Cycling Strategy 2013 sets out the goals to promote and provide walking and cycling infrastructure across the county (excluding Galway City), and the actions to achieve these goals.	A total of 28 specific projects are supported and listed as infrastructural deliverables, these include: • the Connemara Greenway • the Galway to Dublin Cycleway • the Bearna Greenway • cycle infrastructure along the proposed R336 Bearna to Scríb via Ros an Mhíl Road, and walking trails in Oranmore, Kinvara, Loughrea and Gort • cycle infrastructure along the N59 between Galway City and Clifden and connecting Oranmore to Kinvara Detailed proposals are also included for the towns of Ballinasloe, Tuam, Oranmore and Clifden. Many of the proposals contained within the strategy, even as described in the context existing road corridors, will or may interact directly/indirectly with European sites and have the potential to affect their conservation objectives through a variety of potential impact pathways. Some of these projects fall under the GTS and are assessed separately under their respective headings	No in combination impact Although there is likely to be increased disturbance during construction of a project like the Moycullen -Dangan – NUIG Greenway, this will be temporary and will not affect any of the conservation objectives supporting Otter in the Lough Corrib cSAC. The proposed road development will not be lit across this area. During operation, with the road unlit and elevated above the river corridor there is no potential for any in combination effects with regard to disturbance levels. The proposed road development will not have any habitat loss or degradation effects on QI habitats, or habitats supporting QI species, in this area and therefore there is no potential for in combination effects in that regard also. As this strategy excludes Galway City, the only link between the other locations mentioned in the strategy and the proposed road development, in terms of impacts on European sites, is the potential for impacts on water quality in the River Corrib catchment and Galway Bay during construction; and therefore, the potential to affect aquatic QI habitats and QI/SCI species in Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA. The proposed road development will not adversely affect the integrity of any European sites, in its own right, as a result of any effects on water quality in the River Corrib catchment or Galway Bay.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	(e.g. Galway to Dublin Cycleway, Connemara Greenway and Bearna Greenway). In Tuam, one of the proposed cycle/walking routes passes along a local road within Lough Corrib cSAC. At Oranmore, one of the proposed cycle/pedestrian paths passes through Galway Bay Complex cSAC and Inner Galway Bay SPA. The only one of these projects (aside from the separately assessed Connemara Greenway and Bearna Greenway) that spatially interacts with the proposed road development in close proximity to Lough Corrib cSAC is the Moycullen -Dangan – NUIG Greenway which is described as commencing in the grounds of NUIG and following the old Galway – Clifden railway line. Although habitat loss and degradation type effects are a possibility, the most likely increased pressure on the QIs of Lough Corrib cSAC in this area, and particularly at the NUIG Sporting Campus, is disturbance/displacement of Otter due to increased human presence and potentially due to increased provision of artificial lighting.	All of the proposed infrastructure projects must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the Galway County Development Plan 2015-2021. These land use plans contain objectives and policies to ensure the protection of European sites and surface water quality from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the environmental protection policies included within the Galway County Development Plan 2015-2021, and that alone the proposed road development will not adversely affect the integrity of any European sites, the Galway County Walking and Cycling Strategy 2013 will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites
M6 Motorway, M17 Galway to Tuam Road Project, N18 Oranmore to Gort Road Project and the N17 Tuam Bypass	Yes, there are potential impact pathways. These four schemes have the potential to act in combination with the proposed road development to affect water quality in the River Corrib	No in combination impact All four schemes included pollution control measures to protect water quality receiving watercourses during construction, and a drainage design to prevent a reduction in surface water quality

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	catchment (M17 Galway to Tuam and N17 Tuam Bypass projects) and/or in Galway Bay (all four).	during operation. These were considered and approved by An Bord Pleanála in granting consent for each of these road projects and will not result in impact to water quality in either the River Corrib catchment or Galway Bay that would affect the conservation objectives supporting the conservation condition of the QI habitats and QI/SCI species of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA. The proposed road development will not adversely affect the integrity of any European sites, in its own right, as a result of any effects on existing surface water quality. All four road projects fall within the jurisdiction of the Galway County Development Plan 2015-2021, which has commitments to protect European sites and to protect surface water quality (see **Appendix O**). Considering the mitigation and design associated with these road projects, the environmental protection policies included within the Galway County Development Plan 2015-2021, and that alone the proposed road development will not adversely affect the integrity of any European sites as a result of effects on water quality in either the River Corrib catchment or in Galway Bay, these projects will not act in combination with the proposed road development to have an adverse effects on the integrity of any European sites.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
M6 (M17/M18) Motorway Service Area	This motorway service area is proposed on the M6, near Oranmore. In the absence of any design or construction mitigation being available, there are potential impact pathways connecting this location to European sites. There is the potential that impacts to the existing groundwater regime could occur or contaminated drainage from the site could be discharged to the surface water drainage network and affect water quality in Galway Bay.	No in combination impact This project must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the relevant land use plan. In this location, this is the Galway County Development Plan 2015-2021 has policies to protect European sites, to protect groundwater and to protect surface water quality (see **Appendix O**). Considering the environmental protection policies included within the Galway County Development Plan 2015-2021, and that alone the proposed road development will not adversely affect the integrity of any European sites in Galway Bay as a result of water quality effects, the M6 (M17/M18) Motorway Service Area project will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites.
N59 Clifden to Maam Cross Road Project	This scheme has been refused permission by An Bord Pleanála, and therefore, does not have a status at this time. A decision on whether an alternate development proposal will be advanced in the future has also not been made at this time. The only potential link between a road project in this area and the proposed road development, in terms of potential impact pathways and potential in combination effects on European sites, is the potential for any future iteration of the N59 Clifden to Maam Cross Road Project to affect water quality in the River Corrib catchment and	No in combination impact Any future project must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the Galway County Development Plan 2015-2021 to protect European sites and to protect surface water quality (see **Appendix O**). Considering the environmental protection policies included within the Galway County Development Plan 2015-2021, and that alone the proposed road development will not adversely affect the integrity of any European sites as a result of water quality effects, any future development of the N59 between Clifden and Maam Cross will not act in combination with the proposed road

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	downstream in Galway Bay. Any future road project would also have to bypass Maam Cross to the north in order to cross into the River Corrib catchment.	development to have an adverse effect on the integrity of any European sites.
N59 Maam Cross to Oughterard Road Project	The N59 Maam Cross to Oughterard Road Project is a consented road development project that lies within the River Corrib catchment. It therefore, has the potential to act in combination with the proposed road development via the following potential impact pathway: to affect water quality in the River Corrib catchment and Galway Bay.	No in combination impact The planning application for the N59 Maam Cross to Oughterard Road Project included pollution control measures to protect water quality in receiving watercourses during construction, and a drainage design to prevent a reduction in surface water quality during operation. These were considered and approved by An Bord Pleanála in granting consent for the project and will not result in impact to water quality in either the River Corrib catchment or Galway Bay that would affect the conservation objectives supporting the conservation condition of the QI habitats and QI/SCI species of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA. The proposed road development will not adversely affect the integrity of any European sites, in its own right, as a result of any effects on existing surface water quality. The N59 Maam Cross to Oughterard Road Project falls within the jurisdiction of the Galway County Development Plan 2015-2021, which has commitments to protect European sites and to protect surface water quality (see **Appendix O**). Considering the mitigation and design associated with the N59 Maam Cross to Oughterard Road Project, the environmental protection policies included within the Galway County

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		Development Plan 2015-2021, and that alone the proposed road development will not adversely affect the integrity of any European sites as a result of effects on water quality in either the River Corrib catchment or in Galway Bay, the N59 Maam Cross to Oughterard Road Project will not act in combination with the proposed road development to have an adverse effects on the integrity of any European sites.
N59 Maigh Cuilinn (Moycullen) Bypass Road Project	The N59 Maigh Cuilinn (Moycullen) Bypass Road Project is a consented road development project that lies within the River Corrib catchment. It therefore, has the potential to act in combination with the proposed road development via the following potential impact pathway: to affect water quality in the River Corrib catchment and Galway Bay.	No in combination impact The planning application for the N59 Maigh Cuilinn (Moycullen) Bypass Road Project included pollution control measures to protect water quality in receiving watercourses during construction, and a drainage design to prevent a reduction in surface water quality during operation. These were considered and approved by An Bord Pleanála in granting consent for the project and will not result in impact to water quality in either the River Corrib catchment or Galway Bay that would affect the conservation objectives supporting the conservation condition of the QI habitats and QI/SCI species of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA. The proposed road development will not adversely affect the integrity of any European sites, in its own right, as a result of any effects on existing surface water quality. The N59 Maigh Cuilinn (Moycullen) Bypass Road Project falls within the jurisdiction of the Galway County Development Plan

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		2015-2021, which has commitments to protect European sites and to protect surface water quality (see **Appendix O**). Considering the mitigation and design associated with the N59 Maigh Cuilinn (Moycullen) Bypass Road Project, the environmental protection policies included within the Galway County Development Plan 2015-2021, and that alone the proposed road development will not adversely affect the integrity of any European sites as a result of effects on water quality in either the River Corrib catchment or in Galway Bay, the N59 Maigh Cuilinn (Moycullen) Bypass Road Project will not act in combination with the proposed road development to have an adverse effects on the integrity of any European sites.
R336 Bearna to Scríb via Ros an Mhíl upgrade/improvements	Upgrade/improvements to the R336 between Bearna and Scríb is an objective of both the Bearna LAP and the Gaeltacht LAP with potential impact pathways linking it to a number of European sites. Given the corridor for this scheme shown in both Plans, it has the potential to directly affect Connemara Bog Complex cSAC and Connemara Bog Complex SPA and with the road drainage likely to (at least in part) discharge to Galway Bay, also has the potential to affect water quality in the marine environment.	No in combination impact As there are no potential impact pathways linking the proposed road development with either the Connemara Bog Complex cSAC or the Connemara Bog Complex SPA, the only likely pathways by which the proposed road development could act in combination with works along the R336 to affect the conservation objectives of European sites, is through affecting water quality in Galway Bay (i.e. Galway Bay Complex cSAC and Inner Galway Bay SPA). The proposed road development will not affect the conservation objectives of either Galway Bay Complex cSAC and Inner Galway Bay SPA in its own right. Furthermore, any upgrade or improvement proposals for the R336 must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		policies of the Galway County Development Plan 2015-2021 to protect European sites (see **Appendix O**). Considering the mitigation measures included within the Galway County Development Plan 2015-2021, and that alone the proposed road development will not adversely affect the integrity of any European sites in its own right, any future works along the R336 Bearna to Scríb via Ros an Mhíl Road will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites.
Galway to Dublin Cycleway, Connemara Greenway and the Galway to Spiddal Greenway	Yes, there are potential impact pathways. There are three major greenway projects which overlap with the ZoI of the proposed road development: the Galway to Dublin Cycleway, the Connemara Greenway (from Galway City to Clifden), and the Bearna Greenway. The Galway to Dublin Greenway comprises a number of different project sections across its length. The section between Galway City and Oranmore forms part of the Galway Transport Strategy (GTS) and is assessed under that heading. It poses no risk of having an adverse effect on the integrity of any European sites. Most of the section between Oranmore and Ballinasloe passes through lands which drain to Galway Bay and therefore, poses a temporary/short-term risk to water quality in Galway Bay during construction (the operation	No in combination impact The proposed road development will not adversely affect the integrity of any European sites, in its own right, as a result of any effects on the existing surface water or groundwater regimes. All of the greenway projects must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). In terms of those sections of greenway which could affect water quality in the River Corrib catchment and/or Galway Bay, the overarching land use plans are the Galway County Development Plan 2015-2021 and the Galway City Council Development Plan 2017-2023. These land use plans contain objectives and policies to ensure the protection of European sites and surface water quality from any projects proposed within the plan area. These are presented in **Appendix O**.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	of a walking and cycle route poses no operation risk in that regard). Impacts could affect the conservation objectives supporting the conservation condition of the QI habitats and QI/SCI species of Galway Complex cSAC and Inner Galway Bay SPA. Those section beyond Ballinasloe have no connection with any of the European sites within the ZoI of the proposed road development. The Connemara Greenway consists of two sections: Galway City to Oughterard, and Oughterard to Clifden. The section between Galway City and Oughterard forms part of the GTS and is assessed under that heading. It poses no risk of having an adverse effect on the integrity of any European sites. The only link between the Oughterard and Clifden section and the proposed road development, in terms of impacts on European sites, is the potential for impacts on water quality in the River Corrib catchment during construction; and therefore, the potential to affect aquatic QI habitats and QI/SCI species in Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA. The section between Oughterard and Clifden has planning consent which determined that the project posed no risk to the conservation objectives of, and	Considering the environmental protection policies included within those land use plans, and that alone the proposed road development will not adversely affect the integrity of any European sites, these greenway projects will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	would not have an adverse effect on the integrity of, any European sites. The Galway to Spiddal Greenway consists of two sections: Galway City to Bearna (the Bearna Greenway), and Bearna to Spiddal. The Bearna Greenway forms part of the GTS and is assessed under that heading. It also poses no risk of having an adverse effect on the integrity of any European sites. The only link between the Bearna to Spiddal section and the proposed road development, in terms of impacts on European sites, is the potential for impacts on water quality in Galway Bay; and therefore, the potential to affect aquatic QI habitats and QI/SCI species of Galway Bay Complex cSAC and Inner Galway Bay SPA.	
Sailín to Silverstrand Coastal Protection Scheme Project to construct coastal protection measures and public walkways between Sailín and Silverstrand in Galway City	Yes, there are potential impact pathways. The coastline here lies within both Galway Bay Complex cSAC and Inner Galway Bay SPA. Based on the level of project information presented in the Sailín to Silverstrand Coastal Protection Scheme EIS (Galway City Council, 2006), it is likely that this project will have adverse effects on the integrity of Galway Bay Complex cSAC and Inner Galway Bay SPA as a result of habitat loss. A project like this on the coastline could also potentially affect water quality in Galway Bay	No in combination impact The Galway City Council Development Plan 2017-2023 contains objectives and policies to ensure the protection of European sites from any projects proposed within the plan area, which includes specific policies to protect the coastline (e.g. Policy 4.3 Blue

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	during construction, could introduce non-native invasive plant species to the cSAC, and/or could result in the disturbance/displacement of SCI bird species from habitat areas in the vicinity of Rusheen Bay, within Inner Galway Bay SPA. Therefore, any impacts that have, or may, occur through progressing the Sáilín to Silverstrand Coastal Protection Scheme cannot act in combination with the proposed road development to affect the conservation objectives of Galway Bay Complex cSAC or Inner Galway Bay SPA, or adversely affect the integrity of these European sites.	Spaces: Coast, Canals and Waterways[63]). These are presented in **Appendix O**. Any future works associated with this proposed project must comply with the statutory planning requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). The proposed road development will not adversely affect the integrity of Galway Bay Complex cSAC or Inner Galway Bay SPA, in its own right. It will not result in any habitat loss within either the cSAC or the SPA, nor will it result in the spread of invasive species to these European sites. The proposed road development will not result in any disturbance or displacement of SCI bird species from the SPA, and any impacts to winter bird sites where SCI bird species were recorded (**Section 9.3** and **Section 9.4**) will not have any effect on the SPA populations. Based on the assessment provided in **Appendix F**, **Hydrology**, the proposed road development poses no risk to water quality in Galway Bay that will affect the QI/SCI habitat or species of Galway Bay Complex cSAC or Inner Galway Bay SPA (**Section 9.3** and **Section 9.4**)

[63] *"Protect and maintain the integrity of the coastal environment and waterways by avoiding significant impacts and meeting the requirements of statutory bodies, national and European legislation and standards."*
"Conserve and protect natural conservation areas within the coastal area and along waterways and ensure that the range and quality of associated habitats and the range and populations of species are maintained."

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
Salthill Coastal Protection Works (Blackrock to Galway Golf Club)	Yes, there are potential impact pathways. The coastline here lies within both Galway Bay Complex cSAC and Inner Galway Bay SPA. Based on the level of project information available at present, it is possible that the Salthill Coastal Protection Works (Blackrock to Galway Golf Club) will have, or may already have had, adverse effects on the integrity of Galway Bay Complex cSAC as a result of habitat loss. A project like this on the coastline could also potentially affect water quality in Galway Bay during construction, could introduce non-native invasive plant species to the cSAC, and/or could result in the disturbance/displacement of SCI bird species from habitat areas within Inner Galway Bay SPA.	No in combination impact The Galway City Council Development Plan 2017-2023 contains objectives and policies to ensure the protection of European sites from any projects proposed within the plan area, which includes specific policies to protect the coastline (e.g. Policy 4.3 Blue Spaces: Coast, Canals and Waterways[64]). These are presented in **Appendix O**. Any future works associated with this proposed project must comply with the statutory planning requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). The proposed road development will not adversely affect the integrity of Galway Bay Complex cSAC or Inner Galway Bay SPA, in its own right. It will not result in any habitat loss within either the cSAC or the SPA, nor will it result in the spread of invasive species to these European sites. The proposed road development will not result in any disturbance or displacement of SCI bird species from the SPA, and any impacts to winter bird sites where SCI bird species were recorded (**Section 9.3** and **Section 9.4**) will not have any effect on the SPA populations. Based on the assessment provided in **Appendix F**, **Hydrology**, the proposed road development poses no risk to water quality in

[64] *"Protect and maintain the integrity of the coastal environment and waterways by avoiding significant impacts and meeting the requirements of statutory bodies, national and European legislation and standards."*
"Conserve and protect natural conservation areas within the coastal area and along waterways and ensure that the range and quality of associated habitats and the range and populations of species are maintained."

Plan/Project **Description**	**Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?**	**Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?**
		Galway Bay that will affect the QI/SCI habitat or species of Galway Bay Complex cSAC or Inner Galway Bay SPA (**Section 9.3** and **Section 9.4**). Therefore, any impacts that have, or may, occur through progressing the Salthill Coastal Protection Works cannot act in combination with the proposed road development to affect the conservation objectives of Galway Bay Complex cSAC or Inner Galway Bay SPA, or adversely affect the integrity of these European sites.
Proposed Galway Harbour Port Extension Project to extend Galway Harbour into Galway Bay	Yes, there are confirmed impact pathways. According to the conclusions of the Natura Impact Statement (Galway Harbour Company, 2013), the Proposed Galway Harbour Port Extension will have adverse effects on the integrity of Galway Bay Complex cSAC, Inner Galway Bay SPA, Lough Corrib cSAC and Lough Corrib SPA as a result of: • habitat loss in Galway Bay Complex cSAC – including loss of QI habitats and feeding/foraging habitat of the QI species Otter and Harbour seal • habitat loss in Inner Galway Bay SPA affecting SCI bird species, and possibly some of the SCI species of Lough Corrib SPA	No in combination impact There have also been historic losses of habitat in Galway associated with previous development of the harbour site. The proposed road development will not result in the loss of any habitat within Galway Bay Complex cSAC or Inner Galway Bay SPA, nor will it affect either Atlantic salmon or Sea lamprey in the River Corrib or Galway Bay. Neither project will affect water quality in Galway Bay such that the conservation objectives of Galway Bay Complex cSAC or Inner Galway Bay SPA would be affected. The proposed road development will also not affect the SCI populations of Lough Corrib SPA or Inner Galway Bay SPA as a result of disturbance or displacement from either habitat within the SPA, or from any of the winter bird sites surveyed. Furthermore, it will not add to or exacerbate the adverse effects of the Proposed Galway Harbour Port Extension on the integrity of Galway Bay Complex cSAC, Inner Galway Bay SPA, Lough Corrib cSAC and Lough Corrib SPA.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	• Potential effects on Atlantic salmon and Sea lamprey commuting from the sea to Lough Corrib cSAC	Any impacts that have, or may, occur through progressing the Proposed Galway Harbour Port Extension cannot act in combination with the proposed road development to affect the conservation objectives of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA, or adversely affect the integrity of these European sites.
Water Supply Schemes	Yes, there are potential impact pathways. Any future water abstraction projects in the River Corrib catchment or within the hydrogeological ZoI of the proposed road development (**Figures 10.2.1** and **10.2.2**), or increases to extraction rates at existing facilities, has the potential to affect the existing surface water and/or groundwater regime. These could include local authority led projects or private wells and could lead to reduced water levels in rivers, streams or lakes, or effects on groundwater levels.	No in combination impact The scale of any impact or effect on the conservation objectives of Lough Corrib cSAC or Lough Corrib cSAC would be dependent on the location and scale of the abstraction. Galway Bay Complex cSAC and Inner Galway Bay SPA are beyond the ZoI of any effects from water supply schemes[65]. The proposed road development will not adversely affect the integrity of Lough Corrib cSAC or Lough Corrib SPA, in its own right, as a result of any effects on the existing surface water or groundwater regimes. Any water supply projects must comply with the statutory licencing and planning requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). In terms of the River Corrib catchment and the area within the hydrogeological ZoI of the proposed road development, the overarching land use plans are

[65] There are no desalination schemes proposed in Galway Bay under any of the plans or projects considered in this assessment.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
		the Galway County Development Plan 2015-2021, the Galway City Council Development Plan 2017-2023 and the Mayo County Development Plan 2014-2020. These land use plans contain objectives and policies to ensure the protection of European sites and surface water quality from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the environmental protection policies included within those land use plans, and that the proposed road development will not adversely affect the integrity of any European sites, water supply schemes (either existing or proposed|) will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites.
Wastewater Treatment	Yes, there are potential impact pathways. Discharges from waste water treatment facilities (either those run by the local authority or privately, including septic tanks) have the potential to act in combination with the proposed road development to affect water quality in either the River Corrib catchment and/or Galway Bay via the surface water network. Particularly where they are, or may be (due to increased demands imposed on the treatment process through development), operating at or over capacity. The proposed road development will discharge drainage from the Lackagh Tunnel to the cities foul drainage network. A reduction in water quality could	No in combination impact Any waste water treatment plants, and any proposed or future projects, must comply with the statutory planning and licencing requirements, and be in accordance with the objectives and policies of the relevant land use plans (Development Plans, Local Area Plans etc.). Galway City's waste water treatment facility at Mutton Island has recently been upgraded, increasing capacity from 92,000 to 170,000 p.e. (Galway City Council Development Plan 2017-2023). In terms of the River Corrib catchment and Galway Bay, the overarching land use plans are the Galway County Development Plan 2015-2021, the Galway City Council Development Plan 2017-2023 and the Clare County Development Plan 2017-2022. These land use plans contain objectives and policies to ensure the protection of European sites and

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	consequently affect some of the conservation objectives supporting the QI/SCI species of Lough Corrib cSAC, Galway Bay Complex cSAC and Inner Galway Bay SPA. As Lough Corrib SPA lies upstream of the proposed road development, none of these land use plans could act in combination with it to affect that European site.	surface/marine water quality from any projects proposed within the plan area. These are presented in **Appendix O**. Considering the environmental protection policies included within those land use plans, and that the proposed road development will not adversely affect the integrity of any European sites, waste water treatment (either existing or proposed) will not act in combination with the proposed road development to have an adverse effect on the integrity of any European sites.
Any other projects	Yes, there are potential impact pathways. There is the potential for many other developments to occur within. or in close proximity to Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC and Inner Galway Bay SPA. There are also existing applications for planning consent across the city and environs for projects such as housing renovations, extensions, and agricultural buildings (e.g. livestock sheds). Even small-scale projects like these have the potential to affect the conservation objectives of these European sites. There are two small scale road projects in development by Galway City Council: one at the Kirwan Roundabout, and another to reconfigure the road network in the vicinity of the Parkmore Industrial Estate. Both sites are remote from any European sites. In the case of the Kirwan Roundabout, if the chosen solution were to involve	No in combination impact However, as assessed above for the Galway City Council Development Plan 2017-2023 and the Galway County Development Plan 2015-2021, considering the overarching environmental protection policies included within these Plans, and that the proposed road development will not adversely affect the integrity of any European sites, any future development of this nature poses no risk of resulting in adverse effects on the integrity of any European sites in combination with the proposed road development.

Plan/Project Description	Are there Potential Impact Pathways by which the Plan/Project could act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?	Will the Plan/Project act in combination with the proposed road development to adversely affect the integrity of Lough Corrib cSAC, Lough Corrib SPA, Galway Bay Complex cSAC or Inner Galway Bay SPA?
	works on/near the Terryland River there is the potential for water quality impacts to affect water quality in the river and downstream in Galway Bay (Galway Bay Complex cSAC and Inner Galway bay SPA). The Parkmore area has no existing surface water features but could interact with groundwater. Although, given the hydrogeological baseline described in **Appendix G**, upgrades to the local road network would be unlikely to have groundwater impacts that would affect habitats within any European sites supported by the same groundwater body (Clarinbridge GWB).	

12.2 Conclusion of In Combination Assessment

As noted above, the proposed road development will not affect the integrity of Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA or Inner Galway Bay SPA. It will not result in the loss or fragmentation of any QI habitats, or habitats supporting populations of QI /SCI species, in (or associated with) any European sites, nor will it degrade any such habitats or affect QI/SCI species as a result of tunnelling/excavations, hydrogeological impacts (quality or quantity), shading from built structures or introducing/spreading non-native invasive plant species. It will also not cause a barrier effect or pose a mortality risk to QI/SCI species that will have any effect on their conservation objectives.

However, the potential direct or indirect residual impacts associated with the proposed road development, whilst not of a magnitude to result in adverse effects on European site integrity themselves, were also considered to assess whether there was the potential for other plans or projects to have similar low-level impacts. These could potentially act cumulatively or in combination to adversely affect the integrity of any/all of these European sites.

Although a portion of the drainage from the proposed road development will be discharged to the surface water network that drains to Lough Corrib cSAC, Galway Bay Complex cSAC and Inner Galway Bay SPA, the effect on water quality will be imperceptible. Nevertheless, given the large catchment of the River Corrib and the other river systems that drain to Galway Bay, and the potential for the other plans and projects therein to affect water quality, there is the potential for an In combination effect. However, considering the protective policies and objectives included within the overarching land use plans to protect water quality and European sites (**Appendix O**), none of these plans or projects will act in combination with the proposed road development to affect the integrity of any European sites due to impacts on water quality.

There will be some change in air quality in the vicinity of the proposed road development during operation, although it will not in itself affect the conservation objectives of Lough Corrib cSAC (the only European site within the ZoI of any potential air quality effects). The potential for in combination effects to occur through air quality effects is limited to the immediate vicinity of where the proposed road development passes through, or close to, Lough Corrib cSAC. Therefore, only the Galway City Council Development Plan 2017-2023, and any projects that may arise from it, have the potential to cumulatively affect air quality here. Considering the land use zonings and objectives that relate to lands in this area in the Galway City Council Development Plan 2017-2023 (Recreation and Amenity, Agriculture and High Amenity and Agricultural), and the protective policies and objectives included within the Plan to protect air quality and European sites, the Galway City Council Development Plan 2017-2023 will not act in combination with the proposed road development to affect the integrity of any European sites due to impacts on air quality.

During construction, disturbance to Otter in the River Corrib (Lough Corrib cSAC), and to wintering birds across the scheme study area, will be temporary, will not have any long-term population effects, and will not have any effect on the

conservation objectives of Lough Corrib cSAC, Galway Bay Complex cSAC and Inner Galway Bay SPA. During operation, the proposed road development will not affect Otter use of the River Corrib.

In terms of disturbance to wintering birds, considering the zoning of lands where winter birds were recorded, the protective policies set out in the relevant development plans (see Appendix P), the low number of SCI listed bird species generally recorded and their infrequent use of most of the winter bird sites, the minimal effect of any operational disturbance from road traffic in these winter bird sites, and the abundance of alternative suitable habitat to support wintering birds locally, future development will not act in combination with the proposed road development to affect the SPA SCI bird populations or the integrity of either Lough Corrib SPA or Inner Galway Bay SPA.

The In combination assessment has concluded that there is no potential for adverse effects on the integrity of Lough Corrib cSAC, Galway Bay Complex cSAC, Lough Corrib SPA or Inner Galway Bay SPA to arise as a consequence of the proposed road development acting in combination with any other plans or projects, as:

- In consideration of the mitigation measures detailed in **Section 10** of this report, no adverse effects on European site integrity will arise from the implementation of the proposed road development

Any plan or proposed project that could potentially affect these European sites in combination with the proposed road development must adhere to the overarching policies and objectives of the relevant land use plan, as dependent on the location of the specific plan or proposed project. These are the *Galway County Development Plan 2015-2021*, the *Galway City Council Development Plan 2017-2023*, the *Clare County Development Plan 2017-2022* and the *Mayo County Development Plan 2014-2020*. These policies and objectives will ensure the protection of European sites across all identified potential impact pathways, and will include the requirement for any future project to undergo Screening for Appropriate Assessment and/or Appropriate Assessment.

13 NIS Conclusion

This NIS has examined and analysed, in light of the best scientific knowledge, with respect to those European sites within the ZoI of the proposed road development, the potential impact sources and pathways, how these could impact on the Sites' QI habitats and QI/SCI species and whether the predicted impacts would adversely affect the integrity of the European sites.

Avoidance, design requirements and mitigation measures are set out within this report and its appendices and they ensure that any impacts on the conservation objectives of European sites will be avoided during the construction and operation of the proposed road development such that there will be no risk of adverse effects on these European sites.

It has been objectively concluded by Scott Cawley Ltd. following an examination, analysis and evaluation of the relevant information, including in particular the nature of the predicted impacts from the proposed road development and with the implementation of the mitigation measures proposed, that the proposed road development does not pose a risk of adversely affecting (either directly or indirectly) the integrity any European site, either alone or in combination with other plans or projects, and there is no reasonable scientific doubt in relation to this conclusion.

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