N63 Liss to Abbey Realignment Scheme

Environmental Impact Assessment Report
Volume 2: EIAR

Galway County Council

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Prepared for:

Galway County Council

Prepared by:

AECOM Ireland Limited
4th Floor
Adelphi Plaza
Georges Street Upper
Dun Laoghaire
Co. Dublin A96 T927
Ireland

T: +353 1 238 3100
aecom.com

List of Volumes comprising this Environmental Impact Assessment Report

Environmental Impact Assessment Report

Volume 2: EIAR

Table of Contents

Chapter 04 Description of the Proposed Road Development

Chapter 05 Traffic Analysis

Chapter 06 Population and Human Health

Chapter 07 Biodiversity

Chapter 08 Land and Soils

Chapter 09 Water

Chapter 10 Air Quality

Chapter 11 Climate

Chapter 12 Noise and Vibration

Chapter 13 Landscape and Visual

Chapter 14 Cultural Heritage

Chapter 15 Major Accidents and Disasters

Chapter 16 Material Assets

Chapter 17 Material Assets- Agriculture

Chapter 18 Interactions

Chapter 19 Schedule of Mitigation Measures

Acronyms & Abbreviations

AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
ABP	An Board Pleanála
ADS	Advanced direction signs
AEC	Atlantic Economic Corridor
AEP	Annual Exceedance Probability
AEP	Annual Event Probability
ALARP	As low as reasonably practicable
AM	Ante Meridiem
ATC	Automatic Traffic Counter
BCT	Bat Conservation Trust
BoCCI	Birds of Conservation Concern in Ireland
BSI	British Standards Institute
BTO	British Trust for Ornithology
BWI	Bird Watch Ireland
C&D	Construction and Demolition
CAFE	Clean Air for Europe
CAP	Climate Action Plan
CC	Climate Change
CCR	Climate Change Resilience
CDP	County Development Plan
CEMP	Construction and Environmental Management Plan
CESCP	Construction Erosion and Sediment Control Plan
CFRAM	Catchment Flood Risk Assessment and Management
CH_4	Methane
CHIA	Cultural Heritage Impact Assessment
CIEEM	Chartered Institute of Ecology and Environmental Management
CLP	Classification Labelling and Packaging Regulation
CM	Centimetres
CMU	Catchment Management Unit
CO	Carbon Monoxide
CO_2	Carbon dioxide
CPO	Compulsory Purchase Order
CRTN	Calculation of Road Traffic Noise
CSO	Central Statistics Office
CTMP	Construction Traffic Management Plan
CUR	Connacht Ulster Region
CURWP	Connacht Ulster Region Waste Management Plan
D&B	Design and Build Contract
DAHG	Department of Arts, Heritage and the Gaeltacht
dB	Decibels
DCHG	Department of Culture, Heritage and the Gaeltacht
DEFRA	Department of Environment and Rural Affairs

DEHLG	Department of the Environment, Heritage and Local Government
DfT	UK Department for Transport
DM	Do-minimum
DMRB	Design Manual for Roads and Bridges
DS	Do-something
DTTAS	Department of Transport, Tourism and Sport
EC	European Commission
EcIA	Guideline for Ecological Impact Assessment
EcMS	Ecology Monitoring Strategy
ECoW	Ecological Clerk of Works
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
ED	Electoral District
EFT	Emissions Factors Toolkit
END	Environmental Noise Directive
EOP	Environmental Operating Plan
EPA	Environmental Protection Agency
EPUK	Environmental Protection UK
ER	Employer's Representative
ERP	Emergency Response Plan
ESB	Electricity Supply Board
ESIA	Environmental and Social Impact Assessment
ETS	Emissions Trading System
EU	European Union
EULVs	European Union Limit Values
EV	Electric Vehicles
FCS2	Fisheries Classification Scheme 2
FRA	Flood Risk Assessment
FSU	Flood Studies Update
GAA	Gaelic Athletic Association
GCC	Galway County Council
GCDP	Galway County Development Plan
GCRR	Galway City Ring Road
GCTPS	Galway County Transport & Planning Strategy
GGBS	Ground Granulated Blast Furnace Slag
GHG	Greenhouse Gas
GIS	Geographic Information System
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GMS	Grassland Monitoring Survey
GSI	Geological Survey Ireland
GWB	General Watching Brief
Ha	Hectares
HAZID	Hazard Identification
HCV	Heavy Construction Vehicle
HFC	Hydrofluorocarbons
HGV	Heavy Goods Vehicle
HM	Heavy Metals

HMI	Habitat Modification Index
HMS	Habitat Modification Score
HSE	Health Service Executive
HQA	Habitat Quality Assessment
HUDU	Healthy Urban Development Unit
HV	High Voltage
IAQM	Institute of Air Quality Management
ICCI	In-combination Climate Change Impact
IE	Industrial Emissions
IEMA	Institute of Environmental Management and Assessment
IFI	Inland Fisheries Ireland
IGV	Interim Guidelines Values
IPC	Integrated Pollution Control
IPH	Institute of Public Health
IPC	Integrated Pollution Control
IRP	Incident Response Plan
ISGS	Irish Semi Natural Grassland Survey
ISMP	Invasive Species Management Plan
ISO	International Organization for Standardisation
ISSAMP	Invasive Species Site Assessment and Management Plan
JTC	Junction Turning Counts
KER	Key Ecological Receptors
Kg	kilogram
km	Kilometre
kV	Kilovolt
LCA	Landscape Character Assessment
LED	Light Emitting Diode
LI	Landscape Institute
LoW	List of Wastes
LV	Low Voltage
LVs	Limit Values
m	meter
m^2	Square Meter
m^3	Cubic Meter
MAD	Major Accidents and Disasters
MCA	Multi Criteria Analysis
mm	Millimetres
MRFS	Mid-Range Future Scenario
MV	Medium Voltage
N	Ammoniacal nitrogen
N_2O	Nitrous Oxide
N/A	Non-Applicable
NAP	Noise Action Plan
NBDC	National Biodiversity Data Centre
NCA	National Conservation Assessment
NDP	The National Development Plan

NF_3	Nitrogen trifluoride
NH_3	Ammonia
NHS	National Health Service
NIAH	National Inventory of Architectural Heritage
NIFTI	National Investment Framework for Transport in Ireland
NIS	Natura Impact Statement
NMU	Non-Motorised User
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides of Nitrogen
NPF	National Planning Framework
NPO	National Policy Objectives
NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NSNW	National Survey of Native Woodland
NSO	National Strategic Outcome
NTA	National Transport Authority
NTS	Non-Technical Summary
NWCPO	National Waste Collection Permit Office
NWRA	Northern and Western Regional Assembly
OCEMP	Outline Construction Environmental Management Plan
OPW	Office of Public Works
OSI	Ordinance Survey Ireland
PAG	Project Appraisal Guidelines
PC	Public Consultation
PFA	Pulverised Fly Ash
PFC	Perfluorocarbons
PM	Particulate Matter
PM	Post Meridiem
pNHA	Proposed Natural Heritage Area
PPPs	Plant Production Products
PPV	Peak Particle Velocity
PRAI	Property Registration Authority of Ireland
PRF	Potential Roost Feature
QI	Qualifying Interest
RBMP	River Basin Management Plan
RHS	River Habitat Survey
RLB	Red Line Boundary
RMP	Record of Monuments and Places
RPA	Root Protection Area
RPS	Record of Protected Structures
RSA	Road Safety Authority
RSES	Regional Spatial and Economic Strategy
SAAR	Standard Average Annual Rainfall
SAC	Special Area of Conservation
SEM	Site Environmental Manager
SF_6	Sulphur hexafluoride

SFILT	Strategic Framework for Investment in Land Transport
SI	Statutory Instrument
SMP	Soil Management Plan
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SPT	Standard penetration test
SRA	Southern Regional Assembly
SUDS	Sustainable Urban Drainage System
TEN-T	Trans-European Transport Network
TII	Transport Infrastructure Ireland
TMU	Traffic Monitoring Units
TNI	Transport Northern Ireland
TPA	Tonnes per annum
TTVs	Timed Tetrad Visits
TWB	Targeted Watching Brief
U1	Unacceptable Material
UK	United Kingdom
UN1 & UN2	Unattended Noise Surveys
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VEM	Visual Envelope Map
VOC	Volatile Organic Compound
WERLA	Waste Enforcement Regional Lead Authority
WFD	Water Framework Directive
WHO	World Health Organisation
WMO	World Meteorological Organization
WMP	Waste Management Plan
WSSP	Water Services Strategic Plan
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility
ZVI	Zone of Visual Influence
%	Percent

Glossary of Terms

Term	Definition
Adverse (quality of effects)	A change which reduces the quality of the environment (for example, lessening species diversity, diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance)
Aggregate	Granular material (e.g. sand, gravel or crushed rock) that can be used for building and/or civil engineering purposes (e.g. for concrete production)
Air quality limit value	A maximum pollutant concentration to be achieved in the atmosphere, either without exception or with a permitted number of exceedances. Limit values are defined in European Union Directives and implemented in United Kingdom legislation
Air quality objective	Objectives are policy targets generally expressed as a maximum ambient pollutant concentration to be achieved. The objectives are set out in the UK Government's Air Quality Strategy for the key air pollutants
Air quality sensitive receptors	People, property, species or designated sites for nature conservation that may be at risk from exposure to air pollutants potentially arising as a result of a proposed development
Air quality standards	In order to protect our health, vegetation and ecosystems, EU directives set down air quality standards in Ireland and the other member states for a wide variety of pollutants. These rules include how we should monitor, assess and manage ambient air quality
Alternatives	A description of other options that may have been considered during the conception of a project, these include alternative locations, alternative designs and alternative processes
Amenity	The benefits of enjoyment and wellbeing which are gained from a resource in line with its intended function. Amenity may be affected by a combination of factors such as: sound, noise and vibration, dust/air quality, traffic/congestion and visual impacts
Appropriate Assessment	An assessment (required under regulation 48 of the Conservation (Natural Habitats, &c.) Regulations 1994) of the effects of a plan or project on the Natura 2000 network of European sites of nature conservation significance. The assessment focuses on the plan or project's implications for the site and any potential adverse impacts on its integrity
Aquatic (ecology)	Aquatic ecology includes the study of relationships between individuals of the same species, between different species and between organisms and their physical and chemical environments. Relationships in all aquatic environments, including oceans, estuaries, lakes, ponds, wetlands, rivers, and streams
Aquifer	A body of permeable soil or rock which can contain, store or transmit groundwater
Archaeological Survey of Ireland	The Archaeological Survey of Ireland (ASI) is a unit of the National Monuments Service. The ASI was established to compile an inventory of the known archaeological monuments in the State. The information is stored on a database and in a series of paper files that collectively form the ASI Sites and Monuments Record (SMR)
Architectural Conservation Area	Areas which are designated in a county development plan, under Section 81(1) of the Planning and Development Act, 2000 (Revised), in order to "*preserve the character of a place, area, group of structures or townscape" that are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or value or "contributes to the appreciation of protected structures*."
Architectural Fragment	A piece of worked wood or carved stone that has been removed from a building. These may be of any date from the early medieval period (5th-12th centuries AD) onwards.
As low as reasonably practicable	A principle which involves weighing a risk against the time and cost needed to control it
Automatic traffic counts	Traffic counts undertaken using automatic traffic counters to record the speed and volume of traffic at a specific location
Average Annual Daily Traffic	An estimate of the mean daily traffic volume over the course of a year
Backfill	Material used to refill an excavation
Baseflow	The normal discharge of a surface water as a result of groundwater seeping into the river channel

Term	Definition
Baseline environment	A description of the relevant aspects of the current state of the environment. An outline of the likely evolution thereof without implementation of the project as far as natural changes from the baseline can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge
Baseline survey	A survey to establish the current state of environmental characteristics
Bat roost	The resting place of a bat or any structure or place, which any wild bat uses for shelter or protection
Bedrock	Rock that underlies loose soil deposits
Best Available Technique	Means the most effective and advanced stage in the development of activities and their methods of operation which indicates the practical suitability of particular techniques for providing the basis for emission limit values and other permit conditions designed to prevent and, where that is not practicable, to reduce emissions and the impact on the environment as a whole
Biodiversity	The variety of life in the world or in a particular habitat or ecosystem
Biodiversity action plan	A nationally used programme that addresses threatened species and habitats and seeks to protect and restore biological systems
Borehole	A hole bored into the ground, usually as part of investigations, typically to test the depth and quality of soil, rock and groundwater. A borehole can also be used to dewater the ground
Brownfield	Land previously used for industrial or commercial operations with known or suspect contamination
Bund	An embankment or structure which acts as a visual or noise screen or acts as a barrier to control the spillage of fluids
Carbon budget	A carbon budget is the total quantity of greenhouse gas emissions permitted in the United Kingdom over a specified time period
Carbon sink	An area of vegetation, especially a forest, or a phytoplankton-rich sea that absorbs the carbon dioxide produced by the burning of fossil fuels
Chapel	A free-standing building which is used for private worship. These date from the late medieval period (c. 1400 to the 16th century AD) onwards.
Chartered Institute of Ecology and Environmental Management	The professional body which represents and supports ecologists and environmental managers, mainly in the United Kingdom but increasingly in Ireland and mainland Europe, and the rest of the world
Circa	Meaning approximately, often used in a historic context in reference to a date
Clay	An inorganic component of soil derived from the weathering of rock and comprising particles less than 0.002mm in equivalent diameter
Climate	The climate can be described simply as the ‘average weather’, typically looked at over a period of 30 years. It can include temperature, rainfall, snow cover, or any other weather characteristic
Climate change	This refers to a change in the state of the climate, which can be identified by changes in average climate characteristics which persist for an extended period, typically decades or longer
Climate change mitigation	Describes action to reduce the likelihood of an event occurring or reduce the impact if it does occur. This can include reducing the causes of climate change (e.g. emission of greenhouse gases) as well as reducing future risks associated with climate change
Climate change resilience	The ability to anticipate, prepare for and respond to hazardous events, trends, or disturbances related to climate
Construction environmental management plan	A plan which outlines how a construction project will avoid, minimise or mitigate effects on the environment and surrounding area
Contaminated	Made impure by the addition of a harmful or undesirable substance
Contaminated land	Any land which appears to the local authority in whose area it is situated to be in such a condition, by reason of substances in, on or under the land, that: (a) significant harm is being caused or there is a significant possibility of such harm being caused (b) significant pollution of controlled waters is being caused, or there is a significant possibility of such pollution being caused

Term	Definition
	(Section 78A(2) of the Environmental Protection Act 1990)
Cultural heritage	The practices, representations, expressions, knowledge, skills – as well as the instruments, objects, artefacts and cultural spaces associated therewith – that communities, groups and, in some cases, individuals recognize as part of their cultural heritage
Cultural heritage asset	A monument, building, group of buildings and sites which are the combined works of nature and man constituting the historic or built environment (World Heritage Convention 1972)
Cumulative impacts/effect	The addition of many minor or significant impacts, including effects of other projects, to create larger, more significant impacts
Culvert	A structure that conveys water beneath a feature such as a road
Decibel(s) A-weighted	The human ear system does not respond uniformly to sound across the detectable frequency range and consequently instrumentation used to measure sound is weighted to represent the performance of the ear. This is known as the 'A weighting' and is written as 'dB(A)'
Decibel(s) or dB	Between the quietest audible sound and the loudest tolerable sound there is a million to one ratio in sound pressure (measured in Pascal, Pa). Due to wide range, a level scale called the decibel (dB) scale, based on a logarithmic ratio, is used in sound measurement. Audibility of sound covers a range of approximately 0-140dB
Defra	The Government department responsible for policy and regulations on environmental, food and rural issues. The department's priorities are to grow the rural economy, improve the environment and safeguard animal and plant health
Designed Landscape Feature	A man-made feature that is laid out to produce the effect of natural scenery, or other features, usually within demesnes and associated with a country house. These date from the 17th to the 19th century AD. See also Designed landscape - ornamental lake, Designed landscape - tree-ring, Designed landscape - folly, Designed landscape - belvedere, Designed landscape - teahouse and Designed landscape - summer house.
Development plan document	Documentation which seeks to guide development and planning in a local authority area for a set period of time
Dewater	To remove water from, for example, an excavation
Direct (effect)	A direct (or primary) effect may be defined as an effect that is directly attributable to the development
Directive	Legal obligations imposed on European member states by the European Union
Disaster	natural hazard (e.g. earthquake) or a man-made/external hazard (e.g. act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident.
Dust	All airborne particulate matter
Earthworks	The removal or placement of soils and rocks such as in cuttings, embankments and environmental mitigation, including the in-situ improvement of soils/rocks to achieve the desired properties
Ecological receptor	Any living organisms other than humans, the habitat which supports such organisms, or natural resources which could be adversely affected by environmental contaminations resulting by a release at or migration from a site
Ecological status	The state of a water body, derived from a number of factors, including: the abundance of aquatic flora and fauna, nutrient availability, salinity, temperature and chemical pollution levels
Ecosystem	Biological community of interacting organisms (e.g. plants and animals) and their environment
Effect	Used throughout this environmental impact assessment report to refer to the consequence of an impact to the receiving environment
Effluent	Liquid waste or sewage
Embedded control measures	Avoidance measures that have been integrated into the project proposal. The assessment of effects takes into account any embedded control that forms an inherent part of the Proposed Development design
Emission Factor Toolkit	Published by Defra and the Devolved Administrations to assist local authorities in carrying out Review and Assessment of local air quality as part of their duties under the Environmental Act 1995

Term	Definition
Environmental Impact Assessment	A process to systematically assess the potential environmental effects of proposed development. An environmental impact assessment is a legal requirement for certain public and private projects in European Union countries
Environmental Impact Assessment Report	A suite of documents providing the necessary environmental information in respect of an environmental impact assessment undertaken for a proposed development. It must include all information that is reasonably required to assess the potential significant environmental effects
Environmental Protection Agency	The Environmental Protection Agency is at the front line of environmental protection and policing in Ireland. They ensure that Ireland's environment is protected, and monitor changes in environmental trends to detect early warning signs of neglect or deterioration.
Excavated material	Largely natural soil and rock material that is removed from the ground during construction
Field system	A group or complex of fields which appear to form a coherent whole. These date to any period from the Neolithic (c. 4000-2400 BC) onwards.
Fill	Material used to artificially raise the existing ground levels
Filter drain	A trench filled with granular material that allows temporary storage of runoff and removal of sediment
Flood Risk Assessment	An assessment to determine whether a site or development is, or is likely to be, impacted by flooding and potential flood-related development constraints
Floodplain	Land adjacent to a watercourse over which water flows or would flow in times of flood, but for defences in place
Frequency (of effects)	How often the effect will occur. (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)
Geological Survey Ireland	The national earth science knowledge centre. They provide data and maps on Ireland's subsurface and act as a research collaborator
Geomorphological	Of or relating to the form or surface features of the earth or another celestial body.
Greenhouse gases	Atmospheric gases such as carbon dioxide, methane, chlorofluorocarbons, nitrous oxide, ozone, and water vapour that absorb and emit infrared radiation emitted by the Earth's surface, the atmosphere and clouds.
Ground investigation	Survey to determine ground conditions prior to construction work to inform design and reduce any hidden risks that may cause delay or impact on costs
Groundwater	All water which is below the surface of the ground and within the permanently saturated zone
Groundwater body	A distinct volume of groundwater within an aquifer
Groundwater dependent terrestrial ecosystems	Wetlands which are directly dependent upon water from a groundwater body to maintain their form and function
Groundwater vulnerability	A term used to represent the natural ground characteristics that determine the ease with which groundwater may be contaminated by human activities
Habitat	The natural surroundings in which an animal or plant usually lives
Habitat loss	Thinning, fragmenting, or outright destruction of an ecosystem's plant, soil, hydrologic, and nutrient resources
Habitat survey	Field survey technique to record semi-natural vegetation and other wildlife habitats
Hardstanding	A hard surface on which cars, aircraft etc. may stand
Haul roads	Temporary roads provided within a contractor's site area to allow for the movement of construction material, construction machinery and/or construction labour around the site
Hazardous waste	Waste which displays one or more of the hazardous properties listed in Annex III
Heavy goods vehicle	A large road vehicle for carrying goods
Heavy metals	A term which refers to a group of metal and metalloids, many of which can be toxic to some degree
Hectad	A hectad is an area 10 km x 10 km square

Term	Definition
Highways England	Highways England operates, maintains and improves England's motorways and major A roads. Highways England works with the Department for Transport
Hydraulic fluids	A fluid, usually of low viscosity, as oil, used in a hydraulic system
Hydrofluorocarbons	A group of organic chemicals containing hydrogen and fluorine atoms, often used in cooling and refrigeration processes
Hydrogeology	The nature, distribution and movement of groundwater in soils and rocks, including in aquifers
Impact	Used throughout this environmental statement to refer to changes to the environment that have the potential to occur as a result of the construction and/or operation of the Proposed Road Development (see also: 'effect')
Imperceptible (impact significance)	An impact capable of measurement but without significant consequences
In-combination climate change impact assessment	Combined effect of the Proposed Road Development and future climate change on receptors in the surrounding environment
In-combination effects	In-combination effects arise where receptors are affected by a combination of a number of environmental effects (for example, from sound, noise and vibration; dust and air quality
Indirect (effects)	Impacts on the environment, which are not a direct result of the project, often produced away from the project site or because of a complex pathway
Infrastructure	The basic structure, framework or system which supports the operation of a project for example, installations such as roads and sewers which are necessary to support development projects
In-situ preservation (cultural heritage)	Conservation of an archaeological asset in its original location
Institute of Air Quality Management	The professional body for air quality professionals. They act as the voice of air quality in the UK by producing useful and timely guidance on matters affecting air quality professionals and by responding to Government consultations
Invasive species	Any non-native species that significantly modifies or disrupts the ecosystem it colonizes
Invertebrate	An animal lacking a backbone, such as an arthropod, mollusk, annelid, coelenterae etc.
Junction Turning Count	A survey of vehicles turning in each direction at a junction
Landfill	Waste disposal site for the deposit of waste onto or into land (i.e. underground)
Landscape character	The distinct and recognisable pattern of elements in the landscape that makes one landscape different from another, rather than better or worse
Landscape character area	These are single unique areas which are the discrete geographical areas of a particular landscape type
Landscape effects	Effects on the landscape as a resource in its own right
Landscape elements	Individual components which make up the landscape such as trees and hedges
Landscape features	Particularly prominent or eye-catching elements, like tree clumps, church towers or wooded skylines
Landscape receptor	Defined aspects of the landscape resource that have the potential to be affected by a proposal
Landscape resource	The combination of elements that contribute to landscape context, character and value
Landscape value	The relative value or importance attached to different landscapes by society. A landscape may be valued by different stakeholders for a whole variety of reasons
Land-use	The human activities which take place within a given area of space
Leacht Cuimhne	A type of cenotaph (see Cenotaph), the name is derived from the Irish 'leacht' meaning a grave, cairn or sepulchral monument and 'cuimhne' meaning a commemoration or a memorial. They consist of tall, rectangular or square stone piers, usually of drystone construction, frequently surmounted by simple crosses. Set into the piers are stone plaques commemorating, in English, departed relatives. They date from the 1640s up to the 1890s AD.

Term	Definition
Level of effect	Determined through the combination of sensitivity of the receptor and the proposed magnitude of change brought about by the development
Likely effects	The effects that are specifically predicted to take place - based on an understanding of the interaction of the Proposed Road Development and the receiving environment
Made ground	An area or material where the pre-existing (natural or artificial) land surface is raised by artificial deposits. It may be composed of a variety of materials including imported natural soils and rocks with or without residues of industrial processes (such as ash) or demolition material (such as crushed brick or concrete)
Magnitude (of effects)	A term that combines judgements about the size and scale of the effect, the extent of the area over which it occurs, whether it is reversible or irreversible and whether it is short or long term in duration
Major accident	Events that threaten immediate or delayed serious environmental effects to human health, welfare and/or the environment and the use of resources beyond those of the client or its appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events.
Material assets	Material assets to be taken to mean 'built services' (i.e. utilities networks including electricity, telecommunications, gas, water supply and sewerage), 'waste management' and 'infrastructure' (i.e. roads and traffic)
Meteorological	Relating to the branch of science concerned with the processes and phenomena of the atmosphere, especially as a means of forecasting the weather
Mill - corn	A mill, including where present the millrace and millpond, for grinding corn. These date from the 18th to the 20th century AD. In this database only mills which are post-1700 AD in date are classified by function.
Mitigation measures	Measures designed to avoid, reduce, remedy or offset impacts. These measures can mitigate impacts: by Avoidance When no impact is caused (often through consideration of alternatives). by Prevention When a potential impact is prevented by a measure avoid the possibility of the impact occurring by Reduction When an impact is lessened by Remedy When an impact is resolved by a remedial action by Offsetting When an adverse impact is balanced by a positive impact
Moderate (effect significance)	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Monitoring	The observation, measurement and evaluation of environmental data to follow changes over a period of time, to assess the efficiency of control measures. This is typically a repetitive and continued process carried out during construction, operation or decommissioning of a project
National Inventory of Architectural Heritage	A state initiative established under the provisions of the Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 to identify, record, and evaluate the post-1700 built heritage of Ireland, uniformly and consistently as an aid to its protection and conservation
National Monument	A monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic, or archaeological interest
National Monuments Service	Part of the Department of Culture, Heritage and the Gaeltacht and plays a key role in the protection of our archaeological heritage
National Parks and Wildlife Service	The NPWS is fully integrated in the Heritage Division of the Department and has responsibility for the protection and conservation of Ireland's natural heritage and biodiversity at national government level
National Roads Authority	Transport Infrastructure Ireland, formerly known as the National roads Authority. A state body in Ireland, responsible for the national road network.

Term	Definition
Natura Impact Statement	The statement prepared following Appropriate Assessment of Natura 2000 sites as required under the Habitats Directive which presents information on the assessment and the process of collating data on a project and its potential significant impacts on Natura 2000 site(s)
Natural England	Executive non-departmental public body constituted under the Natural Environment and Rural Communities Act 2006 (section 2(1)) to ensure that the natural environment is conserved, enhanced and managed for the benefit of present and future generations, thereby contributing to sustainable development
Natural resources	All the land, forests, energy sources and minerals existing naturally in a place that can be used by people
Neutral (quality of effect)	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error
Noise barrier	A solid construction that reduces unwanted sound. It may take many forms including: engineering cutting; retaining wall; noise fence barrier; landscape earthworks; a 'low level' barrier on a viaduct; a parapet barrier on a viaduct; or any combination of these measures
Non-hazardous waste	Any waste not defined as ‘hazardous’ under Directive 91/689/EEC
Non-technical summary	A report which, in the case of this environmental impact assessment report, briefly describes the main points discussed in the environmental impact assessment report without the use of technical language
Not significant (effect significance)	An impact which causes noticeable changes in the character of the environment but without significant consequences
Office of Public Works	An Irish Government agency whose primary function is to support the implementation of Government policy and advise the Minister for Public Expenditure and Reform and the Minister of State at that Department, principally in the disciplines of property and flood risk management
Ordnance Datum	Ordnance Datum refers to the height above mean sea level, taken from a reference point at Newlyn, Cornwall. This is the national height system for the UK
Ordnance Survey Ireland	The national mapping agency for Ireland
Particulate matter	Discrete particles in ambient air, with diameters ranging between nanometres (billionths of a metre) to micrometres (millionths of a metre)
Pathways	The routes by which pollutants are transmitted through air, water, soils, plants and organisms to their receptors
Peak particle velocity	The peak particle velocity is the maximum velocity that is recorded during a particular vibration event. It is commonly used to assess the potential for damage to structures due to ground-borne vibration
Perfluorocarbons	Man-made compounds containing just fluorine and carbon. They are generally colourless, odourless non-flammable gases at environmental temperatures and for the most part chemically unreactive
Permanent (duration of effects)	Effects lasting over sixty years
Permeable	Allowing liquids or gases to go through
Petrifying spring	Groundwater outflow rich in lime, which deposits tufa (a porous rock)
Photomontage	A visualisation which superimposes an image of a Proposed Road Development upon a photograph or series of photographs
Piling	Driving and embedding piles of wood, concrete or steel deep into the ground, to support buildings/structures at the foundation level
Planning authority	The local authority or council that is empowered by law to exercise planning functions
PM10	PM_{10} is any particulate matter with an aerodynamic diameter equal to or less than 10 micrometres.
PM2.5	$PM_{2.5}$ is any particulate matter with an aerodynamic diameter equal to or less than 2.5 micrometres
Pollutant	A substance that pollutes something, especially water or the atmosphere

Term	Definition
Pollution	Any release to the environment which has a subsequent adverse effect on the environment or man
Positive (quality of effects)	A change which improves the quality of the environment (for example, by increasing species diversity; or the improving reproductive capacity of an ecosystem, or by removing nuisances or improving amenities)
Potential effects/impacts	The effect/impact that would occur without mitigation
Protected structure	A structure that a planning authority considers to be of special interest from an architectural, historical, archaeological, artistic, cultural, scientific, social or technical point of view
Qualifying interest	The Annex I habitats or Annex II species for which the site has been designated
Qualitative (approach)	Relating to the nature or standard of something, rather than to its quantity
Quaternary	The most recent period of geological time, approximately equated to the period of the ice ages to the present day
Receptor	A component of the natural or built environment (such as a human being, water, air, a building or a plant) affected by an impact of the construction and/or operation of a proposed development
Receptor sensitivity	The potential of a receptor to be significantly affected
Record of Monuments and Places	A list of historical and archaeological sites the Republic of Ireland established under the National Monuments Acts. It comprises a list of recorded monuments and places and accompanying maps on which such monuments and places are shown for each county
Record of Protected Structures	Each county as a Record of Protected Structures, which is usually outlined in the county development plan. The Record of Protected Structures lists all protected structures and buildings in the county; this includes structures of architectural, historical, archaeological, artistic, cultural, social, scientific or technical importance
Residual Effects/Impacts	The effect/impact after mitigation
Ringfort	General term given to circular enclosures surrounded by one, two or three banks of earth of stone, with or without, enclosing ditches constituting the defended farmhouse or dwelling site of the Early Medieval period in Ireland
Riparian Area	The interface between land and a river or stream
Risk Assessment	An assessment of the probability of a hazard occurring that could result in an impact
River Basin Management Plan	Plans developed under the EU Water Framework Directive setting out environmental objectives for all groundwater and surface water bodies and protected areas within a river basin district
Road Safety Authority	A state agency formed by the Irish Government to promote road safety within the Republic of Ireland
Runoff	The flow of water over the ground surface
Sand	Soil particles from 0.06 mm-2.0 mm in equivalent diameter. Fine sand particles are from 0.06 mm-0.2 mm; medium sand from 0.2 mm-0.6 mm; and coarse sand from 0.6 mm-2.0 mm
Scoping	The process of identifying the significant issues which should be addressed by a particular Impact Assessment as well as the means or methods of carrying out the assessment
Screening	The first stage in an environmental impact assessment used to determine if further assessment is necessary
Sensitivity	The potential of a receptor to be significantly affected
Setting (cultural heritage)	The surroundings in which a heritage asset is experienced. Its extent is not fixed and may change as the asset and its surroundings evolve. Elements of a setting may make a positive, negative or neutral contribution to the significance of an asset and may affect the ability to appreciate it
Severance	The separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flows
Seveso site	The Seveso III Directive was implemented in Ireland as the S.I. No. 74/2006 - European Communities (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2006. The Directive defines major accident hazard sites as those that store or can generate quantities of dangerous substances in excess of specified thresholds.

Term	Definition
Sewerage	System by which waste matter (sewage) is carried away in a network of pipes
Short term (duration of effects)	Effects lasting one to seven years
Significance (of effects)	The importance of the outcome of the impact (or the consequence of change) for the receiving environment
Silt	Soil particles from 0.002 mm to less than 0.06 mm in equivalent diameter
Silt fence	A barrier made of porous material, which is installed to prevent/slow down the movement of sediment
Silt trap	A holding basin in which water is retained, to prevent silt loading of drains
Single carriageway	A road with one, two or more lanes arranged within a single carriageway with no central reservation to separate opposing flows of traffic
Slight (impact significance)	An impact which causes noticeable changes in the character of the environment without affecting its sensitivities
Soil	The upper layer of the earth's crust, in which plants grow. It consists of weathered rock, organic matter, air spaces and water. Descriptions usually identify the relevant characteristics of its (usually) horizontal layers in terms of their significance for soil characteristics and crop growth, usually to a depth of 1.2 m
Soil structure	The combination or aggregation of soil particles into larger compound units (or peds) with pore spaces and channels between that allow the flow of air and water and the penetration of roots. The secondary units are characterised and classified on the basis of size, shape and degree of development
Sound power	Sound power is the rate per unit time at which airborne sound energy is radiated by a source. It is expressed it watts (W). Sound power level or acoustic power level is a logarithmic measure of the sound power in comparison to the reference level of 1 pW (picowatt). The sound power level is given the letter "Lw" or SWL. It is not the same thing as sound pressure (Lp). Any Lp value is dependent of the distance from the noise source and the environment in which it was measured. Lw values are preferred for noise prediction purposed as their value is independent of distance or environment. There are recognised formulas for converting Lw to Lp. A-weighted sound power levels are usually denoted LwA (dB) or sometimes Lw (dBA) or SWL (dBA)
Sound power level	The sound power level (Lw) of a source is a measurement of the total acoustic power it radiates. The sound power level is an intrinsic characteristic of a source (analogous to its volume or mass), which is not affected by the environment within which the source is located
Source	The activity or place from which an effect originates
Special Area of Conservation	Areas of special interest containing habitats or species of European significance. They are being established under the Habitats Directive (Council Directive 92/43/EEC)
Special Protection Area	Areas of special interest for the conservation of wild bird habitats, especially listed, rare or vulnerable species and migratory species. Established under the Birds Directive (Council Directive 79/409/EEC)
Statutory body	A body set up by the government to consider evidence and make judgements in some field of activity
Statutory consultee	Organisations and bodies, defined by statute, which must be consulted on relevant planning matters
Stockpile	A stockpile of things is a large quantity of them that have been stored for future use
Stormwater	standing water produced after a heavy rainfall or snowfall
Subsoil	Weathered soil layer extending between the natural topsoil and the unweathered basal layer (geological parent material) below, or similar material on which topsoil can be spread. Subsoil has lower organic matter and plant nutrient content than topsoil. In most cases topsoil requires a subsoil to perform one or a number of natural soil functions
Surface water	Waters including rivers, lakes, loughs, reservoirs, canals, streams, ditches, coastal waters and estuaries
Temporary (duration of effects)	Effects lasting less than a year

Term	Definition
Tetrahydrofuran	A clear liquid soluble in water and organic solvents, used as a solvent for resins, in polymerizations and as a chemical intermediate
The Landscape Institute	A British professional body for landscape practitioners, including landscape architects, landscape planners, landscape managers and urban designers
Till	Unsorted glacial sediment deposited directly by a glacier
Topography	The study and description of the physical features of an area, for example its hills, valleys, or rivers, or the representation of these features on maps
Topsoil	Upper layer of a soil profile, usually darker in colour (because of its higher organic matter content) and more fertile than subsoil, and which is a product of natural biological and environmental processes
Traffic flow capacity	The capability of a junction/road link to accommodate the volume of traffic
Traffic management plan	A plan that provides a means of planning and implementing how all likely road users will be safely and efficiently guided through/to/from a site
Transport Infrastructure Ireland (TII)	A state agency in Ireland dealing with road and public transport infrastructure (formally NRA)
Trial pit	A trial pit (also known as a test pit) is a type of intrusive ground investigation that is used as a means of determining the condition of the ground, typically before beginning construction works
Type or nature of effect	Whether an effect is direct, indirect, temporary or permanent, positive (beneficial), neutral or negative (adverse) or cumulative
Unlikely (effects)	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented
Vehicle movement	A journey made by a vehicle. This can either be a one way or two-way trip
Viewpoint	A place from which something can be viewed
Visual amenity	Value of a particular place in terms of what is seen by visual receptors taking account of all available views and the total visual experience
Visual effect	Effects on specific views and on the general visual amenity experienced by people
Visual receptor	Individuals and/or defined groups of people who have the potential to be affected by a proposal
Visualisation	Computer simulation, photomontage or other technique to illustrate the appearance of a development
Volatile organic compounds	A number of chemicals, including benzene and acetone, that evaporate or vaporize readily and are harmful to human health and the environment
Waste	Any substance or object which the holder discards or intends or is required to discard (Waste Framework Directive 2008/98/EC)
Waste management plan	A document that describes, in detail, the amount and type of waste from a construction project and how it will be reused, recycled or disposed of
Wastewater	Water used by a factory, household, etc. and discharged as sewage
Water quality	The degree to which water is clean, and whether it is suitable for drinking, for making plants grow, or for fish to live in, etc.
Zone of influence	The zone of influence (ZoI) for a project (or “spatial extent of the impact” as described in Annex III(3) of EIA Directive 2014/52/EU) is the area whereby ecological features may be subject to impacts as a result of a Proposed Road Development and associated activities
Zone of theoretical visibility (ZTV)	Area within which a Proposed Road Development may have an influence or an effect on visual amenity

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 01: Introduction

Galway County Council

February 2022

Table of Contents

Figures

Tables

Volume 03 Figures

Volume 04 Appendices

1. Introduction

1.1 General

This Environmental Impact Assessment Report (EIAR) has been prepared by AECOM Ireland Limited (AECOM) on behalf of Galway County Council (GCC) (hereafter referred to as the 'Applicant') who are seeking planning permission for the design and construction of the proposed N63 Liss to Abbey Realignment Scheme (hereafter referred to as the 'Proposed Road Development') in Co. Galway.

The EIAR is presented in four volumes as outlined below:

- **Volume 1: Non – Technical Summary (NTS);**
- **Volume 2: Main Text;**
- **Volume 3: Figures; and**
- **Volume 4: Appendices.**

This chapter of the EIAR provides an overview of the Proposed Road Development, the Environmental Impact Assessment (EIA) methodology, structure of the EIAR, non-statutory consultation undertaken and the names and qualifications of the lead contributors to the EIAR.

This EIAR identifies the potential significant environmental effects arising from both the construction and operational phases of the Proposed Road Development. Where potential significant environmental effects are identified, mitigation measures are proposed to avoid, prevent, reduce or offset the effects. In addition, cumulative and residual environmental impacts and associated effects of the Proposed Road Development have been assessed, where appropriate. This EIAR also details the consideration of alternatives. When referring to the construction and operation of the Proposed Road Development throughout the EIAR, the future tense has been used; for example, "*the Proposed Road Development will be located…, will consist of ….*"etc., this is with the understanding that all aspects of the Proposed Road Development are subject to the necessary statutory permits and consents and does not in any way presume approval.

Proposed and granted planning permissions were identified to determine the existing and future developments to provide the basis for consideration of the potential for likely cumulative environmental effects of the Proposed Road Development.

This EIAR should be read in conjunction with all the particulars of the planning application for this Proposed Road Development, which will be submitted to An Bord Pleanála .

1.2 Proposed Road Development Overview

The Proposed Road Development is situated to the north-east of Galway City, located along the existing N63 corridor. The N63 is a national secondary route, and this section of the N63 is located directly to the east of Abbeyknockmoy village. The Proposed Road Development will consist of a 2.3 km road realignment which will extend from the eastern edge of Abbeyknockmoy, across the Abbert River, to the townland of Derreen and on towards the junction of the N63 with the L6234.

The Proposed Road Development will cross the Abbert River, which is part of the Lough Corrib Special Area of Conservation (SAC), and within close proximity to Knockmoy Abbey, a National Monument (the monument was taken into ownership under the National Monuments Acts 1930 to 2014 – Reference 166). A full description of the Proposed Road Development is provided in Chapter 02 Description of the Proposed Road Development.

Figure 1-1 highlights the approximate location of the Proposed Road Development. A location plan for the Proposed Road Development is presented in Volume 03; Figure A1-1.

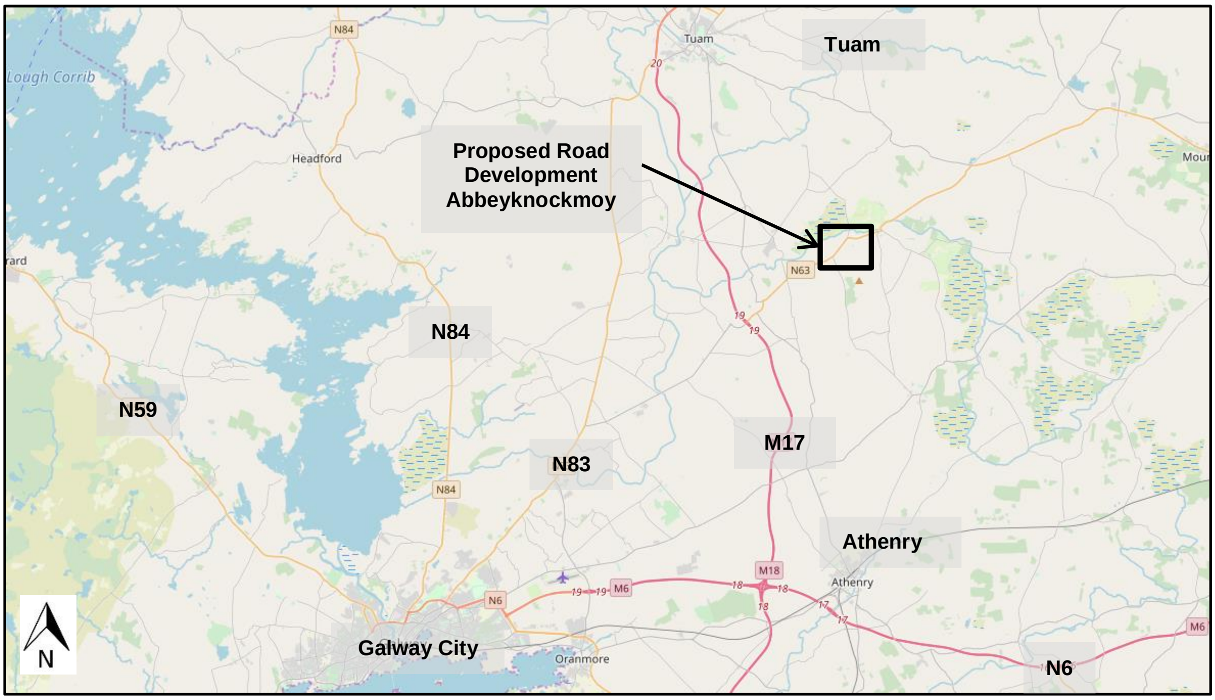

Figure 1-1 Regional Location of Proposed Road Development

1.3 EIA Legislation and Guidance

EIA requirements derive from Directive 2011/92/EU of the European Parliament and the Council on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 (the 'EIA Directive'). Directive 2014/52/EU was transposed into Irish planning law by the provisions of the Roads Act 1993 (as amended by the European Union (Roads Act 1993) (Environmental Impact Assessment) (Amendment) Regulations 2019) (S.I. No. 279 of 2019).

Section 50(2) of the Roads Act 1993 as amended by the European Union (Roads Act 1993) (Environmental Impact Assessment) (Amendment) Regulations 2019) and Annex IV of the EIA Directive outline the information to be contained within an EIAR in relation to the Proposed Road Development. This EIAR has been prepared in full accordance and compliance with the provisions of Directive 2014/52/EU, as well as the Roads Act 1993 (as amended by the European Union (Roads Act 1993) (Environmental Impact Assessment) (Amendment) Regulations 2019) and the Roads Regulations 1994 (as amended by The Roads (Amendment) Regulations 2019 (S.I. No. 486/2019)).

The preparation of the EIAR was undertaken in accordance with the requirements as set out in the EIA Directive and relevant guidelines and documentation including:

- Transport Infrastructure Ireland's (TII) 'Environmental Impact Assessment of National Road Schemes – A Practical Guide' (TII 2008);
- European Commissions (EC) 'Interpretation of definitions of project categories of annex I and II of the EIA Directive'. European Union, 2015 (EC 2015);
- Environmental Protection Agency (EPA) draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA 2017) (hereafter referred to as the 'EPA draft guidelines');
- EC, 'Environmental Impact Assessment of Projects, Guidance on the preparation of Environmental Impact Assessment Reports' (Directive 2011/92/EU as amended by 2014/52/EU) (EC 2017);
- Government of Ireland's 'Guidelines for Planning Authorities and An Bord Pleanála on carrying out Environmental Impact Assessment, (Government of Ireland 2018);
- TII Environmental Guidelines; and
- Other guidelines relevant to the environmental aspects assessed, as noted in specific chapters of the EIAR.

1.4 Methodology

1.4.1 Consultation

"*Consultation is a key element of each stage of the EIA process. The requirement for consultation is included in the definition of EIA in the Directive*…." (EPA, 2017). Consultation with relevant statutory and non-statutory bodies form important parts of the EIA process. Consultations help to ensure that all of the impacts, issues, alternatives, and mitigation measures, which interested parties believe should be considered in the EIAR, have been addressed (EC, 2017). Given the nature of the Proposed Road Development and the focus of the EIA being on air quality, waste, traffic, population and human health and Cultural Heritage, consultation for the preparation of the EIAR was focused on consultation with the following statutory and non-statutory bodies:

- An Taisce - The National Trust of Ireland;
- Department of Housing, Local Government and Heritage;
- Department of Culture, Heritage and the Gaeltacht;
- Department of Transport;
- The Heritage Council;
- Fáilte Ireland - The National Tourism Development Authority;
- An Comhairle Ealaíon - The Arts Council of Ireland;
- Department of Agriculture, Food and the Marine;
- Environmental Protection Agency;
- Inland Fisheries Ireland;
- The Office of Public Works;
- Iarnród Éireann HQ;
- National Transport Authority;
- Bord Gáis Energy;
- ESB Networks;
- EirGrid Plc;
- BirdWatch Ireland;
- BirdWatch Ireland – Barn Owl Project;
- Irish Wildlife Trust;
- Bat Conservation Ireland;
- Irish Raptor Study Group; and
- Badger Watch Ireland.

A summary of responses received are outlined in the table below.

Table 1-1 Consultee Responses Relevant to the Proposed Road Development

Consultee for Planning Application	Comment	Response
Development Applications Unit Government Offices Newtown Road, Wexford, County Wexford, Y35 AP90	**Underwater Archaeology** *(Underwater Archaeology Unit c/o Department of Tourism, Arts, Gaeltacht, Sports and Media)* The Underwater Archaeology Unit has recommended that the areas to be impacted by proposed works be subject to a full underwater archaeological assessment – in particular the proposed crossing of the River Abbert in proximity to Abbeyknockmoy Cistercian Abbey (GA058-004001-) and any other streams to be impacted by the road construction and associated vehicular/construction plant. The underwater surveys should also be accompanied by a metal detection survey. The underwater assessment should occur under license.	The Underwater Archaeology Unit has recommended that the areas of the river to be impacted by the proposed works and any other streams should be subject to the underwater assessment. Baseline research has determined that the Abbert River was subject to drainage works by the Office of Public Works between 1954 and 1964 when the riverbed was enlarged including by blasting. Earth banks on the south side of the river adjacent to the location of the proposed river crossing may represent management of the river with the upcast providing a barrier against flooding. Additionally, historic cartographic evidence shows that sections of the river adjacent to the scheme have been straightened. These drainage works will have destroyed any archaeological remains which may have been present within the river. Given this, underwater archaeological surveys of the area of the river crossing were not undertaken.
	Nature Conservation • The Department advises that any intrusive or disturbing site investigation works, archaeological testing, or other advance works prior to the main application for consent will require, at a minimum, screening for appropriate assessment and should have due consideration of the need for planning permission (for exempted development where there are restriction on exemption). • The National Parks and Wildlife Service website (www.npws.ie) should be consulted as a key source of data, information and publications on the SAC, NHA, other nature conservation sites and biodiversity issues of potential relevance to the project and its environmental assessment(s). • The assessment should be undertaken with respect to the project in its entirety and direct, indirect and cumulative effects should be assessed. • Any losses of biodiversity habitat associated with this proposed development such as semi-natural grassland, woodland, scrub, hedgerows and other habitats should be mitigated for and the presence of any Annex I habitats outside designated sites should be given due consideration as part of the consideration of biodiversity. The loss of Annex 1 habitats outside SACs should be avoided wherever possible. • The EIAR should provide an estimate of the length/area of any hedgerow/scrub that will be removed. Where it is proposed that trees or hedgerows will be removed there should be suitable planting of native species as mitigation should be included.	Refer to Chapter 07 Biodiversity

Consultee for Planning Application	Comment	Response
	• Where possible, hedgerows, uncultivated vegetation and trees should not be removed during the nesting season. Consideration of riparian woodland and its potential as the Annex I priority habitat Alluvial Woodland (91E0)1, should also be considered and assessed. • Ground and surface water quality should be protected during construction and operation of the proposed development. The EIAR should include a detailed assessment of the hydrological impacts on wetlands from the proposed development. Any watercourse or wetland which may be impacted on should be surveyed for the presence of protected species and species listed on Annexes II and IV of the Habitats Directive. • Any proposed development should be located at least 10 m away from a waterway and should consider movements between waterways and waterbodies by otters. It should be noted that as an Annex IV species, otter is 'strictly protected' and their resting place (couches and holt) can only be disturbed and/or destroyed under licence. • Flood plains should be identified in the EIAR and left undeveloped to allow for the protection of these valuable habitats and provide areas for flood water retention (green infrastructure). • All bat species are strictly protected and bat roosts can only be disturbed and/or destroyed under licence. • The EIAR should address the issue of invasive alien plant and animal species such as Japanese Knotweed or Crayfish plague, and detail the methods required to ensure they are not accidentally introduced or spread during survey and or construction. • It is expected that best practice will be adhered to with regard to survey methodology and if necessary, non-Irish methodology adapted for the Irish situation, noting specific gaps in relation to species and age of the data outlined in some guidance documents. • Assessment of the direct and indirect significant effects of the project on biodiversity should be made, where applicable, with regard to: ▪ Natura 2000 sites ▪ Habitats and species protected under Habitats Directive ▪ Other designated sites, or sites proposed for designation ▪ Species protected under the Wildlife Acts including protected flora ▪ Important bird areas such as those identified by Birdwatch Ireland ▪ Features of the landscape, which are of major importance for wild flora and fauna ▪ Other habitats of ecological value in a national to local context ▪ Red data book species ▪ Biodiversity in general • Reference should be made to the National Biodiversity Action Plan 2017-2021, Galway County Heritage and Biodiversity Plan 2017-2022, and the All Ireland Pollinator Plan 2015-2020. • To assess mitigation measures, the following tasks must be completed: ▪ List each of the measures to be introduced (e.g. noise bunds, tree planting) ▪ Explain how the measures will avoid the adverse impacts on the site; ▪ Explain how the measures will reduce the adverse impacts on the site. • Then, for each of the listed mitigation measures: ▪ Provide evidence of how they will be secured and implemented and by whom;	

Consultee for Planning Application	Comment	Response
	▪ Provide evidence of the degree of confidence in their likely success; ▪ Provide a timescale, relative to the project or plan, when they will be implemented; • Opportunities for landscape enhancement should be considered within the Landscape Plan which should seek to integrate Green Infrastructure and 'Nature Based Surface Water Management' into the project design and consideration of SuDS requirements. • If new lighting proposal are required as part of the project, then a Lighting Impact Assessment should be included within the EIAR to assess potential for impact of road lighting on biodiversity. • Evidence should be provided of how the mitigation measures will be monitored, and should mitigation failure be identified, how that failure will be rectified. • The applicant should not use any proposed post construction monitoring as mitigation to supplement inadequate information in the assessment.	

Two public consultation events were held during the route selection process. The first Public Consultation (PC1) was held on the 2nd October 2019, with Public Consultation (PC2) taking place on 3rd February 2020. Both events took place at the Abbeyknockmoy Community Centre between 2.30pm and 7.30pm (PC1) and 2.00pm and 7.00 pm (PC2).

A summary of the feedback and further information on the public consultation events can be found in Chapter 03 Consideration of Alternatives.

1.4.2 EIA Process

EIA is the process for anticipating the impacts and associated effects (both positive and negative) from a proposed development or project on various environmental receptors. In EIA, impacts are defined as the changes resulting from an action, whereas effect is the term used to express the consequence of an impact (expressed as the 'significance of effect'). If the anticipated effects are unacceptable, design measures or other relevant mitigation measures can be implemented to reduce or avoid those effects. The EIAR describes the current state of the environment and assesses the likely significant effects of a proposed development on the environment, including the residual effects once mitigation and monitoring measures have been implemented.

The EIA process can involve several stages: consultation, screening, scoping, baseline surveys, impact assessments ongoing feedback into a project design and preparation of the EIAR (Figure 1-2) The EIAR is then submitted as part of a project planning application to the competent authority to enable them to carry out the EIA and evaluation of the EIAR before consenting (in the case of the Proposed Road Development, An Bord Pleanála). The definition of EIA provides for a clear distinction between the process of EIA to be carried out by the competent authority and the preparation by the developer of an EIAR. The EIAR must include the relevant information and assessments in accordance with the aforementioned legal provisions in order for An Bord Pleanála to come to a reasoned conclusion on the significant effects of the Proposed Road Development on the environment.

The EIA Directive states that "*environmental impact assessment*" is a process consisting of:

(i) the preparation of an environmental impact assessment report by the developer, as referred to in Article 5(1) and (2)

(ii) the carrying out of consultations as referred to in Article 6 and, where relevant, Article 7

(iii) the examination by the competent authority of the information presented in the environmental impact assessment report and any supplementary information provided, where necessary, by the developer in accordance with Article 5(3), and any relevant information received through the consultations under Articles 6 and 7

(iv) the reasoned conclusion by the competent authority on the significant effects of the project on the environment, taking into account the results of the examination referred to in point (iii) and, where appropriate, its own supplementary examination

(v) the integration of the competent authority's reasoned conclusion into any of the decisions referred to in Article 8a

Further details of the EIA process and methodology undertaken for the Proposed Road Development are presented in the following sub-sections.

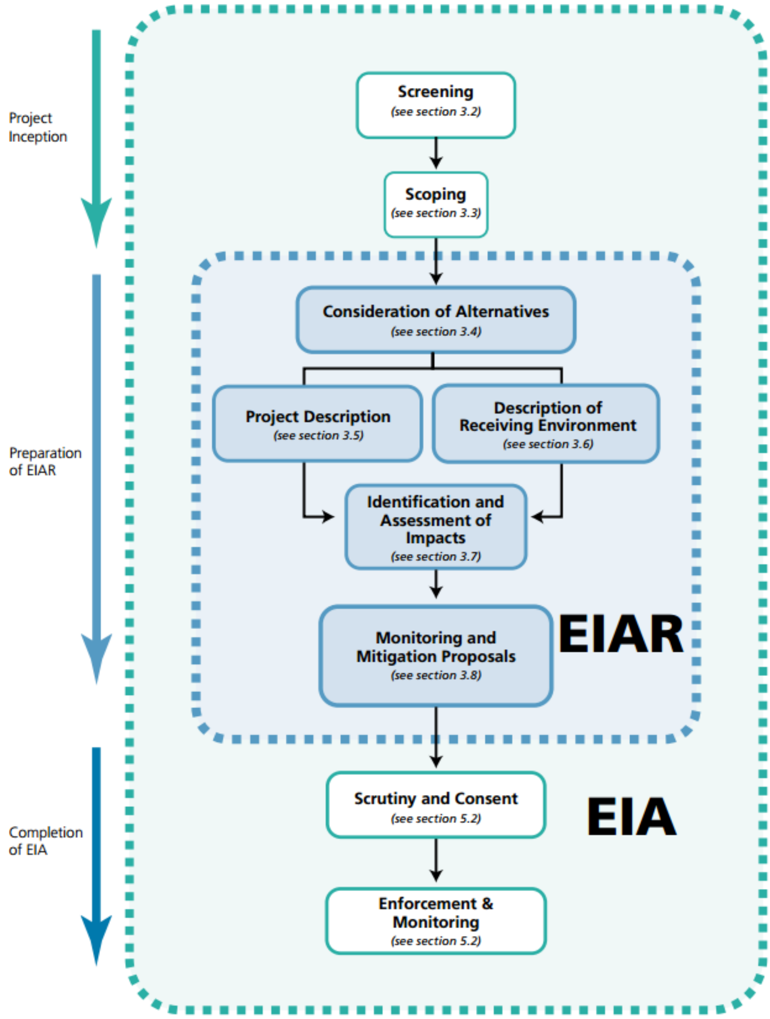

Figure 1-2 The EIA Process

Source: EIAR Draft Guidelines (EPA 2017)

1.4.2.1 Screening

'Screening' a step in the EIA process, is used to determine whether an EIA is required (EPA, 2017), and usually commences at the project design stage. The EIA Directive lists those projects that require a mandatory EIA (Annex I) such as motorways or roads with 4 or more lanes wide over 10 km in length (Annex 17(b)[1]) and those projects for which an assessment must be undertaken to determine if they are probable to result in likely significant effects (Annex II). For Annex II projects, Member states can decide to subject these projects to an EIA on a case by case basis or according to thresholds or criteria such as location and potential impacts (EU 2015). As outlined within Section 3.2.3 of the EPAs EPA draft guidelines , should a project of a specified type not meet or exceed thresholds then the likelihood of significant effects should be considered (EPA 2017).

Annex III, of the EIA Directive, sets out the criteria to be examined when carrying out EIA screening. These criteria include the characteristics of projects, location of projects, and type and characteristics of the potential impact.

In Ireland, generally the process of ascertaining whether a development requires an EIA is determined by the Planning and Development Act 2000 (as amended) and the Planning and Development Regulations 2001 (as amended). However, for road developments, the requirements are outlined within Section 50 of the Roads Act 1993 (as amended).

The EIA Screening Report for the Proposed Road Development concluded that the Proposed Road Development did not trigger the mandatory criteria for a road development under Section 50 of the Roads Act 1993 (as amended) and Article 8 of the Roads Regulations, 1994 (as amended) as it did not involve any of the following:

[1] https://ec.europa.eu/environment/eia/pdf/cover_2015_en.pdf

1. Construction of a motorway;
2. Construction of a busway;
3. Construction of a service area; and
4. Any prescribed type of road development consisting of the construction of a proposed public road or the improvement of an existing public road including:
    a. The construction of a new road of four or more lanes, or the realignment or widening of an existing road so as to provide four or more lanes, where such new, realigned or widened road will be eight kilometres or more in length in a rural area, or 500 metres or more in length in an urban area;
    b. The construction of a new bridge or tunnel which will be 100 metres or more in length.

However, Section 50(1)(d) of the Roads Act 1993 (as amended), states,

"*(d) In particular, where a proposed development (other than development to which paragraph (a) applies) consisting of the construction of a proposed public road or the improvement of an existing public road would be located on —*

(i) a European Site within the meaning of Regulation 2 of the European Communities (Birds and Natural Habitats) Regulations 2011 (S.I. No. 477 of 2011),

(ii) land established or recognised as a nature reserve within the meaning of section 15 or 16 of the Wildlife Act 1976 (No. 39 of 1976),

(iii) land designated as a refuge for fauna or flora under section 17 of the Wildlife Act 1976 (No. 39 of 1976), or

(iv) land designated a natural heritage area under section 18 of the Wildlife (Amendment) Act 2000 ,

the road authority or the Authority, as the case may be, proposing the development shall decide whether or not the proposed development would be likely to have significant effects on the environment."

It was identified that as the Proposed Road Development will traverse the Abbert River, (part of the Lough Corrib, SAC), there will be potential for significant effects on water quality and biodiversity. Therefore, it was determined that a sub-threshold assessment was required to identify if an EIA was required. The sub-threshold assessment concluded that the Proposed Road Development has the potential to result in significant effects on sensitive biodiversity, landscape, and cultural heritage receptors and therefore should be subject to preparation of an EIAR to accompany the planning application.

The EIA Screening Report was then submitted to the GCC who determined an EIA was required under Section 50 of the Roads Act 1993 (as amended).

Under Section 50 of the Roads Act 1993 (as amended), GCC submitted the EIA Screening Report to An Bord Pleanála for their consideration and in order to seek a direction on GCC's determination prior to making this planning application. An Bord Pleanála determined that an EIAR was required for the Proposed Road Development (An Bord Pleanála -309050-20). It was considered the Proposed Road Development would be likely to have significant effects on the environment, landscape, visual amenities, and cultural heritage (inc. archaeology and architecture).

1.4.2.1 Scoping

If it is determined that an EIA is required, the next step is to 'scope' the content of the EIAR. Scoping considers the potential for likely significant effects throughout different phases of a proposed project to determine "*the content and extent of the matters which should be covered in the environmental information to be submitted in the EIAR"* (EPA, 2017).

As described in the draft EPA guidelines, "*the potential for likely significant effects throughout different phases of the proposed project, are considered as far as possible at scoping stage – whether they would individually require consent or not. These include, as relevant, site investigations, construction, commissioning and operation to eventual decommissioning. Scoping also considers the range of alternatives to be considered in an EIAR*" (EPA, 2017).

Throughout various stages of the project, relevant statutory and non-statutory consultees were contacted. These consultees are listed in Section 1.4.1 of this report. Please see individual chapters for the content and scope of each assessment chapter.

A formal statutory scoping opinion from An Bord Pleanála was not requested due to the scale of the Proposed Road Development and the expectation that all prescribed environmental factors would be considered in the EIAR.

1.4.2.2 Environmental Impact Assessment Report

An EIAR is prepared as part of the EIA process. Typically, the EIAR includes a baseline assessment to determine the status of the existing environment; impact prediction and evaluation to determine the significance of effects identified (this can include cumulative effects); determination of mitigation and monitoring measures to reduce the impacts identified; and a residual impact assessment once any mitigation and monitoring measures have been implemented.

The Roads Act 1993 (as amended), has been amended by the European Union (Environmental Impact Assessment) (Amendment) Regulations 2019 (SI 296 of 2019) to take account of the requirements of the EIA Directive (Directive 2014/52/EU). Section 50 of the Roads Act 1993 (as amended), provides information on carrying out an EIA for a roads development. Section 50 (2) specifically states:

"(2) The road authority or the Authority, as the case may be, shall ensure that an environmental impact assessment report referred to in subsection (1B) —

(a) is prepared by competent experts,

(b) subject to subsection (3) , contains the following information:

(i) a description of the proposed road development comprising information on the site, design, size and other relevant features of the development;

(ii) a description of the likely significant effects of the proposed road development on the environment;

(iii) a description of any features of the proposed road development and of any measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment;

(iv) a description of the reasonable alternatives studied by the road authority or the Authority, as the case may be, which are relevant to the proposed road development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed road development on the environment;

(v) a non-technical summary of the information referred to in subparagraphs (i) to (iv);

(vi) any additional information specified in Annex IV that is relevant to the specific characteristics of the particular proposed road development or type of proposed road development and to the environmental features likely to be affected,

and

(c) takes into account the available results of other relevant assessments carried out pursuant to any Act of the Oireachtas or under European Union legislation with a view to avoiding duplication of assessments".

1.4.2.3 General Approach to Assessment

For each technical EIAR chapter, the classification and significance of effects is generally evaluated in accordance with the EIA Directive and the methodology outlined in the EPA's draft guidelines. Where more relevant and specific standards and methodologies exist, they are adopted and outlined in the respective methodology sections within each technical chapter (for example, specific criteria and assessment terminology used to assess air quality impacts).

1.4.2.3.1 Determining the Sensitivity of the Existing Environment/Receptor

Each receptor and/or environmental resource which may be impacted by the Proposed Road Development is identified and assigned a value on the basis of its importance or sensitivity to the potential impacts. The terminology used to describe the sensitivity of resource/receptor is High, Medium, Low or Negligible. The sensitivity, importance or value of a receptor/resource is normally derived from:

- Designated status within the land use planning system;
- Reference to standards in environmental assessment guidance;
- The number of individual receptors, such as residents;
- An empirical assessment on the basis of characteristics such as rarity or condition; and
- Its ability to absorb change.

1.4.2.3.2 Determining Impacts and Effects

The potential impacts of the Proposed Road Development and associated effects on the sensitive receptor are then determined. This is undertaken by assessing the character of effect (including magnitude, duration probability and quality) in comparison to baseline conditions using the relevant terminology outlined in the EPA's draft guidelines (EPA, 2017). The assessment of impacts takes into account any embedded control measures that forms an inherent part of the Proposed Road Development (and as included in the EIAR Chapter 04 Description of the Proposed Road Development). For this assessment, 'embedded control measures' are those that have been incorporated into the design of the development and any 'additional mitigation' are those preventing, reducing and offsetting any remaining significant adverse effects. Where it has not been possible to quantify effects, qualitative assessments are carried out, based on expert opinion and professional judgement. Where uncertainty exists, this is noted in the relevant EIAR chapter. Overall, a character of effect of High, Medium, Low or Negligible is then assigned to the impact being assessed.

The assessment also takes into consideration cumulative impacts with consented, planned and reasonably foreseeable projects as discussed in the following section.

1.4.2.3.3 Classifying Significance

The matrix in Figure 1-3 adapted from the EPA's draft guidelines (EPA 2017) is then used to classify the significance of effect being assessed. This considers the overall character of effect with the sensitivity of the receptor/existing environment.

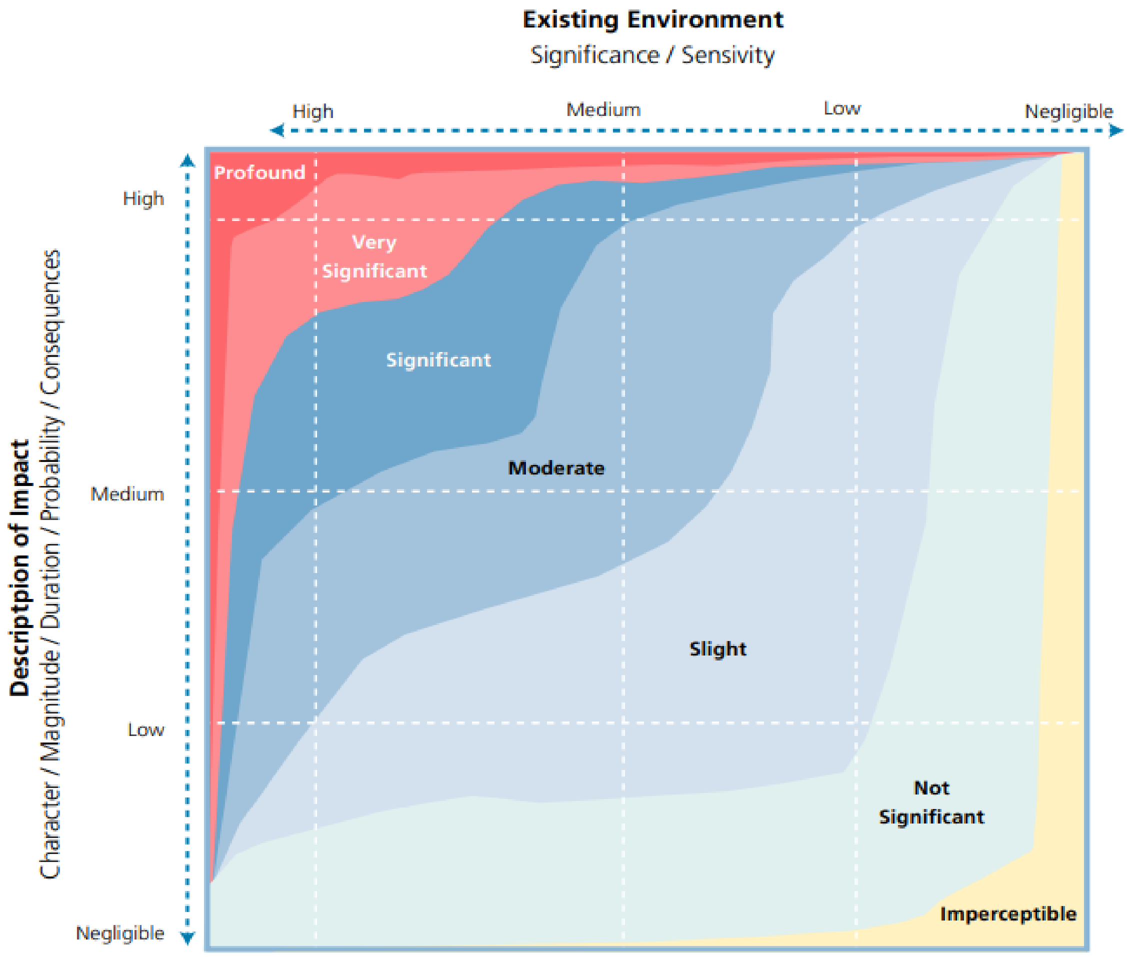

Figure 1-3 Determination of Significance

Source: Figure 3.5, EPA Draft Guidelines (EPA, 2017)

1.4.2.3.4 Mitigation and Monitoring Measures

Mitigation and monitoring measures are identified through the assessment process to prevent, reduce, offset/remedy the likelihood of the environmental impact identified arising.

1.4.2.3.5 Residual Impacts and Effects

'Residual impacts' are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines, the effects that remain after all assessment and mitigation are referred to as 'Residual Effects' (EPA, 2017). Determination of residual effects follows the same methodology outlined above.

It is important to note that the methodology outlined above is a general approach only. Characterising the character/significance of a potential effect can have specific criteria which is documented in the assessment chapters.

1.4.2.3.6 Planning Search

A desktop search of proposed and existing planning applications was undertaken on the 22 January and updated on the 26 July 2021. The search used publicly available data from MyPlan.ie 'National Planning Application' database, (search included results from 2011 to July 2021), GCC planning application portal and An Bord Pleanála online database. An additional search of planning applications within the Proposed Road Development site was carried out on the 04 February 2022, no additional planning applications were identified.

The purpose of this search is to inform the cumulative impact assessments within this EIAR. The scope of the search was based within a 5 km radius taken from the approximate centre point of the Proposed Road Development. The initial search flagged planning applications within a period dating back to 2011 (10 years).

A criterion of any refused, invalid or withdrawn applications was included in the search and later omitted. The criteria then focused on foreseeable developments to be considered in line with the Proposed Road Development. In respect of this, any small-scale residential type developments, such as; extensions and modifications, minor amendments to existing dwellings and changes of use developments were omitted from the search.

The relevant planning application search is listed in Volume 04; Appendix A1-1 The findings show small to large-scale developments within the 5 km scope that have been granted planning permission.

Volume 04; Appendix A1-1 also sets out relevant Part 8 decisions (note Part 8 applications are uploaded at the discretion of GCC; this search assessed available data at the time of writing).

A further search was undertaken for Section 5 Declarations, Exemptions, however, no public records were identified within the search scope – i.e. within 5 km radius of the Proposed Road Development within the last 10 years.

As previously mentioned, the purpose of this planning history search is to inform the cumulative impact assessments within this EIAR. The cumulation of the Proposed Road Development with other existing and/or proposed developments has been assessed within each relevant chapter of this EIAR.

1.5 Structure of the EIAR

This EIAR has been prepared in accordance with the EPA's draft guidelines (EPA 2017). Table 1-2 provides the structure of the EIAR.

Table 1-2 EIAR Contents

Volume	Content	Chapter Title
Volume 1	Non-Technical Summary	
Volume 2	Chapter 01	Introduction
	Chapter 02	Need for the Scheme and Planning Policy Context
	Chapter 03	Consideration of Alternatives
	Chapter 04	Description of the Proposed Road Development
	Chapter 05	Traffic Analysis
	Chapter 06	Population and Human Health
	Chapter 07	Biodiversity
	Chapter 08	Land & Soils
	Chapter 09	Water
	Chapter 10	Air Quality
	Chapter 11	Climate
	Chapter 12	Noise & Vibration
	Chapter 13	Landscape and Visual
	Chapter 14	Cultural Heritage
	Chapter 15	Major Accidents and Disasters
	Chapter 16	Material Assets (Non-Agriculture)
	Chapter 17	Material Assets (Agriculture)
	Chapter 18	Interactions of the foregoing
	Chapter 19	Mitigation and Monitoring Measures
Volume 3	Figures	*Figures to accompany the technical assessment chapters*
Volume 4	Appendices	*Various appendices to accompany the technical assessment chapters*

1.6 Expertise of the EIAR Team

This EIAR has been compiled by AECOM on behalf of GCC with assessment and reporting provided by competent experts for each individual topic. Table 1-3 provides the details of the management and technical leads responsible for the preparation of this EIAR along with their relevant qualifications and a brief summary of relevant experience.

Table 1-3 Expertise of EIA team

	EIAR Chapters/Role	Consultant	Qualification	Expertise
	Project Manager	Eoin Greene (AECOM)	Technical Director, BA, BAI, MIEI, CEng	Eoin Greene is a Technical Director in the AECOM Roads team with more than 16 years' post-graduate experience. He has been employed by AECOM since 2004 and has spent his career to date working on transportation projects. He has extensive experience in all types of transportation schemes in Ireland, with recent direct experience leading the planning and design of a number of road schemes in Ireland and the UK. He has experience of leading the delivery of transportation schemes in both rural, urban, and regional town settings, with schemes including cycling improvements, junction upgrades, TII major schemes, and TII national and secondary schemes. Eoin has experience of all types of statutory processes for transportation schemes including EIA, Appropriate Assessment, Compulsory Purchase Orders, Part 8 planning schemes, Section 38 traffic management schemes and has delivered a large number of public consultations on behalf of road authorities.
	EIAR Manager	Niamh O'Connell (AECOM)	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MIEnvSc	Niamh O'Connell is an associate director in the AECOM Environment and Sustainability Team and has more than 17 years' post-graduate experience in environmental consultancy for major transport projects. She has extensive experience of major and minor infrastructural highway and light rail schemes having worked with both public and private sector clients taking projects from feasibility through route selection, EIAR, and through construction. Niamh has been the EIA coordinator on a number of projects including a 52 hectare multinational private power import project, the 37 km N8 Cashel to Mitchelstown, the N7 Castletown to Nenagh, a large mine abstraction project and a number of small distributor roads. In addition, Niamh has worked on a significant number of major highway schemes for the discharge of planning and construction phases in Ireland including the M3 Clonee to Kells, N9 N10 Knocktopher to Powerstown, N8 Cashel to Mitchelstown, N8 Dunkettle Interchange, N7 Castletown to Nenagh, and the N25 Waterford Bypass
	EIAR Lead Verifier	Gareth Coughlin (AECOM)	Technical Director BSc (Hons) MPhil CEnv CSci C.WEM FCIWEM FIEMA	Gareth Coughlin is a Technical Director (Environmental Scientist), and Environmental Team Leader/Project Manager, responsible for the project management of Environmental Statements and Scoping studies throughout Northern Ireland and Ireland. He holds a 1st Class BSc (Hons) in Environmental Science and a MPhil (by research) in Quarrying impacts on the landscape. He is also a Chartered Water and Environmental Manager (C.WEM), Chartered Environmentalist (CEnv) and Chartered Scientist (CSci) and has been with the firm since 1999, working in the engineering industry for clients in both the public and private sectors. For over 22 years now, he has been responsible for the management and assessment of environmental impacts on a range of major infrastructure projects, most notably on strategic road schemes. He has also project managed a number of SEA projects. Gareth is AECOM's Environment & Sustainability Sector Lead for Highways across Scotland, Northern Ireland and Ireland.
1	Introduction	Noelle O'Leary (AECOM)	Environnemental Consultant BSc (Hons), MSc, MIEnvSc	Noelle has five years of experience supporting environmental impact assessment projects in Ireland. Of relevance to the Proposed Road Development, Noelle has been responsible for the production for a number of introductory chapters for small-medium scale infrastructure projects in Ireland.
2	Need of the Proposed Road Development and Planning Policy Context	Shauna Woods (AECOM)	Associate Planning Environmental Consultant, BSc (Hons) MSc MIPI	Shauna Woods is an Associate Planning Consultant in the AECOM Environment and Sustainability Team and has more than 13 years' post-graduate experience. She has extensive experience of major and minor infrastructural projects having worked with both public and private sector clients taking projects from site feasibility through option appraisals, project evolution and the planning process. Shauna has worked on a large number of major infrastructure projects in Ireland including for Irish Water, Failte Ireland, National Transport Authority (NTA) and Transport Northern Ireland (TNI).
		Eoin Greene (AECOM)	Technical Director, BA, BAI, MIEI, CEng	*As above.*

	EIAR Chapters/Role	Consultant	Qualification	Expertise
3	Consideration of Alternatives	Niamh O'Connell (AECOM)	Associate (Environment and Sustainability), BA (Mod) Eng, H dip Env Eng, MSc, PM, MIEnvSc	*As above.*
4	Description of the Proposed Road Development	Eoin Greene (AECOM)	Technical Director, BA, BAI, MIEI, CEng	*As above.*
5	Traffic Analysis	Eoin Greene (AECOM)	Technical Director, BA, BAI, MIEI, CEng	*As above.*
6	Population and Human Health	David Widger (AECOM)	Regional Director BSc, MSc	David heads up AECOM's Economic Development Team. He has over 20 years' experience in economic development and regeneration with particular expertise in health impact assessment, and community and socio- economic impact assessment of major mixed-use and infrastructure schemes. David is an experienced Technical Lead with significant experience of working with internal and external staff to deliver complex, major infrastructure projects. He has worked on and successfully led population and health assessments for several major schemes including High Speed 2, Heathrow, A303 Stonehenge and Dublin Airport. He has also appeared as an expert witness at several examinations in public providing evidence on Population and Health. Schemes at which Dave has appeared as an expert witness include A303 Stonehenge, M42 Junction 6 and A38 Derby Junctions.
		Noelle O'Leary (AECOM)	Environmental Consultant BSc (Hons), MSc, MIEnvSc	*As above.*
7	Biodiversity	Billy Flynn (Flynn Furney)	Director, MCIEEM MIBiolI MIEnvSc CEnv	Billy is a Chartered Environmental Scientist and Ecologist and a Director of Flynn Furney Environmental Consultants. He has over 20 years' post-graduate experience in ecology and environmental management. His work has included survey, environmental design and mitigation on numerous motorway construction schemes including the M1, M3, M6, M7 and M8 as well as numerous national and regional road projects. He has also worked on light rail, drainage, flood relief and communications infrastructure. His firm also has an established track record on the planning and design of greenway and cycleway projects.
8	Land & Soils	Sinead Fitzpatrick (AECOM)	Technical Director, BA, MSc	Sinead has over 20 years of experience in environmental consultancy work, specialising in project management of large complex environmental projects. Experience includes implementation of investigations/risk land assessments for a variety of sites including complex industrial/commercial sites, landfills, quarries, oil terminals, fuel depots and retail petrol stations. Of relevance to the Proposed Development, Sinead has been involved in the preparation and co-ordination of a number of EIA projects including aviation, pharmaceutical, commercial, data centres and residential developments, and business parks. Along with her coordination role, she has provided specialist input to land and soils and waters chapters for roads and greenway projects.
		David Misstear (AECOM)	Senior Environmental Scientist, BA, BAI, PhD, MIEI	David completed a BA BAI in civil, structural and environmental engineering, and a PhD in environmental engineering (water disinfection). He has 10 years of experience in environmental consultancy work. David has project managed numerous contaminated land investigations and surface water monitoring programmes. He has supervised remediation projects at a variety of sites across the UK and Ireland, including major brownfield redevelopment schemes. He has prepared Land & Soils and Water chapters for a number of EIAs.

	EIAR Chapters/Role	Consultant	Qualification	Expertise
9	Water	Sinead Fitzpatrick (AECOM)	Technical Director, BA, MSc, AIEMA	*As above.*
		David Misstear (AECOM)	Senior Environmental Scientist, BA, BAI, PhD, MIEI	*As above.*
10	Air Quality	Dr David Deakin (AECOM)	Technical Director BSc (Hons), MIEnvSc, IAQM	David is the Highways air quality leader for AECOM in the UK and Ireland. He is responsible for managing the delivery and technical quality of highways air quality commissions. David has led or technical reviewed infrastructure assessments in England, Ireland, Wales and Scotland. He has undertaken or managed air quality assessments for a wide range of infrastructure schemes including: trams, rail, new roads, new junctions, junction alterations, bypass schemes, widening schemes, smart motorway schemes, traffic management schemes, tunnels, cycling schemes, public realm improvements and construction sites. In addition, David has also fulfilled air quality peer reviewing, research, advisory and expert witness roles (planning inquiry, DCO and judicial review). He is a member of the Institute of Air Quality Management (IAQM) and Institution of Environmental Sciences (IES). David has over 17 years of experience. David is qualified and competent to carry out air quality impact assessments in line with the 2014 EIA Directive.
11	Climate	Ian Davies (AECOM)	Associate Director, BA (Hons)	Over 15 years of professional experience in the management and delivery of greenhouse gas and climate change assessments across the UK and Ireland. Ian has led the delivery of climate impact and mitigation strategy assessments for inclusion in EIA and ESIA on a range of climate impact assessments for large scale infrastructure projects, industrial and residential development. Ian has led on climate impact assessments for a number of road Schemes including the LDR4 Abbeyland Navan in Ireland and the M54 to M6 link road, M42 Junction 6 Improvement, A303 Stonehenge, A38 Derby Junctions, A428 Blackcat, Melton Mowbray Distributor Road in the UK. He has appeared on behalf of Scheme promoters as an expert witness on climate at public enquiries and Development Consent Order Examination Hearings
12	Noise and Vibration	Mike Simms (AWN)	Senior Acoustic Consultant BE MEngSc MIOA MIET	Mike Simms holds a Bachelor of Mechanical Engineering and Master of Engineering Science from University College Dublin he also holds a Diploma in Acoustics and Noise Control from the University of Ulster at Jordanstown. He has 20 years' experience in the field of environmental acoustics, in particular using computer-based noise modelling for environmental noise assessments. He has extensive experience of road noise modelling and produced one of the first road noise models of the entire M50 motorway.

	EIAR Chapters/Role	Consultant	Qualification	Expertise
13	Landscape and Visual	Joerg Schulze (AECOM)	Associate Landscape Architect, Dipl.-Ing. (FH), LA, MILI	Joerg is a professional landscape architect with over 18 years' experience working for clients in the private and public sector in Ireland and the UK. He is a corporate member of the Irish Landscape Institute since 2008 and has a comprehensive track record in developing and managing landscape and visual impact assessments of infrastructural, large industrial, commercial, residential, renewable energy, tourism and civic developments. He has extensive experience in all stages of the planning, design, tender and implementation process, contract management and as consultant for Part 8 and EIA/EIAR processes. As part of the LVIA EIA/EIAR process, Joerg has developed and prepared constraints studies, site suitability assessments, feasibility studies, options assessments and associated mapping. He also prepared advice on mitigation measures to minimise landscape and visual impacts, the preparation of detailed mitigation planting schemes and general landscape design with proposed development sites according to national and European good practice guidelines. He has also produced residential visual impact assessments of individual private properties, manages the production of photomontages and the preparation of ZTV/TVI mapping and has been supervising the required maintenance period for mitigation planting schemes. Joerg is a regular expert witness at oral hearings/public inquiries and prepared affidavits. He is an experienced team leader and works closely with other disciplines. He undertakes stakeholder engagements, consultations with communities and planning authorities, and has organised and participated in public workshops.
14	Cultural Heritage	David Kilner (AECOM)	Senior Archaeological Consultant, BA (Hons), PG Dip, MSc, MIAI	David has over 20 years of experience working in the heritage sector. Prior to joining AECOM, David was Senior Archaeologist with a commercial archaeological company based in Belfast which involved working all over Ireland. His experience covers a range of projects, from planning advice to archaeological baseline research and EIA to procuring and managing archaeological specialists and sub-contractors undertaking field survey. This experience includes numerous road schemes. His previous experience includes acting as Senior Researcher on the A1 Beech Hill to Cloghogue dual carriageway, the A8 dual carriageway and the A26 dual carriageway Frosses bypass schemes. Since joining AECOM, David has taken on the role of Project Archaeologist on the A6 Drumahoe to Dungiven dualling, the A6 Randalstown to Castledawson dualling, the Newry Southern Relief Road, the A24 Ballynahinch Bypass and the York Street Interchange projects, providing archaeological consultation throughout the development process from initial scheme design through EIA, advanced archaeological works and management of post-excavation through to final report publication.
15	Major Accidents and Disasters	Alison Couley (AECOM)	Associate Process Safety Consultant, BEng (Hons) CEng MIChemE	Alison Couley is an Associate Director within AECOMs Air Quality, Permitting and Process Safety Team. Alison is a Chartered Chemical Engineer (CEng, MIChemE) with over 25 years' professional experience in process engineering and process safety, working for contractors and consultants, including ABB and AMEC/Wood. Her areas of expertise include process safety and environmental risk assessments, such as HAZOP Studies, and assessments of Major Accidents and Disasters to support EIA for a range of infrastructure and industrial developments. Alison is the technical lead within AECOMs Process Safety Practice Group in the UK.
		Noelle O'Leary (AECOM)	Environmental Consultant BSc (Hons), MSc, MIEnvSc	*As above*
16	Materials Assets (Non-Agriculture)	Eoin Greene (AECOM)	Associate Director, BA, BAI, MIEI, CEng	*As above.*
		Noelle O'Leary (AECOM)	Environmental Consultant BSc (Hons), MSc, MIEnvSc	*As above.*

	EIAR Chapters/Role	Consultant	Qualification	Expertise
17	Material Assets (Agriculture)	Con Curtin (Curtin Agricultural Advisers Ltd.)	Agricultural Consultant, BSc	Con Curtin is an agricultural consultant with an undergraduate honours degree in Agricultural Science from University College Dublin (1987), a Level 6 Certificate in Agricultural Land Drainage (awarded by Teagasc in 2016) and has 30 years' experience working in the agricultural consultancy sector. He has worked for three years with ADAS (Agricultural Development and Advisory Service) in the UK as an agricultural advisor, and since 1990 as an agricultural consultant in Ireland. In 1996 he established his own company, Curtin Agricultural Advisers Ltd. Con divides his time between general consultancy work for his farmer clients (dairy, pigs, beef, sheep and equine) and Land Use/Agricultural Environmental Impact Reports for consulting engineers. Con has prepared Land Use/Agricultural Impact Reports for linear developments such as railway schemes, electricity overhead lines and major roads schemes (15 No. since 1998) including; M20 Cork to Limerick Motorway Scheme (80 km); N22 Baile Bhuirne to Macroom (25 km); M7 Castletown to Nenagh (40 km); N25 New Ross Bypass (13.5 km); N25 Waterford Bypass (40km); and N6 Galway City Outer Bypass (21 km – 2006 planning application). He has prepared constraints and route selection reports and presented oral evidence at public hearings for most of these road projects. He has prepared the Land Use Impact Report for the North - South 400kV Interconnection Development (140 km) in Counties Meath, Cavan, Monaghan, Armagh and Tyrone. Con has carried out land damage assessments for Bord Gais along gas pipelines in Northern Ireland and the Republic of Ireland and advises on drainage issues.
18	Interactions of the Foregoing	Niamh O'Connell (AECOM)	Associate (Environment and Sustainability), BA (Mod) Eng, H dip Env Eng, MSc, PM, MIEnvSc	*As above.*
19	Mitigation and Monitoring Measures	Noelle O'Leary (AECOM)	Environmental Consultant BSc (Hons), MSc, MIEnvSc	*As above.*

1.7 References

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 02: Need for the Scheme and Planning Policy Context

Galway County Council

February 2022

Table of Contents

Figures

Tables

2. Need for the Scheme and Planning Policy Context

2.1 Introduction

This chapter outlines the need for the Proposed Road Development based on the planning policy, the deficiencies in the existing road network, project objectives, and identified future needs of the study area.

This chapter also sets out the overarching planning framework, by examining planning strategy, policy and guidance at European, national, regional and local levels.

2.2 Need for the Proposed Road Development

2.2.1 Introduction

The overall need for the scheme is defined in terms of the following key issues. It should be noted that detailed scheme objectives are provided below in Section 2.2.9.

The N63 forms part of the National Secondary Road network. Overall, the need for the scheme revolves around the need to providing a safe, robust and resilient National Secondary road network, allowing the more efficient movement of people and goods at a regional and local level, and the provision of improved facilities to encourage and promote active travel modal share.

2.2.2 Resolving Existing Safety & Alignment Issues on the National Road Network

The existing N63 is generally narrow with no hard shoulders. Alignment of the road is poor in both the horizontal and vertical planes. There is no off-carriageway provision for pedestrians or cyclists. The existing Liss Bridge is narrow and significantly restricts traffic flows, with two Heavy Goods Vehicles (HGV's) travelling in opposite directions unable to safely pass on the Liss Bridge, in addition site inspections have identified a number of bridge strikes, with the existing sub-standard parapet walls repaired in several locations.

Figure 2-1 Existing N63 at Liss Bridge, Narrow Cross Section and Poor Existing Horizontal Road Alignment

Figure 2-2 Existing N63 Typical Cross Section, with No Provision for Active Travel

Given the rural nature of the scheme, agricultural vehicles conflict with local road traffic on the Liss Bridge on a regular basis, which in turn generates localised traffic issues. There have been collisions at this location as identified in Transport Infrastructure Ireland (TII) and Road Safety Authority (RSA) collision data. A summary of existing traffic and road safety issues on the N63 are described in the following sections below.

2.2.3 Providing Improved Regional Connectivity

The N63 is a regional connector route connecting Roscommon to the M17 which leads on to Galway. The proposed upgrade to the current sub-standard N63 alignment will improve the route consistency of the national road network and increase the overtaking opportunities. This will help with connectivity between these areas and improve journey times and reliability.

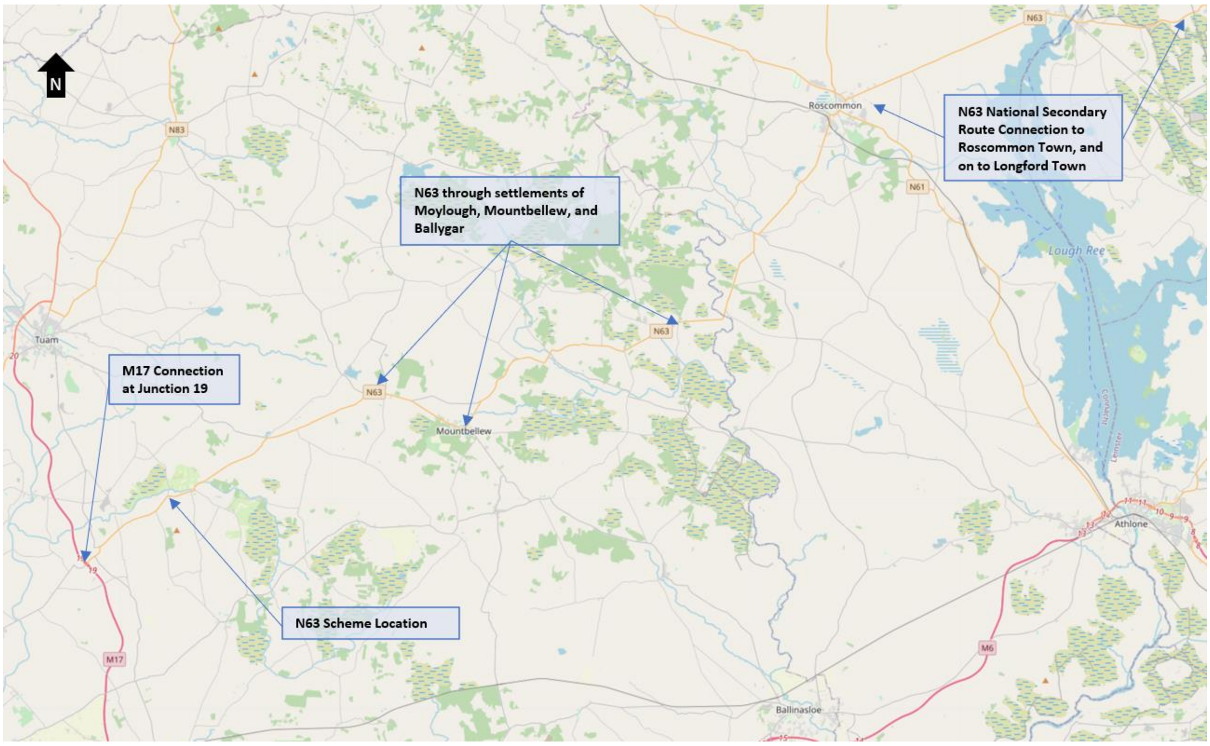

Figure 2-3 Local & Regional Connectivity

To the west of Abbeyknockmoy there is a recently upgraded section of the N63 connecting to the M17 which consists of a Type 2 single carriageway cross-section; any proposed upgrade for this section of the N63 will aim to use the same cross-section which will help improve route consistency along the national road network and offers an improved cross-section for all road users.

2.2.4 Providing Improved Local Connectivity at a Community Level

Abbeyknockmoy is split into two distinct areas a residential area and a community facilities area, which houses schools, GAA pitches and a Church. The existing N63 provides a link between these two areas as well as catering for regional traffic, however, this link does not provide for any active travel modes and the mixing of local and regional traffic impacts both safety and journey time for both types of traffic and raises safety concerns in particular in the vicinity of the school drop-off areas.

The introduction of a new offline road alignment will help mitigate these safety and journey time issues by separating local and regional traffic.

Figure 2-4 Local & Regional Connectivity

2.2.5 Enabling Modal Shift to Active Travel Modes at a Community Level

The existing arrangement is also deemed to be suppressing an active travel modal shift at a local level. At a local level there is a demonstrated need for an active travel improvement linking the two sections of the community in Abbeyknockmoy which will again further improve safety for all road users.

In particular access to community facilities such as the local primary school and GAA Club via provision of a high-quality pedestrian and cycling link was identified as a key need during the early scheme preparation.

The need for the Proposed Road Development and associated active travel improvements was reiterated at both Public Consultations for the scheme held in the local school, undertaken during the options development phase, where the local community showed great support for the scheme and were very enthusiastic for the scheme to progress. This was reflected in the responses to the Public Consultation, which are detailed in Chapter 03 Consideration of Alternatives.

As is shown in Figure 2-5 and Figure 2-6 below, the need to provide suitable active travel facilities is clear as the current road network has no facilities for Non-Motorised Users (NMUs), which makes this an unsafe route for many who would consider active travel modes for local tryps and limits the connection between these two sections of the village. There is the opportunity to walk and cycle between the residential areas and the community facilities.

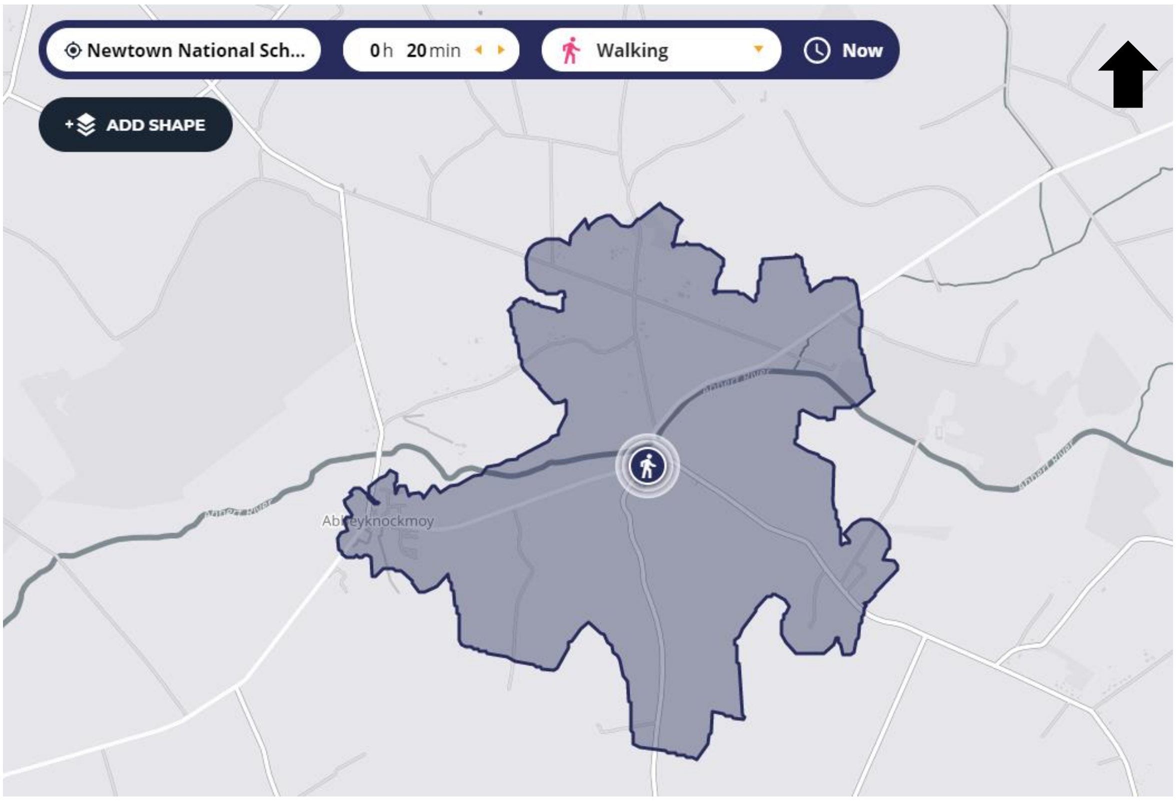

Figure 2-5 Newtown National School, Abbeyknockmoy - 20 minutes Walking Zone

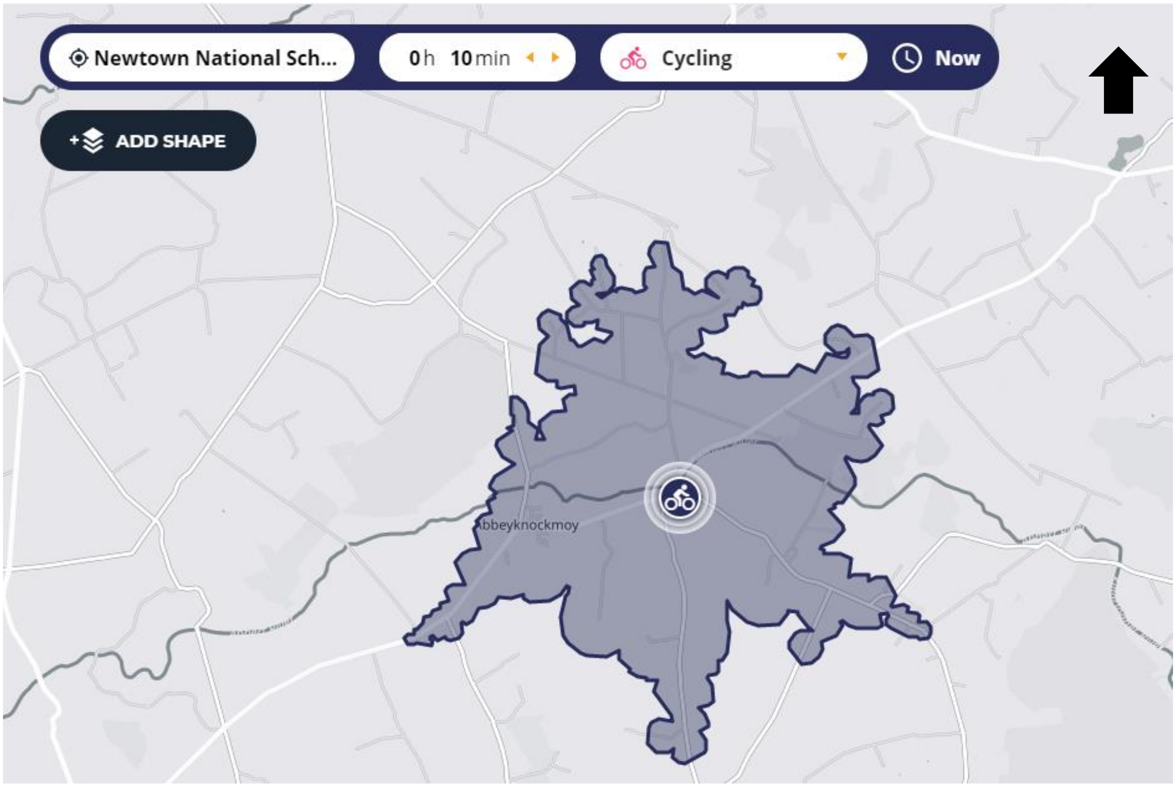

Figure 2-6 Newtown National School, Abbeyknockmoy - 10 minute Cycling Zone[1]

2.2.6 Existing Road Conditions

The existing N63 is generally narrow with no hard shoulders. Alignment of the road is poor in both the horizontal and vertical planes. There is no off-carriageway provision for pedestrians or cyclists. The existing Liss Bridge is narrow and significantly restricts traffic flows, with two HGV's travelling in opposite directions unable to safely pass on the Liss Bridge. Given the rural nature of the study area, agricultural vehicles conflict with local road traffic on the Liss Bridge on a regular basis, which in turn generates localised traffic issues.

[1] https://app.traveltime.com/search/0-lng=-8.72898&0-tt=10&0-mode=cycling-ferry&0-title=Newtown%20National%20School%2C%20N63%2C%20Chapelfield%2C%20Abbey%20East%20Electoral%20Division%2C%20Athenry-Oranmore%20Municipal%20District%2C%20County%20Galway%2C%20Connacht%2C%20Ireland&0-lat=53.43991

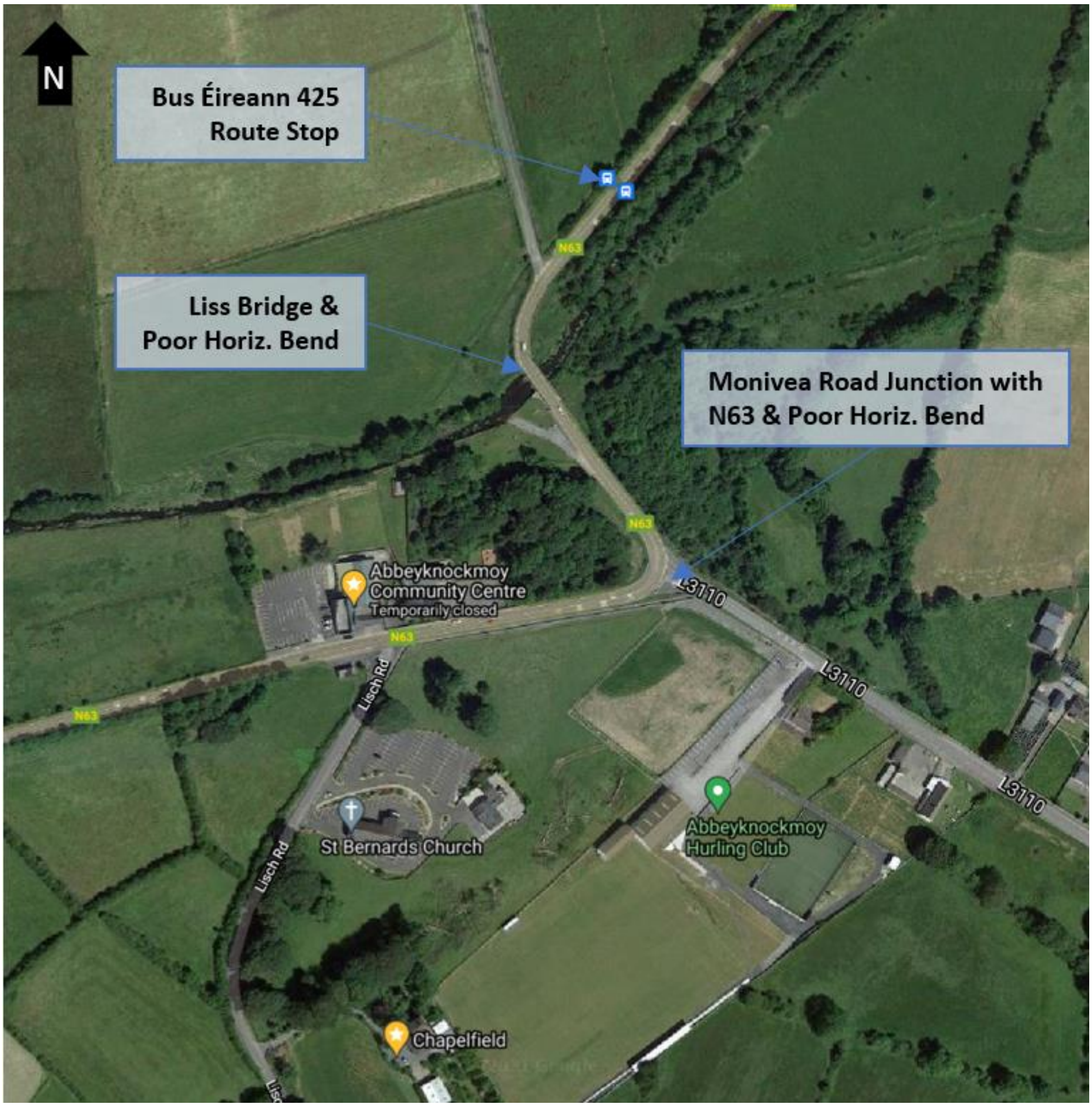

Figure 2-7 Area of poor Alignment Associated with Liss Bridge & Junction with Monivea Road (L3110)

Safety is also compromised by the number of at-grade junctions and private accesses. There are nineteen direct accesses onto the N63 within the study area. The overriding principle in TII publication DNGEO-03060 'Geometric Design of Junctions', is that direct access onto national roads should be avoided. Several of these accesses do not have the required sight distance and are thus a safety risk.

The Proposed Road Development will not only improve journeys across the Abbert River, with improved horizontal and vertical alignments, but the improved cross-sections, realignment and upgraded junctions will improve safety, particularly for pedestrians and cyclists.

Abbeyknockmoy is split into two distinct sections with the residential area being to the west and community facilities such as; the school, church, GAA Club and Community Centre being to the east and connected via the existing N63. The existing N63 does not have any dedicated NMU facilities between these two sections so there is limited opportunity for safe travel for NMUs between the two sections of Abbeyknockmoy. During both Public Consultations it was emphasised by a number of participants the desire for dedicated NMU routes along the existing N63 to encourage active travel between the two sections and give children a safe opportunity to walk/cycle to school or the GAA Club.

Outside of the study area, the N63 is a relatively straight road with standard verges and a number of overtaking areas when travelling from east to west towards Abbeyknockmoy. To the west of Abbeyknockmoy, there is a recently upgraded section of the N63 connecting to the M17 which consists of a Type 2 single carriageway cross-section; with a high quality shared pedestrian and cyclist facility, any proposed upgrade for this section of the N63 will aim to use the same cross-section which will help improve route consistency along the national road network and offer an improved cross-section for all road users, in particular the provision of improved cycling and pedestrian facilities where they are not currently present on the existing N63.

2.2.7 Existing Traffic Issues

The existing road network is described in Chapter 05 Traffic Analysis.

TII maintains a network of traffic counters on the National Road Network. One such traffic counter (Ref. TMU N63 080.0W) is located on the N63 between Roscommon and Galway at Derreen, Co. Galway. A traffic survey was undertaken in the summer of 2019 to inform the Phase 1 Feasibility Report. Junction Turning Counts and Automatic Traffic Counts were monitored and compared with the Annual Average Daily Traffic (AADT) data for the last three years, as obtained from the TII traffic counter located in the vicinity as noted above.

Automatic Traffic Count tubes were installed at three locations within the study area over a two-week period between Tuesday 21st May 2019 and Monday 3rd June 2019. The Junction Turning Counts were completed at five junction locations over a 12hr period (7am to 7pm) on Tuesday 21st May 2019. The AADT for the last three years from the TII Traffic Counter along with existing traffic flows from automatic traffic counts are shown in Table 2-3.

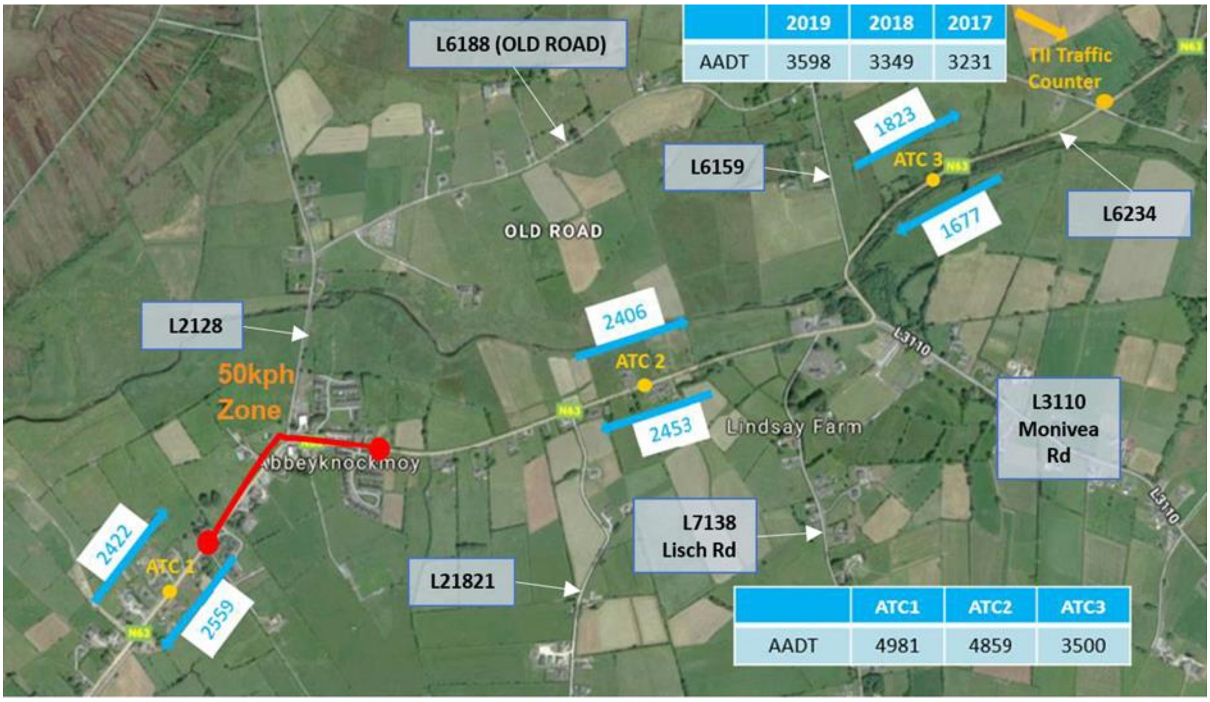

Figure 2-8 Existing Traffic Flows

A number of key conclusions can be drawn from the review of the existing and completed traffic surveys, including:

- Traffic volumes along the route have grown at a rate of 4% between 2017-2018 and 7% between 2018-2019 (based on the TII Permanent Traffic Count data);
- The 85th percentile speed along the existing N63 is high, particularly in consideration of the existing sub-standard road alignment and proximity to local schools and community facilities;
- The existing community building and schools are in close proximity to the road edge, the single lane bridge has substandard entry radii;
- The significant number of road junctions and direct accesses give rise to a safety concern when considered in conjunction with these high speeds;
- Analysis of the traffic survey data indicates that the AADT flow on the N63, at Derreen townland (i.e. at the eastern end of the scheme), North East of Abbeyknockmoy village, in 2019 was 3,500 vehicles per day with

3.6% HGV. The traffic volumes are relatively high for such a rural link road and they are largely dominated by through flows;

- Tidal flows appear to dominate in the morning and evening peaks with the majority of traffic travelling west towards the M17 in the AM and then returning again east in the PM peak;
- Typical journey times along the N63 within the study area are in the order of 3 minutes. As a result of the congesting influence of the narrow bridge, journey time reliability is negatively affected with some vehicles achieving a clear movement across the existing narrow bridge, while others need to yield to opposing traffic, this therefore generates an unreliability with vehicular journey times; and
- There are a number of right turn movements along the route. The movement to the L3110 from the N63 has potential to generate collisions, given the limited visibility at this location and proximity to the community facilities and the Liss Bridge;

In addition to the above, the TII National Roads Network Indicators 2018 report describes that the N63 is operating at a volume/capacity ratio of below 80% in most areas, including the section considered under the Proposed Road Development. However, it is noted that, the N63 is operating at a volume /capacity ratio of 100%-120% at a number of pinch points along the rest of the N63 route, with one section in proximity of Moylough where the N63 is operating at above 120% volume capacity.

2.2.8 Existing Road Safety Issues

2.2.8.1 Collision Statistics

Eleven road collisions have been recorded on the road network surrounding the Proposed Road Development as shown in Figure 2-9.

The existing N63 within the study area has poor horizontal and vertical alignment in the vicinity of the Liss Bridge, adding to the safety concerns raised due to the narrow cross-section of the Liss Bridge. The Proposed Road Development will reduce the levels of traffic congestion on the road network in proximity to the existing Liss Bridge, likely providing a corresponding reduction in collisions along this link. By segregating a significant proportion of the regional traffic and the local traffic there will be less chance of conflict between these two types of road users. In addition, the Proposed Road Development will be compliant with the current design standards, which should help improve road safety. Providing a standard alignment for regional traffic will offer better safety opportunities as it removes the risk of sub-standard horizontal and vertical alignments.

Figure 2-9 TII Collision Map 2016-2018

Based on the Road Safety Authority (RSA) website, see Figure 2-10 below, the collision data along the N63 between the Liss Bridge and Abbeyknockmoy village between 2005 and 2016 is as follows:

- Fatal: 0;
- Serious Injury: 3; and
- Minor accidents: 8.

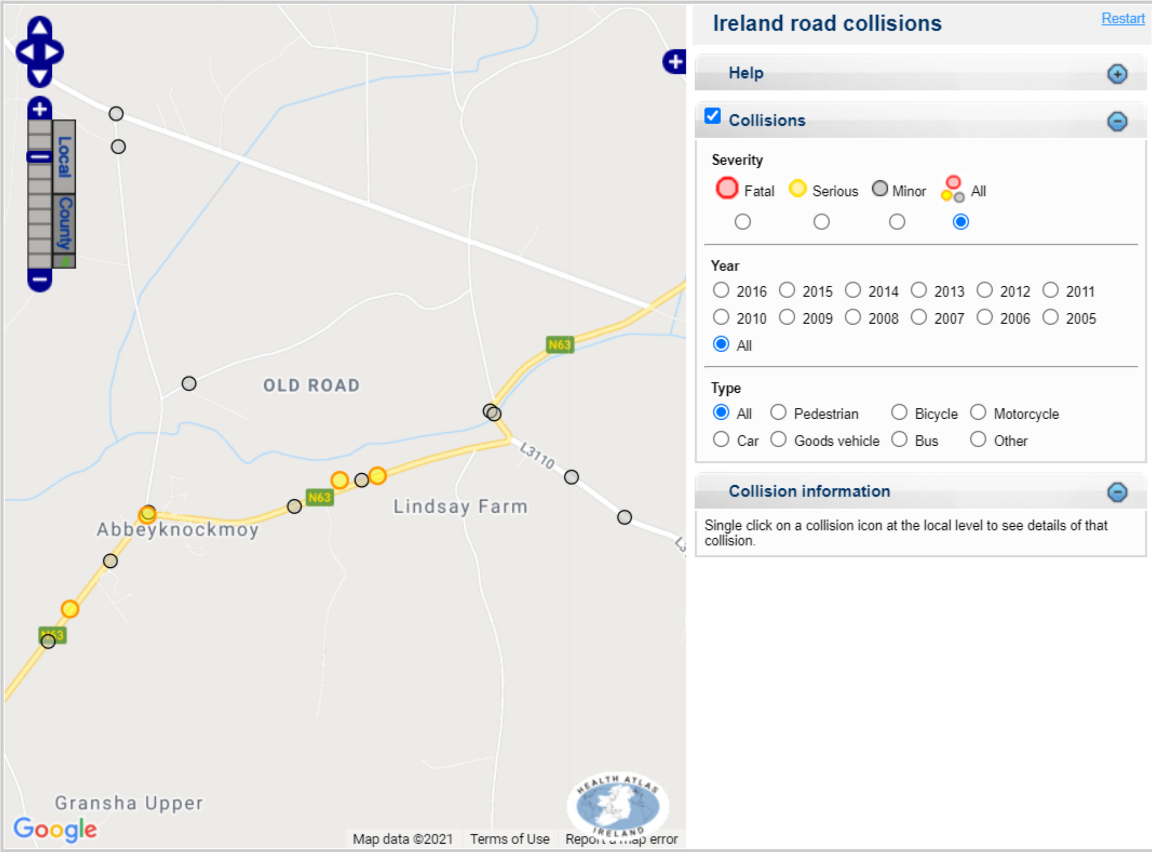

Figure 2-10 Extract from the Road Safety Authority – Road Collisions 2005 – 2016

As shown in the figures above, it is evident that there are safety concerns with the existing road network. The accident data is twice that expected and results from the road collisions data shows there have been a number of incidents in the vicinity of the Liss Bridge and along the section of N63 between the community facilities and the residential area. The introduction of a partially realigned section of regional road with an improved river crossing will help mitigate the risk of collisions by improved road standards and by segregating a significant proportion of the local and regional traffic.

2.2.9 Project Objectives

The overall ambition of the Proposed Road Development is to achieve a number of specific objectives under a number of multi criteria categories. Each of these objectives are linked to the European, national, regional and local policies set out in Section 2.3 below. The overarching headings for each of the areas of the scheme objectives have been structured around the headings required by the TII Project Appraisal Guidelines, which are Environment, Safety, Physical Activity, Economy, Accessibility & Social Inclusion, and Integration. Every endeavour has been made to ensure these objectives were met as much as possible in the development of the Proposed Road Development.

The objectives of the Proposed Road Development are detailed in the following sections.

2.2.9.1 Environment

The key ecological receptor identified within the vicinity of the Proposed Road Development is the Abbert River which is within the Lough Corrib Special Area of Conservation (SAC). (Site Code 000297). The SAC boundary extends to include adjacent wet grassland to the south of the river. The existing Liss bridge crosses over the Abbert River.

Knockmoy Abbey (National Monument No. 166; GA058-004001) and one National Monument subject to Preservation Order (earthworks and buildings associated with Knockmoy Abbey (NM No. 166 & PO No. 4/1989; GA058-004004) are situated within the study area. The Abbey is a very well-preserved ruin of an important 13th-century Cistercian foundation, with royal patronage and at least one royal burial. Its fabric and setting are protected by the National Monuments Acts. Preserving the character and visual amenity of the ruins will be an important challenge for the present scheme.

The key environmental objectives of the Proposed Road Development are:

- To avoid adverse impacts on the internationally important European Sites;
- To improve road drainage;
- To be sensitive to the visual amenity of the Knockmoy Abbey and enhance views; and
- To minimise any noise impacts on properties.

2.2.9.2 Safety

The key safety objectives are:

- To reduce the collision rate along the national road network between Abbeyknockmoy village and Derreen to below the national average rate;
- To reduce the severity of collisions along the national road network between Abbeyknockmoy village and Derreen;
- To provide an improved section of N63 with safer horizontal and vertical geometry along with a standard cross-section along its length
- To improve safety for all road users including pedestrians and cyclists along both the national road network and on the surrounding road network between Abbeyknockmoy village and Derreen;
- To reduce the number of direct accesses onto the N63 and to upgrade a number of existing junctions along the network to safer arrangements;
- To support the RSA Road Safety Strategy 2013-2020; and
- To improve the security of vulnerable road users by providing dedicated routes and safe crossing locations for non-motorised users.

2.2.9.3 Physical Activity

The following objectives are outlined for physical activity:

- To improve facilities and segregation between national and regional traffic, and the movement of local non-motorised users such as pedestrians and cyclists;
- To provide a dedicated route for pedestrians and cyclists along the existing road network, promoting healthy lifestyle choices, particularly with regard to children’s movement to and from school/community facilities; and
- To improve connectivity to the community facilities in the local area to help encourage active travel between the two sections of Abbeyknockmoy.

2.2.9.4 Economy

The key economic objectives are:

- To reduce journey times and improve journey time reliability on the N63 for long distance trips between the West and North-West Regions and medium distance trips between Longford/Roscommon and Galway; and
- To assist in supporting the economic performance of the counties of Galway, Longford and Roscommon through the provision of improved transport infrastructure, which will reduce the cost of travel for business and tourism and assist in reducing the overall cost of production, thereby improving competitiveness.

2.2.9.5 Accessibility & Social Inclusion

The principal accessibility and social inclusion objectives are:

- To improve accessibility to key facilities, such as employment, education, transport, and healthcare for all road users, but in particular for vulnerable groups;
- To improve accessibility and reduce severance particularly within the community of Abbeyknockmoy village and in turn support social and economic development within the village and its hinterland; and
- To support the accessibility and social inclusion objectives of national, regional and local planning policy including the Updated National Action Plan for Social Inclusion 2015-2017.

Of the residents in the area, between 10.0%-13.9% are disabled. A dedicated pedestrian/cycle route and improved road network conditions will assist these people with onward travel and their independence.

The 2016 Pobal HP Deprivation Index at Electoral Districts (ED) level is 'Marginally below average' in all the three ED within the study area (Abbey West, Abbey East and Moyne).

The separation of regional and local traffic coupled with the introduction of pedestrian/cycling facilities will improve accessibility to employment, community facilities and heritage resources. As a result, the social inclusion of vulnerable groups will be improved by the Proposed Road Development.

2.2.9.6 Integration

The Proposed Road Development is required to integrate with general policies and plans under the headings of Transport, Land Use, Geographical and Government Policy. The following objectives are outlined for integration:

- To support the integration objectives set out in European, national, regional and local planning policy by upgrading the N63 National Secondary between Abbeyknockmoy village and Derreen; and
- To support initiatives to bring investment into the West Region; and to support transport integration within the wider region, maximising the benefits of previous investment in the N63 route, integrating with regional public transport facilities, and improving access to the main ports and airports.

2.3 Policy Overview

A general overview of the relevant planning guidance on a European, national, regional and local policies that were assessed for this chapter, are listed below;

European Policy

- TEN-T Trans-European Transport Network

National Policy

- Project Ireland - 2040: National Planning Framework
- National Development Plan 2021 – 2030
- Strategic Framework for Investment in Land Transport
- Draft National Investment Framework for Transport in Ireland
- Programme for Government – Our Shared Future 2020
- Climate Action Plan 2021
- Road Safety Strategy 2013 – 2020

Regional Policy

- Northern and Western Region - Regional Spatial Economic Strategy 2022-2032

Local Policy

- Galway County Development Plan 2015-2021
- Draft Galway County Development Plan 2022-2028

2.3.1 European Policy

2.3.1.1 Trans-European Transport Network

The Trans-European Transport Network (TEN-T), which was the subject of Regulation (EU) No. 1315/2013 (EU, 2013), provides for the TEN-T and requires the development of a core network by 2030 with a connecting comprehensive network of high-quality routes incrementally by 2050. The requirements for the comprehensive network, is described by the regulations as follows:

> *"The comprehensive network should be a Europe-wide transport network ensuring the accessibility and connectivity of all regions in the Union, including the remote, insular and outermost regions, as also pursued by the Integrated Maritime Policy established by Regulation (EU) No 1255/2011 of the European Parliament and of the Council, and strengthening social and economic cohesion between them. The guidelines laid down by this Regulation ("the guidelines") should set the requirements for the infrastructure of the comprehensive network, in order to promote the development of a high-quality network throughout the Union by 2050."*

While the Proposed Road Development does not form part of the comprehensive TEN-T Network, the proposed improvements will support the objectives of the TEN-T in broad terms by improving the connection to Junction 19 on the M17 TEN-T network which in turn feeds into;

> *"...the core network at regional and national level. The aim is to ensure that progressively, throughout the entire EU, the TEN-T will contribute to enhancing internal market, strengthening territorial, economic and social cohesion and reducing greenhouse gas emissions."*

2.3.2 National Policy

2.3.2.1 National Planning Framework

The National Planning Framework (NPF) is the Government's high-level strategic plan (published in 2018) for shaping the future growth and development of Ireland to the year 2040 (Government of Ireland, 2019a), released in tandem with the National Development Plan which sets out the budget for national infrastructure investment for the next 10 years.

> *"The success of the National Planning Framework depends on its policy reflection and programme delivery at national, regional and local level. Implementation of the Framework will therefore be combined with streamlined governance arrangements and focused public capital investment priorities."*

The Proposed Road Development directly supports National Strategic Outcome (NSO) 2 - Enhanced Regional Accessibility, which is defined as:

> *"A co-priority is to enhance accessibility between key urban centres of population and their regions. This means ensuring that all regions and urban areas in the country have a high degree of accessibility to Dublin, as well as to each other. Not every route has to look east and so accessibility and connectivity between places like Cork and Limerick, to give one example, and through the Atlantic Economic Corridor to Galway as well as access to the North-West is essential."*

In addition, NSO 2 Enhanced Regional Accessibility aims to achieve for example:

> *"…Better accessibility between the four cities and to the Northern and Western region will enable unrealised potential to be activated as well as better preparing for potential impacts from Brexit."* and looks to maintain *"the strategic capacity and safety of the national roads network including planning for future capacity enhancements"* amongst others.

Furthermore, the NPF has delivered a series of National Policy Objectives (NPO) to set the context for regional and local planning policy in Ireland. Table 2-1 lists the NPOs that are considered most relevant and supportive of the Proposed Road Development.

Table 2-1 National Planning Framework - National Policy Objectives

Policy Ref.	Objective
NPO 45	In co-operation with relevant Departments in Northern Ireland, support and promote the development of the North West City Region as interlinked areas of strategic importance in the North-West of Ireland, through collaborative structures and a joined-up approach to spatial planning.
NPO 62	Identify and strengthen the value of greenbelts and green spaces at a regional and city scale, to enable enhanced connectivity to wider strategic networks, prevent coalescence of settlements and to allow for the long-term strategic expansion of urban areas.
NPO 74	Secure the alignment of the National Planning Framework and the National Development Plan through delivery of the National Strategic Outcomes.

Source: National Planning Framework 2018

Of significance in terms of the NPF, is the fact that the N63 connects directly to the core component of the Atlantic Economic Corridor (AEC), which is defined within the Plan as:

> *"… a linear network along the Western seaboard, stretching from Kerry to Donegal, which has the potential to act as a key enabler for the regional growth objectives of the National Planning Framework. The corridor straddles parts of both the Northern and Western Region and the Southern Regions, with the potential to further extend its scope by building on the Cross-Border relationship between Letterkenny and Northern Ireland, and into Cork City and County to the south. The overarching objective of the AEC initiative is to maximise the infrastructure, talent and enterprise assets along the western seaboard and to combine the economic hubs, clusters and catchments of the area to attract investment, improve competitiveness, support job creation and contribute to an improve quality of life for the people who live there. The lack of high-quality connectivity between the regions within the AEC has been a major impediment to its development as a counter-balance to Dublin and the East coast."*

Improved connectivity between Galway, Longford, Roscommon and also to Clare via the M17/M18 will be delivered through this Proposed Road Development; thereby in turn enhancing accessibility for the region.

Consequently, the principle of the Proposed Road Development is encouraged and supported by the overarching planning framework for Ireland; the NPF outlines the multiple benefits of a development of this nature.

2.3.2.2 National Development Plan 2021-2030

The National Development Plan (revised NDP) 2021 – 2030 was drafted over two phases of review commencing back in October 2020 and later published in October 2021. The revised NDP supersedes the previous NDP published in 2018.

As part of Project Ireland 2040 the revised NDP (Government of Ireland, 2021a) sets out the Government's over-arching investment strategy and budget for the period up to 2030. The primary purpose of the revised NDP aims to balance the demand for public investment across all sectors and regions of Ireland with a specific emphasis on improving the delivery of infrastructure projects. In this regard, the revised NDP has allocated a total public investment of €165 billion (an increase of €49 billion from previous NDP) of for the lifetime of the plan. It is noted that the revised NDP is not intended to provide a comprehensive list of all the public investment projects, however, a notable element does outline the range of expenditure commitments.

The revised NDP also sets out the framework through which investments of the relevant sectoral strategies and subsequent strategic investment priorities across each of the ten NSOs set out in the NPF. In addition, the revised NDP will continue to align with the NPF, with a particular focus on enhancing Ireland's regional cities by ensuring regional connectivity is enabled through the previously identified national roads projects.

In reference to the Government's commitment in the previous NDP, in regard to investment in regional access being complemented by investment and maintenance of local and regional routes throughout the country, this will enhance local communities through access to local, national and international markets and services.

> *"….the objective is to complete those linkages so that every region and all the major urban areas, particularly those in the North-West, which have been comparatively neglected until recently, are linked to Dublin by a high-quality road network."*
>
> *"…the other major objective is to make substantial progress in linking our regions and urban areas not just to Dublin but to each other. This will be a major enabler for balanced regional development to occur. A particular priority in this is substantially delivering the Atlantic Corridor, with a high quality road network linking Cork, Limerick, Galway and Sligo."*

Of further relevance, is NSO 3: Empowered Rural Economies and Communities, which sets out for full participation of rural communities in the strategic development of the State, as envisaged in the NPF. The NDP outlines a number of key rural initiatives that set out to revitalise rural areas and to enhance economic growth. In particular;

> *"Public capital investment has a vital role to play to support the regions, including rural areas, in achieving their economic and social potential, and in particular to facilitate the jobs growth necessary to support future population growth".*

The NDP also sets out that the investment in regional access will be complemented by investment in and maintenance of local and regional routes throughout the country. This aimed to enable communities access local, national and international markets and services. Protecting the quality and value of past investments is a priority with the NDP stating; "*It is an investment priority to ensure that the existing extensive transport networks, which have been greatly enhanced over the last two decades, are maintained to a high level to ensure quality levels of service, accessibility and connectivity to transport users*.

The revised NDP has acknowledged that when evaluating the progression of such identified national roads projects, prioritisation must be in line with the '2:1 Programme for Government commitment on new public transport and new roads, the NIFTI framework, the National Planning Framework and the requirements of the Climate Action Plan.'

In considering the forementioned policies are aligned with the overarching NPF and requirement to be consistent with the associated NSOs, of particular relevance, NSO 2 '*Enhanced Regional Accessibility',* the revised NDP re-confirms that the government is fully focused on delivering such infrastructure that will facilitate with the projected growth for Ireland's towns and cities. The previous NDP listed significant investment in new inter-urban roads, strengthening the connection between regions and urban centres. The revised NDP re-confirms that investment will continue, with regard to the potential for carrying public transport services and better integrating public transport and active travel networks on the approaches to urban areas.

> *"A key priority will be to maintain the existing national road network to a robust and safe standard and a significant percentage of national roads expenditure over the course of this NDP will relate to maintenance works, in order to protect and renew existing assets."*

The concept of the Proposed Road Development is considered compliant with the previous and revised NDP with strong confluence between NSO 2 and NSO 3, that aim to improve regional accessibility, maintain the strategic capacity and safety of the national roads network and enhance economic growth for the Northern and Western Region.

2.3.2.3 Strategic Framework for Investment in Land Transport

The Strategic Framework for Investment in Land Transport (SFILT) which was published by the Department of Transport, Tourism and Sport (DTTAS) (DTTAS, 2015) outlines the key principles against which national and regional, comprehensive and single mode-based plans and programmes will be drawn up and assessed. The framework does not set out a list of projects to be prioritised, however the following three priorities are noted in terms of investment:

- *Priority 1 – Achieve steady state maintenance;*
- *Priority 2 – Address urban congestion; and*
- *Priority 3 – Maximise the value of the road network.*

In terms of Priority 3, the report states that "*the value of the road network will be maximised through targeted investments that:*

- *Enhance the efficiency of our existing network, particularly through the increased use of ITS applications;*
- *Support identified national and regional spatial planning priorities;*
- *Provide access for large-scale employment proposals; and*
- *Support identified national and regional spatial planning priorities."*

The Proposed Road Development supports the objectives of the SFILT by improving the efficiency of this section of the national road network.

The SFILT will be updated by the National Investment Framework for Transport in Ireland which is currently in draft format.

2.3.2.4 Draft National Investment Framework for Transport in Ireland

The National Investment Framework for Transport in Ireland (NIFTI) is the Department of Transport's framework for prioritising future investment in the land transport network to support the delivery of the National Strategic Outcomes the draft framework was published for public consultation on 31 March 2021 and the consultation concluded on 28 May 2021. The intention of NIFTI is to form the Government's long-term strategy for accommodating population growth in a sustainable manner and has been developed to ensure that transport sectoral strategy is underpinned by and supports the achievement of the spatial objectives and National Strategic Objectives set out in the National Planning Framework.

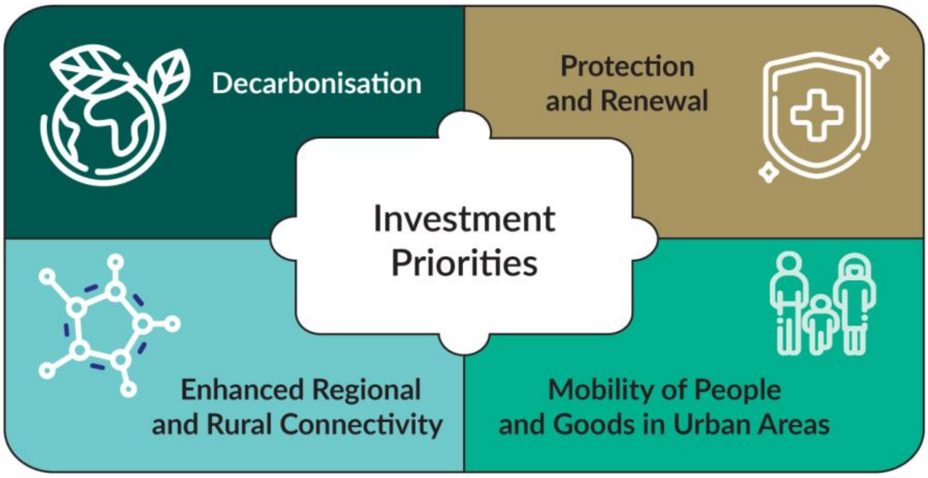

Figure 2-11 NIFTI Investment Priorities, Extracted from Draft NIFTI

NIFTI background paper 12 outlined some key elements of the draft framework which deal with the priorities for the rural and regional transport network, and include the following elements:

- *"Enabling a high level of service for all users by protecting the existing extensive network of rural roads;*
- *Protecting areas with vulnerable transport networks by identifying and prioritising 'lifeline' infrastructure;*
- *Leveraging rural Ireland's economic potential by preserving access to urban centres of scale; and,*
- *Supporting the adaptation of rural infrastructure to extreme weather events caused by climate change."*

The draft strategy also outlines that *"Enhancing connectivity means delivering reliable, shorter journey times to and between centres of scale for people and goods"*.

The principles of the Proposed Road Development will support this draft strategy by providing essential transport infrastructure to ensure rural connectivity at regional level across the N63 National Secondary Route Corridor between multiple rural settlements such as Abbeyknockmoy, Moylough, Mountbellew, and Ballycar to both Galway and Tuam to the west (via the M17) and to Roscommon and Longford in the east (via the eastern section of the N63).

2.3.2.5 Programme for Government – Our Shared Future 2020

The Programme for Government was published in October 2020 (Government of Ireland, 2020a). It proposed an ambitious vision to create reform and renewal that will help Ireland recover and thrive.

> *"This is a vision for Ireland that seeks to move beyond division and discord and find shared solutions. Nowhere is this more evident than in the area of Climate Action, where we show that it is possible to move beyond politics and deliver transformative change that benefits our agriculture and fisheries, our society, our economy and our planet."*

In the context of new transport infrastructure, the Government is committed to a 2:1 ratio of expenditure between new public transport infrastructure and new roads over its lifetime. This ratio is to be maintained in each Budget.

The Programme refers to any essential road and public transport maintenance and upkeep budgets to be fully protected to ensure continued public safety and connectivity. In addition, the Programme recognises the importance of improving connectivity and transport in rural Ireland, specifically;

> *"Ensure sufficient investment in the local and regional road network to maintain roads to a proper standard, deal with road safety challenges, and improve regional accessibility."*

Furthermore, the Programme seeks to introduce an ambitious road safety strategy targeting the Vision Zero principle;

- *"Introduce a new road safety strategy focused on reducing death and injuries of vulnerable road users, pedestrians, and cyclists.*
- *Prioritise the consolidation of the existing road traffic legislation and use that as an opportunity to rectify any anomalies that may have developed which hinder appropriate enforcement."*

The Proposed Road Development will directly assist this Programme by improving this important rural section of the national road network.

2.3.2.6 Road Safety Authority Road Safety Strategy 2013 - 2020

The Road Safety Authority (RSA) Road Safety Strategy 2013 – 2020 (RSA, 2013), sets outs targets to be achieved in terms of road safety in Ireland as well as policy to achieve these targets. The primary target of this strategy was to reduce:

> *"… road collision fatalities on Irish roads to 25 per million population or less by 2020 is required to close the gap between Ireland and the safest countries. This means reducing deaths from 162 in 2012 to 124 or fewer by 2020.*
>
> *A provisional target for the reduction of serious injuries by 30% from 472 (2011) to 330 or fewer by 2020 or 61 per million population has also been set."*

The long-term trend of previous road safety strategies have shown that roads in Ireland have become significantly safer for road users overall. The biggest decrease in fatalities was among pedestrians, which showed 68% fewer pedestrian fatalities in 2019 compared to 2000. There were 59% fewer motorcyclist fatalities over this period, and 65% fewer car occupant fatalities.

These strategies have had significant positive progress since the first strategy was introduced in 1998. The challenge for the next strategy will be to further reduce fatalities and serious injuries and to deal with new issues in road safety. As mentioned in Section 2.3.2.5, the government has adopted Vision Zero in the Programme for Government 2020. It is also reminded that a new Road Safety Strategy proposed for 2021 to 2030, the consultation response document issued in October 2020, was also assessed for this section.

The principles of the Proposed Road Development will support the proposed road safety strategy by providing essential transport infrastructure to meet these demands and ensure improved facilities are provided.

2.3.2.7 Climate Action Plan 2021

This Climate Action Plan (CAP) 2021 sets out the roadmap to deliver Ireland's climate target ambitions. The CAP will supersede the 2019 plan with further updates to be carried out annually (Government of Ireland, 2021b), this is reiterated in Action 7 of the CAP; "*Prepare Climate Action Plan 2022 to fully reflect the legally adopted carbon budgets and sectoral ceilings"*. As envisaged in the Programme for Government 2020, a need to identify all the "*emerging technologies, changing scientific consensus or policies"* is required to meet these climate targets. This approach is reflected in the Climate Action and Low Carbon Development (Amendment) Act 2021 and will be a feature of future climate action plans.

As stated in the Programme for Government, Our Shared Future, Ireland is committed to achieving a 51% reduction in overall Greenhouse Gas (GHG) emissions from 2021 to 2030, and to achieving net-zero emissions no later than 2050, this has been reiterated in Action 54 of the CAP; *"Develop a strategy to achieve at least a 51% reduction in GHG emissions and a 50% improvement in public sector energy efficiency by 2030."*. The Climate Act will support Ireland's transition to net-zero and the achievement of a climate neutral economy no later than 2050. It also establishes a legally binding framework with clear targets and commitments, to ensure the necessary structures and processes are in place to deliver our national, EU and international climate goals and obligations.

The recently published CAP outlines 475 Actions directed across all the key sectors. A number of measures are outlined in relation to the transport sector, of relevance to the Proposed Road Development, the CAP acknowledges the need for a significant cut in transport emissions by 2030, the following measures have been identified;

- *"Increasing the proportion of kilometres driven by passenger electric cars to between 40 and 45% by 2030, in addition to a reduction of 10% in kilometres driven by the remaining internal combustion engine cars*
- *Increased rollout of rural public transport through Connecting Ireland. [42-50% reduction in emissions by 2030]*
- *The proposed pathway in transport is focused on accelerating the electrification of road transport, the use of biofuels, and a modal shift to transport modes with lower energy consumption (e.g. public and active transport)".*

The intention of the Proposed Road Development is to provide a better-connected network for all road users, while improving the capacity and safety required to be consistent and deliver on the imperative overarching policies and NSO's highlighted in Section 2.3.2 of this chapter. In addition, an emphasis of the proposed improvement on this section of the national road network aims to encourage a modal shift towards greener travel usage.

2.3.3 Regional Policy

2.3.3.1 Northern and Western Region - Regional Spatial Economic Strategy 2020-2032

There are three regional assemblies in Ireland, they comprise; the Southern, Eastern and Midlands and Northern and Western regions. These regional assemblies have a primary function to identify regional policies and coordinate initiatives that support the delivery of national planning policy. The primary driver for this is the implementation of the Regional Spatial and Economic Strategies (RSES) 2040 (Government of Ireland, 2020b). The RSES provides regional level strategic planning and economic policy in support of the implementation of the National Planning Framework and provides a greater level of focus around the NPO and NSO of the NPF.

While the three regions may differ in some ways, they do not operate in total isolation and there are many complementing and connecting assets shared between the regions. Due to the strategic national and regional nature of some development proposals, a consistent policy approach to regional and economic planning is an essential tool when assessing future development for Ireland.

The RSES recognises the need to significantly improve the integration of Land-use and Transport Planning across the region:

> *"Economic activity is a driver of demand in the regions transport system, whether it be for the local, regional, inter-regional, inter-island or international movement of people and goods. Our landscape and dislocation from cities of scale present challenges of transport connectivity."*

The RSES lists the main challenges relating to transport in achieving a connected region, specifically;

1. *"Maintaining and enhancing accessibility;*
2. *Managing the Environmental impacts of transport;*
3. *Providing transport options both within and between our urban/rural centres;*
4. *Building on this region's freight capacity;*
5. *Utilising our access points to grow domestic and overseas visitors;*
6. *Integrating NSOs to improve health, wellbeing and work-life balance for our communities;*
7. *Meeting the transport needs of our peripheral and island communities; and*
8. *Availing of transport opportunities associated with projected population growth".*

A list of relevant Regional Policy Objectives (RPO) from the Northern and Western RSES are outlined in Table 2-2.

Table 2-2 Northern and Western Region RSES 2020-2032 Relevant Policies

Policy Ref.	Objective
RPO 3.6.1	It is an objective to establish a collaborative approach between the Regional Assemblies (NWRA & SRA), the local authorities and other stakeholders to enable all their metropolitan areas to collaborate to harness their combined potential as an alternative to Dublin.
RPO 6.5	The capacity and safety of the region's land transport networks will be managed and enhanced to ensure their optimal use, thus giving effect to National Strategic Outcome No.2 and maintaining the strategic capacity and safety of the national roads network including planning for future capacity enhancements.
RPO 6.8	The delivery of the following projects shall be pursued, in consultation with and subject to the agreement of TII, through pre-appraisal, early planning and to construction as priority projects to be delivered to an appropriate level of service in the medium-term. • N3 North of Kells to Enniskillen, via Cavan and the A509 in Fermanagh • N5/N26/N58 Mount Falcon to Swinford, Castlebar East to Bohola Project • N13 Manorcunningham to Bridgend/Derry • N13 Stranorlar to Letterkenny • N15 Sligo to Bundoran • N15 Stranorlar to Lifford • N16 Sligo to Blacklion • N53 Dundalk to N2 at Carrickmacross • N54/A3 Cavan to Monaghan Town • N55 Cavan Town to Athlone • N56 Inver to Killybegs • N59 Upgrade (including the N59 Oughterard Bypass and the N59 Clifden to Oughterard Scheme) • N61 Athlone to Boyle improvement • N63 Longford to M17 at Annagh (Junction 18).
RPO 8.12	To ensure that adequate infrastructure is in place to meet demands from continuing growth and development of the economy and to cater to existing and increased population levels.

Source: Northern and Western Region Regional Spatial Economic Strategy 2020-2032

In regard to the above policies, the RSES has placed emphasis on prioritising transport investment;

> *"Major transport infrastructure investments, identified in the National Development Plan, have an important role in enabling the sustainable and balanced development of the region over the period of the RSES."*

In addition, the intention of the RSES is not to list a variety of schemes for development over the lifetime of the strategy. The intention is to ensure that '*road relevant legislation and guidelines and in accordance with the objectives and priorities outlined in this strategy'.*

The RSES does acknowledge that local authorities are progressing a wide range of regional and local roads projects across the region and these should be prioritised in accordance with their respective settlement strategies and road safety considerations. The Proposed Road Development is specifically referred to within the RSES under RPO 6.8 (Table 2-2) as a project integrated with the targeted development of the major urban centres for the region.

With respect to these policies, the Proposed Road Development will satisfy the objectives of the RSES.

2.3.4 Local Policy

2.3.4.1 Galway County Development Plan 2015-2021

A County Development Plan (CDP) is a requirement by law, for every planning authority in Ireland to set out an overall strategy for the proper planning and sustainable development of the area. The Planning and Development Act 2000 (as amended) has stated under Section 27(1);

> *"A planning authority shall ensure, when making a development plan or local area plan, that the plan is consistent with the regional spatial economic strategy in force for its area"*

A primary aim of the CDP is to promote, guide and enforce high quality standards of development for urban and rural areas throughout the county. With the general emphasis to enhance the quality of life, environment, community, and economy that supports the sustainable development of each county.

A Draft Galway County Development Plan (Draft CDP) 2022 – 2028 has been prepared by Galway County Council, further information is provided in Section 2.3.4.2. The most relevant local level policy is the extant Galway County Development Plan 2015-2021 (CDP) (GCC, 2015). The relevant national and regional objectives level have been developed further and translated into local objectives through the CDP. This CDP has been prepared in accordance with Sections 11 and 12 of the Planning and Development Act, 2000 (as amended).

The overall vision of the CDP 2015-2021 aims to;

> *"Enhance the quality of life of the people of Galway and maintain the County as a uniquely attractive place in which to live, work, invest and visit, harnessing the potential of the County's competitive advantages in a sustainable and environmentally sensitive manner."*

The CDP sets out the strategic aims to achieve the overall vision for County Galway. Figure 2-12 highlights the overall spatial strategy and proposed development option.

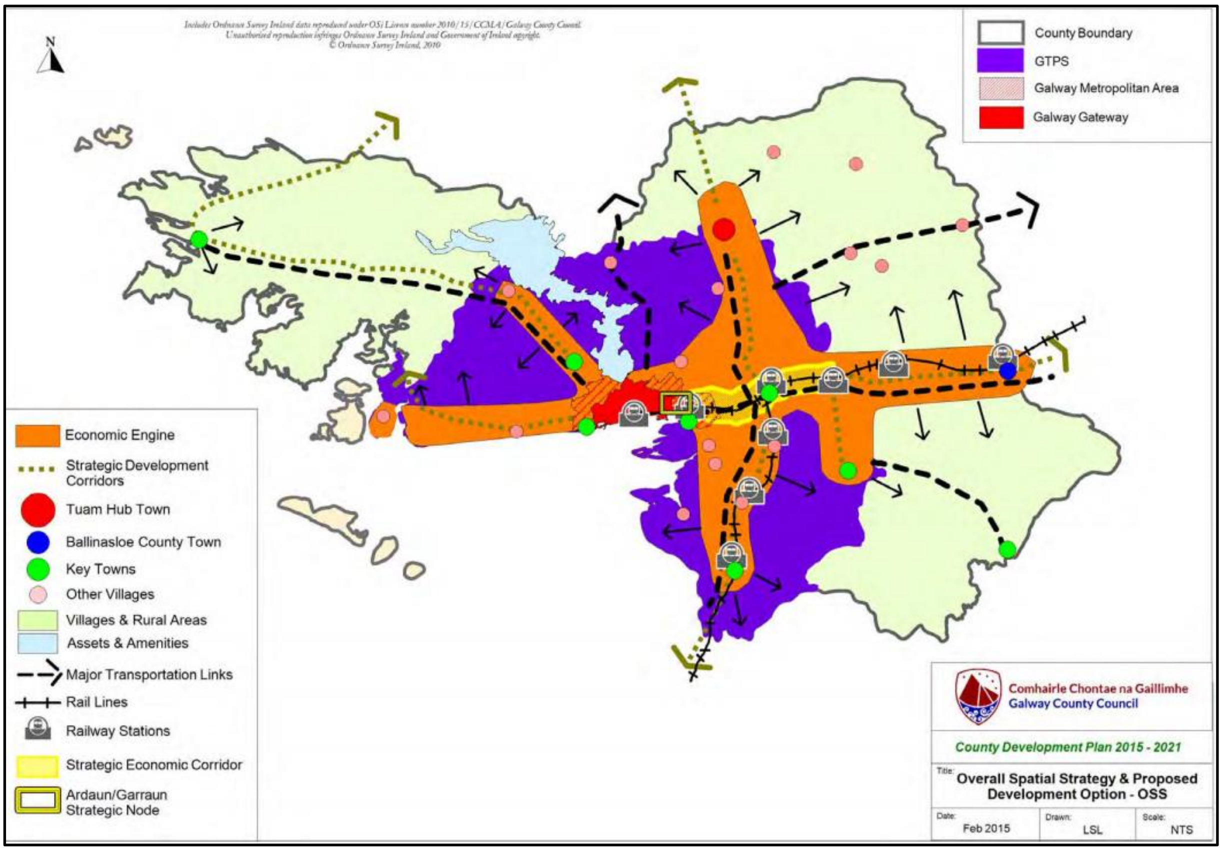

Figure 2-12 Overall Spatial Strategy & Proposed Development Option

Source: Galway County Development Plan, 2015-2021

The Proposed Road Development transverses land considered greenfield and predominantly rural in nature. The closest settlement is Abbeyknockmoy, County Galway. In the tiers set out in the hierarchy of towns, villages and settlements, Abbeyknockmoy is categorised as '*Other Settlements & the Countryside'.* Figure 2-12 highlights the proximity to Tuam, which the CDP identifies as a Hub town. In addition, the CDP has listed Objective DS 1 – Development Strategy:

> *"…To Develop the Hub Town of Tuam, Supporting the Gateway and Key Towns while Encouraging the Development of Other Settlement Centres and Appropriate Development in Rural Areas"*

The CDP specifically mentions that any development in the un-serviced countryside requires sensitive and careful management, in order to balance the need to revitalise and support communities, while ensuring the overall sustainable development of these areas.

Considering the large rural areas of County Galway, the CDP refers to the broad classification of these areas, particularly as; Rural Areas Under Strong Urban Influence and Structurally Weaker Rural Areas.

Rural Areas Under Strong Urban Influence -

> *"….areas exhibit characteristics such as proximity to the immediate environs or close commuting catchment of Galway City, rising population, evidence of considerable planning pressure for development of housing due to proximity to such urban areas or to major transport corridors with ready access to the urban area, and pressures on infrastructure such as the local road network."*

Structurally Weaker Rural Areas -

> *"….areas exhibit characteristics such as persistent and significant population decline as well as a weaker economic structure based on indices of income, employment and economic growth. In addition to the two broad rural areas listed above, there are a number of additional specific planning considerations that need to be taken into account when assessing rural housing in the countryside."*

The CDP states the above distinctions are necessary in order to be able to respond to local circumstances, such as housing, economic and population decline or areas under substantial pressure for development.

Table 2-3 lists some of the strategic aims designated by the CDP along with performance indicators of relevance to the Proposed Road Development.

Table 2-3 Strategic Aims of the Galway County Development Plan 2015-2021

Strategic Aim	Details	Performance Indicators
Promote Regional Development	Promote regional development and growth through harnessing the economic and employment potential of the competitive advantages of County Galway such as its strategic location, quality of life, landscape, heritage and natural resources, in a sustainable and environmentally sensitive manner.	• Population growth in the County is channelled into the appropriate growth settlements in accordance with the plan; • The overall population targets provided for in the Regional Planning Guidelines are not exceeded; • The zoning limits set out in the Core Strategy are carried through to local area plans; • Family income; • Unemployment rate; • Take up of new employment land; • Increase in rates base reflecting growth in commercial properties; • Diversification in employment sectors.
Balanced Urban and Rural Areas	Prioritise development within the Hub town of Tuam, the Galway Metropolitan Area, Ballinasloe, the key towns and smaller towns, villages and settlements within the County, while supporting the role of the rural area in sustaining the rural based economy.	• Number of new houses provided; • Number of areas/houses refurbished in the Local Authority housing stock; • Quality of new housing with regard to design, proximity to services, energy efficiency, green amenity; • Range of house types and size provided; • Diversification in farming and generation from the land of alternative income from farming;

Strategic Aim	Details	Performance Indicators
		• Total hectares of land developed for new enterprises in the plan period on business/enterprise/industrial zoned lands.
Inclusive Communities	Encourage and support the development of inclusive communities which engage and include all members of society facilitating equal physical, social and cultural access and integration.	• Square metres of community/education/institutional zoning granted in the plan period; • Square metres of town centre/commercial zoning granted in the plan period; • Number of new educational/childcare facilities provided; • Number of new leisure/recreational facilities provided; • Improvements in walking/cycling linkages within settlements.
Integrated Development	Ensure a more sustainable and integrated concept of development with regard to land use, transportation, water services, energy supply and waste management over the lifetime of the plan.	• Overall quantum of new infrastructure projects/schemes delivered; • Growth in broadband coverage in the County; • Number of alternative energy projects delivered.
Sustainable Transportation	Minimise travel demand and promote the increase of sustainable mobility throughout the County.	• Reduction in commuting distance time to work and school; • Increase in the provision and use of public transport services; • Overall delivery of “Smart Travel” initiatives.
Infrastructural Projects	Facilitate the development of infrastructural projects, which will underpin sustainable development throughout the County and region during the plan period.	• Delivery of key infrastructural requirements as identified in the plan.

Source: Galway County Development Plan 2015-2021

The CDP refers to the N/M6 and M17/M18 as the main access routes in the region, while the N59, N63, N83 and N84 are important inter-regional routes. In addition, the CDP makes specific reference to the wider N63 Leacht Seoirse-Ballygar route of which the Proposed Road Development is a sub-section.

The core strategy of the CDP has outlined to;

> *“Build on the regional level linkages between County Galway, the Gateway and other parts of the West Region by supporting the implementation of the regional spatial strategy, as set out in the West Regional Planning Guidelines. The regional spatial strategy aims to develop the Galway Gateway, the Tuam Hub and Castlebar-Ballina Linked Hub, supported by the development of the Athlone Gateway and key towns, encouraging the development of other settlement centres and appropriate development in the rural areas of the region;*
>
> *Focus a greater growth in the Hub town of Tuam, the key towns, lower tier other towns and villages in a sequential manner, recognising the role that new infrastructure and public transport links will play in their future, while maintaining the viability of rural communities in the hinterlands of these towns and villages;”*

In respect of the definition above, the Proposed Road Development will greatly enhance the existing regional and local level linkages, by providing improved accessibility and social inclusion to community facilities and to heritage resources. A list of relevant policies and objectives to the Proposed Road Development from the CDP are highlighted in Table 2-4.

Table 2-4 Galway County Development Plan 2015-2021, Relevant Policies and Objectives

Policy Ref.	Objective
DS 1	It is the overarching objective of Galway County Council to support and facilitate the sustainable development of County Galway in line with the preferred development strategy option: Option 4 – To Develop the Hub Town of Tuam, Supporting the Gateway and Key Towns while Encouraging the Development of Other Settlement Centres and Appropriate Development in Rural Areas, which will allow County Galway to develop in a manner that maintains and enhances the quality of life of local communities, promotes opportunities for economic development, sustainable transport options, social integration, and protects the cultural, built, natural heritage and environment while also complying with relevant statutory requirements.
DS 2	a) Continue to recognise the defined Galway Transport and Planning Study Area, the commuter zone of Galway City, which requires careful management of growth and strong policies to shape and influence this growth in a sustainable manner; b) Support a review of the Galway Transportation and Planning Study during the lifetime of the plan, in co-operation with Galway City Council. Consideration of the inclusion of a Strategic Transport Assessment shall form part of this review.
DS 11	Co-ordinate new growth within the key towns, villages and settlements along the strategic development corridors throughout the County in order to create more sustainable development patterns and to optimise public and private investment made within the County and support the appropriate development of the Strategic Economic Corridors.
SS 3	Galway County Council shall promote and secure the development of Tuam, to enable it to fulfil its potential as a Hub town, so that it obtains the critical mass necessary to sustain strong levels of economic growth and prosperity, while supporting improvements in connectivity between the Gateway and the Hub, enhancing their complementary status.
SS 7	In the case of smaller settlements for which no specific plans are available, development shall be considered on the basis of its connectivity, capacity (including social, cultural, and economic, infrastructural and environmental capacity) and compliance with the Core Strategy and Settlement Strategy, good design, community gain and proper planning and sustainable development.
SS 8	Galway County Council shall recognise the important role of rural communities to the sustainable development of County Galway and shall ensure the careful management of development in these areas, having due regard to the relevant policies and objectives set out elsewhere in the plan.
EDT 1	The objectives for the Strategic Economic Corridor include: • To upgrade, improve and maximise the infrastructural facilities available within the corridor; • To seek to reserve lands to support nationally and regionally significant activities and to attract specialist enterprise development that is large scale or high value; • To facilitate opportunities for science and technology based employment; • To ensure development is compatible with the enhancement, preservation and protection of the environment and cultural resources recognised within the corridor; • To identify sites of adequate size and location to accommodate necessary infrastructure or support activities which would not be appropriate in proximity to centres of population or sensitive environments or environmentally sensitive economic activities; • To inform and to aid the preparation of Local Area Plans for strategic areas and those surrounding immediate environs within the corridor.
TI 1	It is the overarching policy of Galway County Council to comply with all relevant Irish and European planning and environmental legislation in implementing its Transportation Strategy.
TI 2	It is the policy of the Council to promote the development of an integrated and sustainable high quality transport system that shall: a) Promote closer co-ordination between land use and sustainable transportation; b) Continue the provision of a range of transport options within the County in collaboration with other statutory agencies and transport providers, including a safe road network, a range of bus and rail services, adequate facilities for walking and cycling and opportunities for air and water-based travel.
TI 5	It is the policy of Galway County Council in conjunction with all relevant statutory agencies and infrastructure providers to provide road and street networks that are safe and convenient, that have adequate capacity to accommodate motorised traffic and non-motorised movements, that have a high environmental quality with appropriate adjacent development and built form, particularly in the case of urban streets and streetscapes, and that adequate parking facilities are provided to serve the needs of towns and villages within the County. In this regard, the principles, approaches, and standards set out in the Design Manual for Urban Roads & Streets (2013) (including any superseding document) shall be applied to new development as appropriate.
TI 6	Seek to protect and safeguard the significant investment made in strategic transportation infrastructure, in particular the network of national roads, the existing rail lines and the Western Rail Corridor.
TI 7	Protect the motorway and national road network and national road junctions in line with Government policies. Safeguard the carrying capacity, operational efficiency, safety and significant investment made in the motorway and national road network within the County including the M6 Dublin to Galway Motorway, the M18 Gort to Crusheen Motorway and the M17/M18 Galway to Tuam when completed.

Policy Ref.	Objective
TI 8	It is the policy of Galway County Council to work with Galway City Council and all relevant statutory bodies to develop an appropriate infrastructural response to the transportation needs of the Galway Gateway, its environs and the west of the County, with a view to relieving congestion, improving travel times, increased safety of all road users and enhancing connectivity and access within the region and enhanced accessibility of the western region in a national and international context. Any such solution shall have due regard to the necessity to protect the environment and will comply fully with the requirements of the Habitats Directive.
TI 9	It shall be the policy of Galway County Council to ensure that any works to be carried out by Galway County Council or other statutory authority to any part of the road network which may affect the delivery of either the Western Rail corridor or any Greenway proposal shall be carried out in such a way so as not to compromise the longer term delivery of such alternative transportation proposals or any interim objectives to use the railway as a greenway.
TI 10	It is a policy of Galway County Council to liaise with the National Roads Authority on the reclassification of Restricted Routes as a result of the construction of motorways.
TI 5	Facilitate the progression of and implement improvements to the existing National and Regional/Local Road networks including the priority transportation schemes, listed in Table 5.1: Priority Transportation Infrastructure Projects for Co. Galway 2015-2021 and those listed within Table 5.2: Regional/Local Projects Proposed 2015-2021 subject to relevant Irish planning and European environmental legislation including Article 6 of the Habitats Directive and/or other environmental assessment, where appropriate.
TI 6	It is an objective of the Council to protect the capacity and safety of the National Road Network and Strategically Important Regional Road network (listed in DM Standards and Guidelines in Chapter 13) in the County and ensure compliance with the Spatial Planning and National Roads Planning Guidelines (2012). Galway County Council will not normally permit development proposals for future development that include direct access or intensification of traffic from existing accesses onto any national primary or secondary road outside of the 50-60 kph speed limit zone of towns and villages.
TI 15	It is an objective of Galway County Council to work with all other relevant bodies to deliver the necessary improvements to transportation infrastructure, including new infrastructure if necessary, to help secure the medium and long term economic and social development of Galway Gateway and the west of the County. Any such investment or project shall be carried out with due regard to the necessity to protect the environment and in full compliance with the provision of relevant legislation, including the Habitats Directive.
ARC 1	It is the policy of Galway County Council to support and promote the conservation and appropriate management and enhancement of the County's archaeological heritage within the plan area. Galway County Council will ensure the implementation of the legislative, statutory and policy provisions relevant to the conservation of the archaeological heritage.

Source: Galway County Development Plan 2015-2021

A primary aim of the CDP is to promote, guide and enforce high quality standards of development for urban and rural areas throughout County Galway. The general emphasis to enhance the quality of life, environment, community and economy in a manner that supports the sustainable development of the entire County. The concept, principles and design process of the Proposed Road Development is considered compliant with the policies and objectives set out in the CDP.

2.3.4.2 Draft Galway County Development Plan 2022-2028

The Draft Galway County Development Plan (Draft CDP) 2022 – 2028 has been prepared in accordance with the provisions of the Planning and Development Act 2000 (as amended). In view of recent implementation of new policies on a national and regional level as referred to in Section 2.3.2 and 2.3.3, the Draft CDP states to have considered these changes associated with these overarching policy frameworks in Ireland (GCC, 2021).

The Draft CDP has not yet been adopted, however has been on public display and available for public consultation from the 20th May 2021 to the 30th July 2021. The adoption of the Draft CDP is required to be completed by May 2022. As mentioned previously, for the purposes of this chapter, the most relevant local level policy is the extant Galway County Development Plan 2015-2021 listed in Section 2.3.4.1.

Notwithstanding this, since the Draft CDP is now publicly available information, this section has reviewed the Draft CDP and included a list of relevant policies and objectives to the Proposed Road Development, these are highlighted in Table 2-5.

Table 2-5 Draft Galway County Development Plan 2022-2028, Relevant Policies and Objectives

Policy Ref.	Objective
PM 4	It is a policy objective of the Council to encourage modal shift in our towns to more sustainable transport alternatives through mixed use development that enables local living and working which is well connected to sustainable transport infrastructure such as walking, cycling, public bus and rail transport.
PM 5	Promote sustainable transport options as an alternative to the private car for people to access local services which will facilitate the transition to a low carbon climate resilient society.
GCTPS 1	It is a policy objective of Galway County Council to support and facilitate the implementation of the Galway County Transport & Planning Strategy and Galway Transport Strategy across all modes of transport.
GCTPS 2	Galway County Council will pursue a fully integrated approach to land use and transportation, actively supporting measures which facilitate and attract developments to locations with high levels of sustainable transport provision (or which can achieve such provision as a result of the development in question).
GCTPS 3	The County will seek to support a variety of measures which will reduce car dependency for residents, and will specifically seek to improve access to sustainable transport choices (including responsive and “flexible” modes) for those residents in rural areas of the County.
GCTPS 7	The County will manage and maintain the efficient and safe operation of the road network under its control, and will work with TII and NTA to identify locations on the national network where targeted improvements may be required to address specific issues.
GCTPS 8	The County will co-operate with TII and the NTA with regard to the maintenance and enhancement of national networks for longer-distance and cross-country travel and movement of through-traffic including freight.
PRP 1	Galway County Council will facilitate the progression of the necessary infrastructure improvements including new roads/projects listed in Table 6.1: Priority Transportation Infrastructure Projects for County Galway 2022-2028 and those listed within Table 6.2: Regional/Local Projects Proposed for 2022-2028 subject to relevant Irish planning and European environmental legislation including Article 6 of the Habitats Directive and/or other environmental assessment, where appropriate.
NR 1	To protect the strategic transport function of national roads, including motorways through the implementation of the ‘Spatial Planning and National Roads Guidelines for Planning Authorities’ DECLG, (2012) and the Trans-European Networks (TEN-T) Regulations.

Source: Draft Galway County Development Plan 2022-2028

Of further importance, Chapter 6 (Transport and Movement) of the Draft CDP, sets out to;

> *“…encourage investment and improvements across all sectors of transport that will support targeted population, economic growth and more sustainable modes of travel including, walking, cycling and public transport”.*

Similar to the Overall Spatial Strategy & Proposed Development Option for the CDP shown in Figure 2-12, the Draft CDP has issued the Strategic Transport Network also highlighted in Figure 2-13. This visually highlights the on-going intentions of Galway County Council.

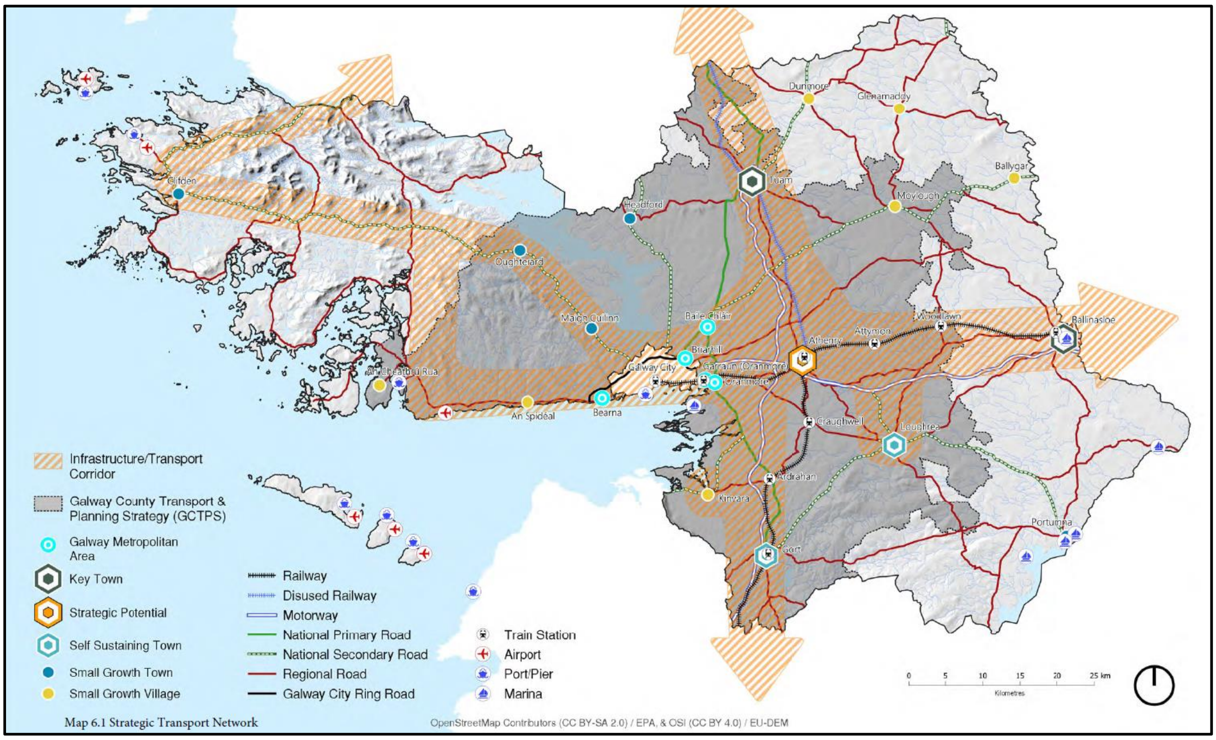

Figure 2-13 Strategic Transport Network

Source: Draft Galway County Development Plan, 2022-2028

As stated in Policy Objective PRP 1 in Table 2-5, and summarised below;

> *"Galway County Council will facilitate the progression of the necessary infrastructure improvements including new roads/projects listed in Table 6.1: Priority Transportation Infrastructure Projects for County Galway 2022-2028 and those listed within Table 6.2: Regional/Local Projects Proposed for 2022-2028…"*

Table 6.2 of the Draft CDP refers to regional/local projects proposed for 2022-2028. As shown in Figure 2-13, the Proposed Road Development is considered a regional road, of relevance, its further states that; "*Local and regional road networks within the County*", have an objective to; "*Continue strengthening, improvements and realignment work where necessary, to these networks.*"

In reviewing the Draft CDP for 2022-2028, it is our view that the concept, principles, and design process of the Proposed Road Development is considered compliant with the policies and objectives set out in the current Draft CDP.

2.3.5 Policy Summary

The Policy section of this chapter has highlighted that the Proposed Road Development is compliant with planning policies at a European, national, regional and local levels. The principles of the Proposed Road Development will particularly assist with:

- Supporting the objectives of the TEN-T in broad terms by improving the connection to Junction 19 on the M17 TEN-T network;
- Enhancing regional and local accessibility, by providing improved accessibility and social inclusion to community facilities and to heritage resources;
- Maintain the strategic capacity and safety of the national roads network including planning for future capacity enhancements;
- Sustaining the economic growth through the provision of improved transport connectivity in this rural location;
- Enhancing environmental benefits, through a reduction in traffic queuing and journey time reliability;
- Improved safety through improved road alignment, pedestrian and cycle user segregation, and ultimately reducing collisions in line with the Road Safety Strategy;

- Ensuring adequate transport infrastructure is in place to meet demands from continued population growth; and
- Protecting and safeguarding investment made in strategic transportation infrastructure.

2.4 Summary

In summary:

- The Proposed Road Development is a multi-modal transport scheme, with a provision for both cyclists and pedestrians. The Proposed Road Development will improve journeys across the Abbert River, with improved horizontal and vertical alignments. These improved cross-sections, realignment and upgraded junctions will improve safety, particularly for pedestrians and cyclists;
- The N63 currently experiences significant traffic congestion issues in the vicinity of the Liss Bridge. The Proposed Road Development will assist in the alleviation of these issues at the local level, while improving safety for both motorised and non-motorised users. Any proposed upgrade to the current sub-standard N63 alignment will improve the route consistency of the national road network and increase the overtaking opportunities. This will help with connectivity between these areas and improve journey times and reliability;
- The overall ambition of the Proposed Road development is to achieve a number of specific objectives under a number of multi criteria categories: economy, safety, environment, accessibility and social inclusion, integration and physical activity. Each of the objectives are linked to the European, national, regional and local policies set out in this chapter; and
- The Proposed Road Development is compliant with planning policies at a European, national, regional and local level. The overall purpose of the Proposed Road Development is to assist in tackling the existing issues of traffic congestion for this section of the road, while improving safety for motorised and non-motorised users.

2.5 References

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 03: Consideration of Alternatives

Galway County Council

February 2022

Table of Contents

Figures

Tables

Volume 03 Figures

Volume 04 Appendices

3. Consideration of Alternatives

3.1 Introduction

A requirement of the Environmental Impact Assessment (EIA) process is the consideration and presentation of reasonable alternatives studied which are relevant to the key project decisions in the context of environmental impact. EIA guidance and legislation requires that consideration of these alternatives should include, where relevant; design, location, routes, alignments/layouts, processes, technology, size, and scale.

Article 5(1)(d) of Directive 201192/EU, as amended by Directive 2014/52/EU, requires an Environmental Impact Assessment Report (EIAR) to contain:

> *"A description of the reasonable alternatives studied by the developer, which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment".*

Also, pursuant to Section 50(2)(b) of the Roads Act 1993 (as amended), the EIAR is to contain *"(iv) a description of the reasonable alternatives studied by the road authority or the Authority, as the case may be, which are relevant to the proposed road development and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed road development on the environment".* This chapter outlines the reasonable alternatives considered during the lifetime of the project and provides an overview of the main reasons for selecting the Proposed Road Development option carried forward and assessed within this EIAR. The alternatives considered are grouped as follows:

- 'Do-Nothing' Alternative;
- 'Do-Minimum' Alternative;
- Alternative Modes;
- Strategic Alternatives– Route Alignment options; and
- Design Development Alternatives (alternative locations and alternative layouts).

The review of alternatives considered did not include any traffic management options or the option to improve public transport links in the area as these were not seen as viable to complete the project objectives.

It is noted that a full Options Selection process was undertaken for this Proposed Road Development as part of the earlier phases of the project and this document is included as an Appendix to this EIAR (Volume 04; Appendix A3-1).

3.2 Project Constraints Study

The study area was defined at the early stages of the project development. Its location was initially determined by the location of key network safety issues identified for the Proposed Road Development and the extent of the study was determined to allow for all viable alternatives, while tying into key topographical boundaries and including all key environmental constraints. It includes key constraints, such as the Lough Corrib Special Area of Conservation (SAC), and Knockmoy Abbey (National Monument No.166), and extends to cover all viable alternatives.

It is noted that the study area is curtailed on the south western side by the presence of Abbeyknockmoy village and the associated residential development along the existing N63 which limited viable alternatives beyond this point. On the North eastern side, the study area boundary covers the area needed to encompass all viable alternatives which meet the project objectives.

Following identification of the study area, a constraints study was undertaken to identify additional natural and artificial constraints that could potentially affect the choice and design of a route for the Proposed Road Development. The study included an overview of:

- Natural Constraints:
  - Biodiversity (incorporating Flora and Fauna);
  - Water (incorporating Flood Risk and Hydrology);
  - Land and Soils (incorporating Soils, Geology, and Hydrogeology); and
  - Landscape and Visual.
- Artificial constraints:
  - Land Use and Planning;
  - Engineering;
  - Agriculture;
  - Cultural Heritage (incorporating Architectural Heritage, Archaeology and the Historic Landscape)
  - Utilities;
  - Local Amenities, Community Activities and Facilities;
  - Noise and Vibration;
  - Air Quality and Climate; and
  - Population, Economy, Business and Tourism.

There were a number of constraints in the area including biodiversity, agriculture, air quality and climate, but the main constraints were cultural heritage (Knockmoy Abbey an important landmark (national monument) (), water (river crossing) and engineering constraints (horizontal geometry, and bridge spans). The constraints can be seen in Figure 3-1 and Volume 03; Figure A3-1. A number of policies and objectives are outlined within both the Galway County Development Plan 2015 – 2021 and the Draft Galway County Development Plan 2022-2028 that support the preservation of national and recorded monuments and their setting such as objectives ARC 1 and ARC 7 of the Galway County Development Plan 2015 – 2021 and policy objectives ARC 4 and ARC 9 of the Draft Galway County Development Plan 2022-2028.

> *"Objective ARC 1 Protection of Archaeological Sites: Protect archaeological sites and monuments their settings and visual amenity and archaeological objects and underwater archaeological sites that are listed in the Record of Monuments and Places, in the ownership/guardianship of the State, or that are subject of Preservation Orders or have been registered in the Register of Historic Monuments and seek to protect important archaeological landscapes;*
>
> *Objective ARC 7 & ARC 9 – Recorded Monuments: Ensure that any development in the immediate vicinity of a Recorded Monument is sensitively designed and sited and does not detract from the monument or its visual amenity".*

The location of the river crossing and skew of the bridge will be limited by the horizontal geometry of the Proposed Road Development. The full constraints study can be found in Chapter 05 of the Options Selection Report (Volume 04; Appendix A3-1).

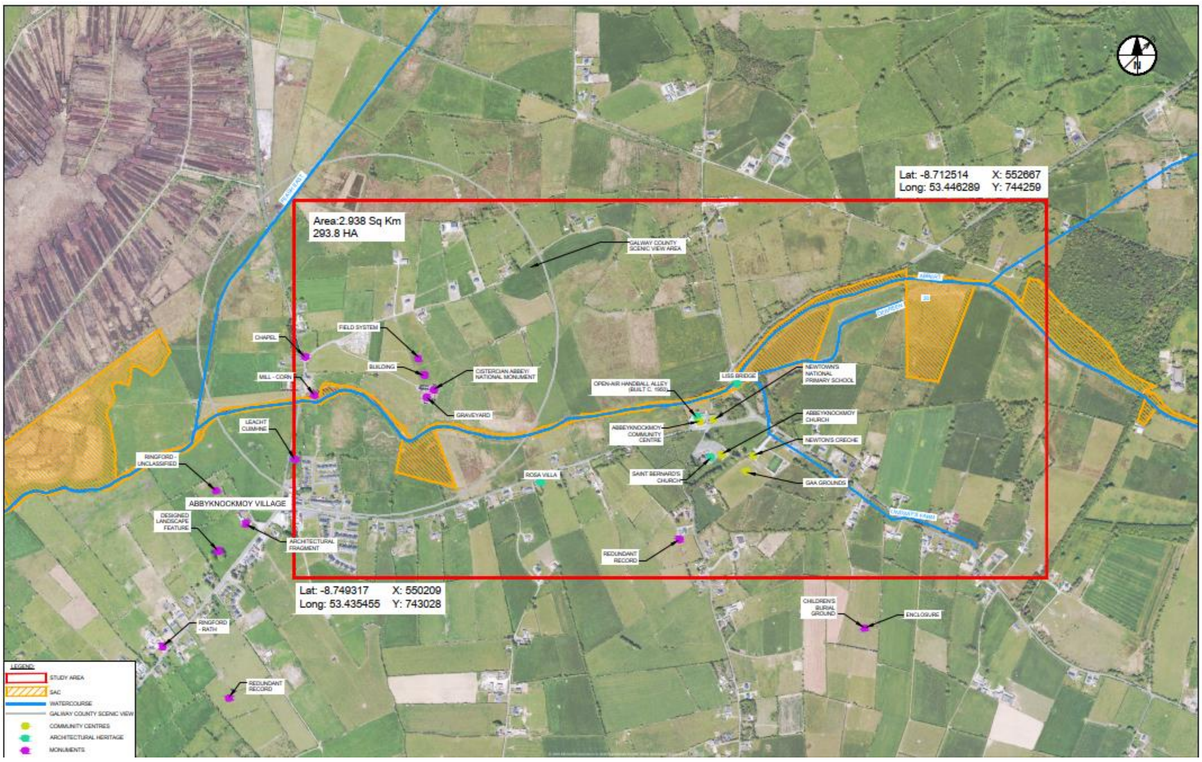

Figure 3-1 Study Area

(Also see Volume 03: Figure A3-1)

3.3 'Do-Nothing' Alternative

The 'Do-Nothing' consideration investigated the existing road infrastructure and its ability to meet future demands for traffic and safety without any upgrade works, other than routine maintenance. The definition in the Transport Infrastructure Ireland (TII) Project Appraisal Guidelines for National Roads (Unit 4.0 - Consideration of Alternatives and Options - PE-PAG-02013*)* (TII, 2016) is as follows:

> *"The Do-Nothing assumes that there will be no other investment in the transport network (other than regular maintenance) during the appraisal period beyond that being considered as part of the Proposed Road Development under appraisal. It is accepted, however, that in certain circumstances the Do-Minimum may actually be a Do-Nothing scenario".*

As per the EPA Draft Guidance, the 'Do-Nothing' scenario is defined as:

> *"The situation or environment which would exist if a proposed, development, project or process were not carried out. This scenario needs to take account of the continuation or change of current management regimes as well as the continuation or change of trends currently evident in the environment".*

The 'Do-Nothing' alternative would not provide for any additional crossing of the Abbert River or improvement of the existing road network other than routine maintenance.

The assessment for the 'Do-Nothing' alternative concluded that:

- Any local or regional traffic travelling on the N63 wishing to cross the Abbert River would be restricted by the existing substandard road geometry and existing Liss Bridge in both directions;
- There would be no positive economic benefits as it would not address the bridge crossing geometry or the conflict between regional traffic and local traffic which are the causes of the journey time problems;
- Would result in a further decrease in efficiency of the transportation infrastructure over time due to the structural integrity of the existing bridge;
- Would not offer any improvement to safety as it does not address the existing horizontal or vertical geometry of the road network;

- Would not benefit from active transport initiatives as it does not facilitate any improvement on these fronts;
- Would not facilitate the implementation of the Galway Transport Strategy measures; and
- Does not involve any construction works, therefore some short- to medium-term potential adverse effects of the Proposed Road Development on the existing environment would be avoided in the 'Do-Nothing' alternative. However, this alternative could lead to increased traffic congestion and potential negative environmental effects including:
  - Increased journey times;
  - From a Population and Human Health perspective the opportunity to improve congestion issues at Liss Bridge, while improving safety for both motorised and non-motorised users would be lost;
  - From a Noise and Vibration perspective noise levels are likely to remain similar to those currently experienced, with the potential for increases in noise levels resulting from traffic congestion with little scope for mitigation measures;
  - From a Water, and Land and Soils perspective the existing drainage infrastructure does not have any environmental protection measures in terms of surface water attenuation and hydrocarbon interceptors which would be included in any new works; and
  - A potential increase in emissions to air.

Based on the foregoing analysis, the 'Do-Nothing' alternative would not meet project objectives, as outlined in Chapter 02 Need and Planning Policy Context. Subsequent sections of this chapter identify and evaluate alternative means of carrying out the Proposed Road Development so that the positive effects would be enhanced, and negative effects avoided where practicable.

3.4 'Do-Minimum' Alternative

3.4.1 Do Minimum – Requirements

As an alternative to the 'Do-Nothing' alternative, the 'Do-Minimum' alternative investigated the potential to upgrade, rather than replace, the existing infrastructure to meet the predicted traffic and non-motorised user demands for the next 30 years. The 'Do-Minimum' alternative is defined in the TII 'Project Appraisal Guidelines for National Roads (Unit 4.0 - Consideration of Alternatives and Options - PE-PAG-02013)' (TII, 2016) as follows:

> *"The Do-Minimum Option provides the baseline for establishing the economic, integration, safety, environmental and accessibility impacts of all options.*
>
> *It also establishes much of the baseline information needed for the Project Brief and Environmental Impact Assessment, since it examines future year travel demand and its impact on a largely unimproved transportation system. This Do-Minimum Option is referred to as the Base Case within the CAF.*
>
> *The Do-Minimum Option should include those transportation facilities and services that are committed within the appraisal period. All elements of the Do-Minimum Option must be part of each proposed Do-Something Option except where an option replaces services or facilities within the corridor. To provide a basis of comparison the Do-Minimum Option must include the following features:*
>
> - *The maintenance of existing facilities and services in the study corridor and region;*
> - *The completion and maintenance of committed projects or policies in the study corridor that have successfully completed their environmental review; and*
> - *The continuation of existing transportation policies."*

3.4.2 Do Minimum – Overview & Issues

The 'Do-Minimum' alternative consists of maintaining the existing N63 in the study area and does not include any other significant interventions other than local minor improvements within the road boundary without consideration of any additional land take.

The 'Do-Minimum' alternative investigated the potential to undertake minor improvement works that would improve safety concerns in the vicinity of the Liss Bridge through localised widening and the introduction of traffic control across the bridge. It was proposed to introduce traffic signals across the bridge to help reduce vehicle conflicts and improve journey time consistency. However, this would have increased the overall journey time in both directions due to the traffic lights and would not ease the traffic and safety issues at the Liss Bridge. Due to the projected growth rate of traffic volumes, the delay in journey time would only be increased in the future due to the introduction of traffic signals.

The 'Do Minimum' alternative also considered if there was the potential to improve the drainage regime however it was concluded there was limited space available for this and it would not be feasible.

The 'Do-Minimum' alternative identified issues with a lack of additional crossings of the Abbert River, the narrow cross-section of the carriageway and poor alignment of the existing N63. Section 2.2.8 of Chapter 02 Need for the Scheme and Planning Policy identified issues such as poor horizontal and vertical alignment associated with the existing bridge over the Abbert River and little prospect of improving road safety as part of the Do minimum scheme. Numerous minor severity head-on collisions have taken place on the N63 mainline in the vicinity of the Liss Bridge (see Section 2.2.8 of Chapter 02 Need for the Scheme and Planning Policy for further information on existing road safety issues).

As part of the 'Do-Minimum' alternative, consideration was given to improving the junctions along the N63/ L3110 to improve driver safety. The limited width of the existing bridge over the Abbert River and the constrained environment in the area surrounding the bridge restrict the options for safety improvements. Improvements to the non-motorised users' facilities (pedestrian and cycle facilities in particular) along the N63 were therefore discounted and would not be viable as part of the Do minimum.

As noted for the Do-Nothing Option from an environmental perspective there would be limited opportunity to improve the safety of motorised and non-motorised users, noise levels are likely to remain similar to those currently experienced, however there would be potential for increases in noise levels resulting from traffic congestion with little scope for mitigation measures, and the existing drainage infrastructure does not have any environmental protection measures in terms of surface water attenuation and hydrocarbon interceptors which would be included in any new works.

3.5 Conclusion 'Do-Nothing/Do-Minimum'

Due to the minor works involved with the 'Do-Minimum' alternative, the 'Do-Nothing' and 'Do-Minimum' alternatives were combined and will be referred to as the 'Do-Nothing/Do-Minimum' alternative for the remainder of this report.

Overall, the 'Do-Nothing' and 'Do-Minimum' alternatives did not perform well in terms of the overall environmental assessment and assessment against the key project objectives as summarised below.

While potentially providing some improvement to safety, the 'Do-Nothing/Do-Minimum' alternative for the Proposed Road Development failed to address the two issues which are predominantly causing the current safety issues.

- Firstly, the 'Do-Nothing/Do-Minimum' alternative would still require all traffic traversing the Abbert River to cross the existing bridge, which has poor horizontal and vertical alignment. The 'Do-Nothing/Do-Minimum' would not improve river crossing options as there would be no new crossing points, due to the minimal works considered under this option.

- Secondly, there would be no economic benefits to traffic as journey times would be increased and there would be no additional capacity for traffic travelling through the area. The introduction of traffic signals across the bridge would help to prioritise traffic in one direction during peaks but the signals would not reduce congestion. The regional traffic and local traffic are not segregated, which results in little prospect of minimising conflict and improving road safety at the same time.

Due to the nature of the 'Do-Nothing/Do-Minimum' alternative, it is not proposed to introduce pedestrian/cyclist facilities as part of this option. The reason for this is that introducing these facilities along a section of road that has below-standard vertical and horizontal alignment may lead to an increase in safety risks for all road users and was deemed too high a risk to safety to be pursued.

The introduction of pedestrian/cyclist facilities were reviewed for other options, but these facilities would work best with options that provide a by-pass of the existing N63 within the study area. This by-pass would allow for the existing section of N63 to be downgraded and pedestrian/cyclist facilities introduced. The introduction of these facilities could require a reduction in the carriageway cross-section which would coincide with a downgrade of road but reducing the carriageway cross-section to introduce the pedestrian/cyclist facilities and keeping the road as a regional route would not be beneficial. It would lead to safety implications for all road users.

In addition, as noted previously noise levels are likely to remain similar to those currently experienced, however there would be potential for increases in noise levels resulting from traffic congestion with little scope for mitigation measures, and the existing drainage infrastructure does not have any environmental protection measures in terms of surface water attenuation and hydrocarbon interceptors which would be included in any new works. Overall, the 'Do-Nothing/Do-Minimum' alternative would not alleviate the existing safety concerns along the N63 or minimise journey times.

3.6 Alternative Modes

Cycling and Pedestrian Facilities

At present there are no dedicated cycle facilities within the area, and there are no planned works in this area. As part of this Proposed Road Development it is proposed to introduce cycling facilities along the bypassed section of the N63.

There is currently a minor network of footpaths and pedestrian facilities in the vicinity of the community facilities only and within parts of Abbeyknockmoy village, however there is no connecting facilities. It is recognised that there is an overall poor level of pedestrian provision in this area, and there are no planned works in this area.

The Proposed Road Development will facilitate active travel modes via connection to existing routes along the existing N63. This will be in the form of a dedicated pedestrian/cycle route. However dedicated pedestrian/cycle facilities alone would not address the project objectives outlined in 'Chapter 02 Need for the Scheme and Planning Policy'.

Public Transport

There are no railways within the study area. The railway to Galway runs south of the study area through Athenry and to the north the railway runs through Roscommon to Westport and Ballina. These lines form part of the Intercity railway network. There is a decommissioned railway line that runs north-south to the west of the study area that connected Tuam and Athenry, but this was decommissioned in 1993. As there are no railways within the study area it was not possible to consider rail as an alternative mode of transport.

Several regional bus routes pass through the study area. These are provided by operator Bus Éireann and Bus 4U. There are four bus stops in the study area, two westbound and two eastbound. There are eastbound and westbound facilities at Abbey, Newtown Cross which are served by Bus Éireann service no. 425 (Galway – Longford). At Mannion's Bar in Abbeyknockmoy there are eastbound and westbound facilities, these stops service the 425 route and the Bus 4U 433 service (Roscommon-Galway Cathedral). Improvements to the bus network or bus facilities would not meet the objectives for the Proposed Road Development and as such were discounted as an alternative option, however public transport will benefit from the Proposed Road Development overall in terms of journey time, safety, and improved access to bus stops. The existing safety issues on the N63 as identified in Section 2.2.6 and 2.2.8 of Chapter 02 Need for the Scheme and Planning Policy are also applicable to buses using the route

3.7 Strategic Alternatives - Route Corridor Options

3.7.1 Stage 1 – Preliminary Options Assessment

The Options Selection Report identified six primary Route Options (A to F) that may satisfy the Proposed Road Development objectives.

These Route Options were identified taking account of the engineering, economic and environmental considerations and having regard to the issues and constraints identified in the Constraints Study.

The option selection assessment process is summarised in the following sections. Further information can be found in the Options Selection Report (Volume 04; Appendix 3-1).

As part of the Stage 1 Preliminary Options Assessment process, six Route Options were developed within the study area to allow an accurate comparison of the alternative options, looking at different tie-in locations with particular regards to the western end of the Proposed Road Development.

Each Route Option was developed to a sufficient level of detail with different tie-in options and junction layouts considered; this was to ensure that all options were potential feasible routes.

All of the Stage 1 Route Options included one crossing of the Abbert River and a tie-in with the L3110 (no other interface with existing local roads or direct accesses were identified at this early stage). All bridge options for the offline routes clear spanned the Abbert River and SAC boundary. All Route Options had the same eastern and western tie-in points to the existing N63, with the current crossroad junction with the L6234 being partially realigned as part of the Proposed Road Development. The tie-in points were developed as a result of constraints to either end of the Proposed Road Development and developing suitable end points to the Proposed Road Development which met the project objectives. The Western extent was physically constrained by Abbeyknockmoy village, while the eastern extent was constrained by the end of the portion of the road that experiences safety issues. The introduction of pedestrian/cyclist facilities was reviewed as part of the route options strategy; however, these facilities would work best with options that provide a by-pass of the existing N63 within the study area. A downgrading of the existing N63 would be required to achieve the required cross-section that meets current road safety standards and also facilitates pedestrian/cyclist facilities being introduced.

A Stage 1 Preliminary Options Assessment was undertaken in accordance with the TII 2016 ‘Project Management Guidelines’ (herein referred to as Stage 1). The Route Options, in addition to the Do-Nothing/Do-Minimum option were subject to a Multi Criteria Analysis assessing Engineering, Economy and Environment.

The purpose of the Stage 1 assessment is to reduce the number of feasible route options to progress through a more detailed and refined assessment of the options as part of the Stage 2 Project Appraisal process. Table 3-1 below summarises the findings from the Stage 1 assessment.

Following the Stage 1 Preliminary Options Assessment, it was decided that three Options (A, B and C) and the Do-Nothing/Do-Minimum should be brought forward to Stage 2 Project Appraisal.

3.7.1.1 Stage 1 – Options and Comparison of Options

The six Stage 1 Route Options are shown in Volume 03; Figure A3-3. The length of each option was as follows;

- Option A – Cyan – 2.12 km;
- Option B – Green – 2.08 km;
- Option C – Yellow – 2.08 km;
- Option D – Pink – 2.06 km;
- Option E – Blue – 2.04 km; and
- Option F – Red – 2.1 km.

A summary and comparison of each option is described below.

3.7.1.1.1 Option A – Cyan

Option A (Cyan) would commence at the fixed tie-in point to the north-east of the study area where it deviates from the existing N63 alignment. From there, the horizontal alignment would run west across a small area of woodland, then the L6159 and into a vast area of agricultural land.

The current L3110 would be extended across the existing Liss Bridge to tie into the proposed alignment through a junction.

The horizontal alignment would sweep south with a tight horizontal curve leading to a new crossing over the Abbert River. Then, it would sweep west again with a tight horizontal curve through more agricultural land to tie back into the existing N63 to the east of Abbeyknockmoy village.

Option A would require significant greenfield land take which could impact upon habitat connectivity, the crossing of the Abbert River and the loss of mature hedgerow where the eastern section of this option ties in with existing infrastructure. The provision of a bridge over Abbert River, part of Lough Corrib SAC, could also cause potential impacts.

Option A results in high effects on the landscape character due to the introduction of extended offline road infrastructure and associated embankments. Visually, Option A is located within an area designated as 'Landscape Focal Point/View' No. 26 – Knockmoy Abbey Southeast of Tuam. This option will considerably alter the visual setting of Knockmoy Abbey as well as views south and east from the Abbey. Option A will become a new feature in views to the north from residential properties located along the existing N63 as well as view to the south from residences located along a local road 'Old Road' north of Knockmoy Abbey.

Option A crosses a field system associated with Knockmoy Abbey and passes in close proximity to the abbey itself, both are protected National Monuments.

3.7.1.1.2 Option B – Green

Option B (Green) would commence at the fixed tie-in point to the north-east of the study area where it would deviate from the existing N63 alignment. From there, the horizontal alignment would run west across a small area of woodland, then the L6159 and into a vast area of agricultural land.

The current L3110 would be extended across the existing Liss Bridge to tie into the proposed alignment through a junction.

The horizontal alignment would sweep south leading to a new skewed crossing over the Abbert River. Then it would sweep west again through more agricultural land to tie back into the existing N63 to the east of Abbeyknockmoy village.

Option B would require significant greenfield land take which could impact upon habitat connectivity, the crossing of the Abbert River and the loss of mature hedgerow where the eastern section of this option ties in with existing infrastructure. The provision of a bridge over Abbert River, part of Lough Corrib SAC, could also cause potential impacts.

Option B will result in high effects on the landscape character due to the introduction of extended offline road infrastructure and associated embankments. The views to and from Knockmoy Abbey will be altered, and the visual setting of the abbey as well as views southeast and east from the abbey will be altered. Option B will become a more prominent new feature in available views to the north of residences along the existing N63.

Option B has considerably higher land takes than the other corridors and passes in close proximity to Knockmoy Abbey and an associated medieval field system which are both protected National Monuments.

3.7.1.1.3 Option C – Yellow

Option C (Yellow) would commence at the fixed tie-in point to the north-east of the study area where it deviates from the existing N63 alignment. From there, the horizontal alignment would run west across a small area of woodland, then would sweep south-west across the L6159 and into a vast area of agricultural land.

The current L3110 would be extended across the existing Liss Bridge to tie into the proposed alignment through a junction.

The horizontal alignment would continue south-west leading to a new skewed crossing over the Abbert River. Then, it would sweep west again through more agricultural land to tie back into the existing N63 to the east of the local road L21821. Then, the Option would run along the existing N63 until the western tie-in point.

Option C would require significant greenfield land take which could impact upon habitat connectivity, the crossing of the Abbert River and the loss of mature hedgerow where the eastern section of this option ties in with existing infrastructure. The provision of a bridge over Abbert River, part of Lough Corrib SAC, could also cause potential impacts.

Option C is one of the shortest offline options resulting in lower effects on the landscape character. The proposed route will be seen in views to the east from Knockmoy Abbey but much further away than Options A and B. Option C will be located closer to community facilities and the school resulting in higher visual effects from these locations.

Options C is likely to experience negative noise and/or vibration impacts during construction and operation due to high numbers of sensitive receptors within 50 m of the carriageway. Option C also has a high number of air quality receptors within 50 m of the carriageway.

Options C passes within the immediate vicinity of Rose Villa (National Inventory of Architectural Heritage (NIAH) No. 30405814) and the handball alley (NIAH No. 30405810) posing a visual intrusion on their settings.

3.7.1.1.4 Option D – Pink

Option D (Pink) would commence at the fixed tie-in point to the north-east of the study area. From here, the horizontal alignment would run along the existing N63 across a small area of woodland and it deviates from the existing N63 alignment on the approach to the L6159.

The current L3110 would be extended across the existing Liss Bridge to tie into the proposed alignment through a junction.

The horizontal alignment would continue south-west leading to a new skewed crossing over the Abbert River to the west of the existing Liss Bridge. The horizontal alignment would pass in close proximity to the north of Newtown National Primary school and then sweeps west again through agricultural land to tie back into the existing N63 to the west of the Newtown National Primary school. Then, the Option would run along the existing N63 until the western tie-in point.

Option D would require significant greenfield land take which could impact upon habitat connectivity, the crossing of the Abbert River and the loss of mature hedgerow where the eastern section of this option ties in with existing infrastructure. The provision of a bridge over Abbert River, part of Lough Corrib SAC, could also cause potential impacts.

Visual effects are considered high as sections of the Option will be located adjacent to community facilities and the school, which are considered highly sensitive receptors.

Options D passes within the immediate vicinity of Rose Villa (NIAH No. 30405814) and the handball alley (NIAH No. 30405810) posing a visual intrusion on their settings.

3.7.1.1.5 Option E – Blue

Option E (Blue) would substantially represent an online improvement option. The Option would commence at the fixed tie-in point to the north-east of the study area. From here, the horizontal alignment would run along the existing N63 until it develops into a three-armed roundabout which connects the L6159 to the north and the tie in with the existing Liss Bridge to the south.

The Option would continue across the Abbert River along the existing alignment before introducing a new three-armed roundabout, which connects the L3110 to the two arms for the N63 heading north and west. Then, the Option would run along the existing N63 until the western tie-in point.

Option E traverses along the existing road infrastructure but also requires land take of green field at the eastern extent of the study area where arms of the proposed option deviate from existing infrastructure. Visual effects will arise mainly due to the slight realignment of the ‘Old Road’ and the introduction of two new roundabouts, which may impact on existing vegetation in close proximity, particular the roundabout with the existing N63 and L3110.

Options E has a high number of sensitive air quality receptors within 50 m of the carriageway.

Option E passes directly over the pre-existing Liss Bridge (NIAH 30405811) which is a Protected Structure (RPS No. 3925).

3.7.1.1.6 Option F – Red

Option F (Red) Option C (Yellow) would commence at the fixed tie-in point to the north-east of the study area where it deviates from the existing N63 alignment. From here, the horizontal alignment would sweep immediately south-west across a small area of woodland and cross the Abbert River at a more easterly point than the other options.

The horizontal alignment would then continue south west between two areas of the Lough Corrib SAC before sweeping west through agricultural land and across some minor watercourses.

The Option would tie back into the existing N63 at the junction with the L3110, which would be upgraded to a four-armed roundabout. Then, the Option would run along the existing N63 until the western tie-in point.

Option F will require one crossing over the Derreen Stream and Lindsay's Farm watercourse. This option is considered the least favourable from a biodiversity point of view as the option will require the crossing of the Abbert River and culverts may be required to cross the Derreen watercourse and it would cut through a portion of mature woodland. The removal of greenfield, woodland and mature hedgerow could impact protected species such as bats, badgers and breeding birds. The provision for a bridge over Abbert River, part of Lough Corrib SAC, could cause potential impacts. Crossing works could also cause potential impacts on the Derreen watercourse.

Option F will have the highest impact on existing stands of trees and hedgerows of all options and contains a longer offline section cross green fields than Options C-E.

Option F has a high numbers of sensitive noise and/or vibration and air quality receptors within 50 m of the carriageway and are therefore more likely to experience negative noise and/or vibration impacts during construction and operation.

Options F passes within the immediate vicinity of Rose Villa (NIAH No. 30405814) and the handball alley (NIAH No. 30405810) posing a visual intrusion on their settings.

3.7.1.1.6.1 Do -Nothing/Do Minimum Option

The opportunity to improve congestion issues at Liss Bridge, while improving safety for both motorised and non-motorised users would be lost. Noise levels are likely to remain similar to those currently experienced, however there would be potential for increases in noise levels resulting from traffic congestion with little scope for mitigation measures, and the existing drainage infrastructure does not have any environmental protection measures in terms of surface water attenuation and hydrocarbon interceptors which would be included in any new works.

3.7.1.1.7 Summary

When all environmental constraints were taken into consideration Option A (Cyan) was identified as the least preferred option when compared against other options B to F. All other options scored similarly bar the do nothing/do minimum scenario which scored not significant/neutral.

Table 3-1 Stage 1 Preliminary Options Assessment Summary

	Do-Nothing/Do-Minimum Option	Option A (Cyan)	Option B (Green)	Option C (Yellow)	Option D (Pink)	Option E (Blue)	Option F (Red)
Engineering	Minor or slightly negative	Moderately positive	Major or highly positive	Minor or slightly positive	Not significant or neutral	Minor or slightly negative	Minor or slightly negative
Environment	Not significant or neutral	Major or highly negative	Moderately negative	Moderately negative	Moderately negative	Moderately negative	Moderately negative
Economy	Minor or slightly negative	Minor or slightly positive	Moderately positive	Minor or slightly positive	Not significant or neutral	Minor or slightly negative	Not significant or neutral
Overall Ranking	**Minor or slightly negative**	**Not significant or neutral**	**Minor or slightly positive**	**Not significant or neutral**	**Minor or slightly negative**	**Moderately negative**	**Minor or slightly negative**

3.7.1.2 Public Consultation 1 (PC1)

Following consideration of the Stage 1 – Preliminary Options Assessment, and prior to commencing the Stage 2 – Project Appraisal Matrix, a Public Consultation (PC1) was held on 02nd October 2019 between 2:30pm and 7:30pm at the Abbeyknockmoy Community Centre.

The purpose of the consultation was to present the study area and the six route options that emerged from the Stage 1 Assessment to the public.

The objective of the Public Consultation was to:

- Introduce the Proposed Road Development and engage with local stakeholders;
- Present the study area and options to the public;
- Inform the public of the process and programme for the project;
- Invite submissions on the Route Options; and
- Gather local information, which may not be known to the design team.

Following the Public Consultation, members of the public were asked to submit comments and feedback to Galway County Council. A total of 134 submissions were received from the public.

3.7.1.2.1 Public Feedback

A number of the PC1 submissions received indicated a Route Option preference:

- Option A – Cyan – ranked first preference by five people;
- Option B – Green – ranked first preference by twelve people;
- Option C – Yellow – ranked first preference by fourteen people;
- Option D – Pink – ranked first preference by one person;
- Option E – Blue – ranked first preference by zero people; and
- Option F – Red -– ranked first preference by two people.

Options B and C were the clear favourites with 12 and 14 attendees ranking them as first choice respectively. There were some concerns raised with regard to the proximity to residential homes and junction alignment.

An analysis of the submissions highlighted the following comments and concerns:

- 96 of the letters submitted were in support of the Proposed Road Development but requested that the Proposed Road Development include cycle and pedestrian facilities, improved road lighting, traffic calming and potential pedestrian crossings;
- The majority of the attendees expressed a strong interest in cycle and pedestrian facilities along the existing N63, linking the residential area of Abbeyknockmoy to the community facilities, to be included as part of this Proposed Road Development;
- Option E was less favourable amongst the public as it does not provide a new river crossing;
- Concern was raised about the western tie into the Proposed Road Development and the land take this would require from residential properties in this area;
- The proximity to Knockmoy Abbey was raised and it was highlighted that the views of the Abbey from the road should advertise the Abbey in a positive light; and
- Any road alignment and bridge crossing should be sympathetic to Knockmoy Abbey.

3.7.2 Stage 2 – Project Appraisal of Route Options

A number of amendments and alterations made to the route options between Stage 1 Preliminary Options Assessment and the Stage 2 Project Appraisal of Route Options (herein referred to as Stage 2). The three highest ranking Route Options and the 'Do-Nothing/Do-Minimum option were progressed from the Stage 1 assessment.

The Options brought forward to Stage 2 were Options A, B and C (Volume 03: Figure A3.4) as overall these three Options resulted in positive results.

Prior to the commencement of Stage 2, further investigations were carried out along each of the three Route Options. The purpose of these investigations was to identify specific issues and to refine the alignments where possible to reduce any potential impacts. There were no major changes between the Stage 1 Route Options and those brought forward to Stage 2. Where possible, Route Options were amended locally and in consultation with all disciplines to minimise impacts, while respecting the study area constraints.

3.7.2.1 Stage 2 – Project Appraisal of Route Options

In accordance with the TII Project Management Guideline 2019 (PE-PMG-02041), a comparison of different Options was carried out using the six Common Appraisal Framework criteria:

- Economy;
- Safety;
- Environment;
- Integration;
- Accessibility & Social Inclusion; and
- Physical Activity[1].

Each of the three Options were ranked based on the same criteria as Stage 1, achieving a score between 'major or highly positive' to 'major or highly negative'. Where all Options are broadly similar in impact/benefit, a rating of a similar level was used. The overall Stage 2 Options Assessment Matrix is presented in Table 3-2 below.

3.7.2.2 Stage 2 Options

All the Route Options presented in the following paragraphs include one new crossing of the Abbert River and an at-grade junction with the L3110. All Route Options would have the same tie-in points to the east and west of the study area. For the purpose of Stage 2, all Route Options were reviewed with the existing Liss Bridge remaining open to vehicles.

As part of the development of the Route Options and considering the feedback received at the Proposed Road Development Public Consultation event, it was proposed to include facilities for non-motorised users along the existing N63. These facilities are expected to be implemented by provision of a footway and/or cycleway along one side of the existing N63; however, the detail of this is subject to development at Phase 3 - Preliminary Design. As such, the provision for non-motorised users would not be required along the realigned section of the N63.

All three Options will also require the acquisition of greenfield lands and would likely result in the loss of treelines and hedgerows between agricultural fields. The removal of trees and hedgerows could impact upon bat roosts, and foraging success and could also impact upon breeding birds should trees be removed during the breeding season. The provision for a bridge over Abbert River, which forms part of Lough Corrib SAC, could cause potential impacts during the construction and operational phases. During construction this would include at the construction site and downstream related to instream works or works in close proximity to the SAC. All Options will require the development of sections of offline road over a 'Regionally Important aquifer'.

3.7.2.2.1 Option A (Cyan)

Beginning at Abbeyknockmoy village this Option sweeps offline to the north of the existing N63 through agricultural land before crossing the Abbert River and passing in close proximity to Knockmoy Abbey. The proposed alignment then sweeps east and continues through more agricultural land, running parallel to the existing N63. The alignment then crosses the L6159 and continues east through an area of existing woodland until it ties in with the existing

[1] Department of Transport, Tourism and Sport - Common Appraisal Framework For Transport Projects And Programmes (March 2016)

N63 at the junction with the L6234. The existing L6159 is realigned to create a north/south staggered junction with the proposed alignment and the L6234 is realigned to tie in with the new alignment.

This Option would result in the most land take and offline works, due to the offline nature of the works it should reduce the visual impacts and pollution near residential areas. It has the least skewed crossing of the Abbert River which should minimise the impact on the watercourse and the SAC. This Option is the one that comes in closest proximity to Knockmoy Abbey, although it should not impact on the Galway County Scenic View.

Option A has the potential to result in the highest effects on the landscape character as well as the visual amenity of residences and Knockmoy Abbey due to its long offline section and its proximity to the abbey.

This option crosses a field system associated with the Knockmoy Abbey. The Option also passes in close proximity to the abbey itself. Both Knockmoy Abbey (NM No. 166; GA058-004001), and field system (NM No. 166 & PO No. 4/1989; GA058-004004) are protected National Monuments.

Option A has the highest potential land take and will sever most agricultural land parcels.

3.7.2.2.2 Option B (Green)

Beginning at Abbeyknockmoy village this Option deviates offline to the north of the existing N63 and continues in a north-easterly direction through agricultural land before crossing the Abbert River at a skewed angle of approximately thirty-five degrees. The proposed alignment then sweeps east and continues through more agricultural land, running parallel to the existing N63. The alignment then crosses the L6159 and continues east through an area of existing woodland until it ties in with the existing N63 at the junction with the L6234. The existing L6159 is realigned to create a north/south staggered junction with the proposed alignment and the L6234 is realigned to tie in with the new alignment.

This Option uses tighter horizontal radii than Option A which should result in less land take required, reduced impact on agricultural land and increases the distance between the proposed alignment and Knockmoy Abbey. Due to the offline nature of the works it should reduce the visual impacts and pollution near residential areas, but there will be a greater impact on some dwellings compared to Option A. The skewed crossing of the Abbert River would impact on the watercourse and the SAC.

Effects related to Option B on the landscape character and the visual amenity are less than for Option A due to its location further east from the Knockmoy Abbey. However, residential receptors to the south along the existing N63, with a view of the Knockmoy Abbey, will experience higher visual effects as the proposal is located closer to these receptors.

This option passes in close proximity to Knockmoy Abbey (NM No. 166 & GA058-004001) and an associated medieval field system (NM No. 166; PO No. 4/1989; GA058-004004) which are both protected National Monuments.

3.7.2.2.3 Option C (Yellow)

Beginning at Abbeyknockmoy village this Option takes advantage of the existing N63 alignment and then deviates offline to the north of the existing N63 before it reaches the Abbeyknockmoy Community Centre. It continues in a north-easterly direction through agricultural land before crossing the Abbert River at a skewed angle of approximately thirty degrees. The proposed alignment continues in a north-easterly direction and continues through more agricultural land. The alignment then crosses the L6159 and continues north-eastern through an area of existing woodland until sweeps east and ties in with the existing N63 at the junction with the L6234. The existing L6159 would be realigned to create a four-armed roundabout with the proposed alignment and the L6234 is realigned to tie in with the new alignment.

This Option uses tighter horizontal radii than the other Options and includes an online section which should result in less land take required, and reduced impact on agricultural land. As the alignment is online it should not introduce a new conflict with Knockmoy Abbey. Due to the online nature of the works there would be visual impacts and pollution near residential areas, including where the proposed alignment comes in close proximity to the rear of the Community Centre. This Option has the greatest skewed crossing of the Abbert River and would result in the greatest impact on the watercourse and the SAC.

Due to the location of the development away from Knockmoy Abbey and residences the visual effects upon the residential dwellings and the Knockmoy Abbey are reduced. While visual effects on community facilities would be higher than for Options A and B, the overall effects on the landscape character and visual amenity are less than for Options A and B.

Option C has less potential for the inclusion of mitigation measures to reduce noise impacts upon noise sensitive receptors when compared to Options A and B.

This option passes within the immediate vicinity of Rose Villa (NIAH No. 30405814) and the handball alley (NIAH No. 30405810) posing a visual intrusion on their settings. This Option had the least impact on cultural heritage receptors.

Based on the Index of Overall Change in Exposure Calculations, there is likely to be an decrease in air quality with Route C.

3.7.2.3 Emerging Preferred Route

From the Stage 2 assessment, it was recommended that Option B should be taken forward as the Emerging Preferred Option for the N63 Realignment Scheme (see Table 3-2 below).

As detailed in the table, all Stage 2 Options would have a negative impact on the environment but due to the land take impact and the impact on the Abbert River, Option B was one of the better options and it provides benefits under all other headings considered.

Table 3-2 Project Appraisal Matrix Summary

	Do-Nothing/Do-Minimum Option	Option A (Cyan)	Option B (Green)	Option C (Yellow)
Economy	Major or highly negative	Moderately positive	Major or highly positive	Minor or slightly positive
Safety	Moderately negative	Moderately positive	Moderately positive	Moderately positive
Environment	Not significant or neutral	Major or highly negative	Moderately Negative	Moderately negative
Integration	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Accessibility & Social Inclusion	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Physical Activity	Not significant or neutral	Moderately positive	Moderately positive	Moderately positive
Overall Ranking	**Minor or slightly negative**	**Not significant or neutral**	**Minor or slightly positive**	**Not significant or neutral**

3.7.2.4 Public Consultation 2 (PC2) – Emerging Preferred Route

Public Consultation 2 (PC2) took place on 03rd February 2020 between 2.00pm and 7.00pm at the Abbeyknockmoy Community Centre.

The purpose of PC2 was to present the three Options that were studied at Stage 2 and present the Emerging Preferred Route. These were;

- Option A – Cyan;
- Option B – Green (Emerging Preferred Route); and
- Option C – Yellow.

The objectives of the Public Consultation were to:

1. Introduce the Emerging Preferred Route and engage with local stakeholders;
2. Invite submissions on the Emerging Preferred Route;
3. Inform the public of the process and programme for the project; and
4. Gather local information, which may not be known to the design team.

Large scale maps and a brochure of the Emerging Preferred Route were presented to the public, as shown in Volume 03; Figure A3.5.

3.7.2.4.1 Public Feedback

A total of 32 submissions were received from the public. A number of the PC2 submissions received indicated they were content with the Emerging Preferred Route.

An analysis of the submissions highlighted the following comments and concerns:

- The majority of the attendees expressed a strong interest in cycle and pedestrian facilities along the existing N63, linking the two sections of Abbeyknockmoy to be included as part of this Proposed Road Development;
- The existing Liss Bridge should be retained for vehicular access;
- Concerns were raised regarding the levels of the road and the proposed bridge and these should be reviewed to minimise visual impacts on Knockmoy Abbey; and
- There were some landowners concerned about land take and the location of the roundabout in relation to their homes.

The public were overall in favour of the Proposed Road Development with the safety benefits of moving traffic away from community facilities clearly seen.

A general preference for the Emerging Preferred Route was indicated during the consultation and in the subsequent submissions. There was concern from landowners due to proximity of the Proposed Road Development to a number of homes and the visual impacts of the route but these were reviewed in further detail during the preliminary design stage. This review led to some alignment changes from the original route corridor.

During the consultation, the desire for non-motorised user facilities to be introduced to connect the community facilities to the dwellings to the west of the study area was heavily emphasised by public response.

3.7.3 Conclusions

The route selection process concluded that that the Emerging Preferred Route was Route Option B. It was recommended that this option be adopted as the preferred route and was therefore taken forward to the preliminary design stage.

3.8 Design Development and Alternatives

The following sections outline the main design alternatives considered, the assessment process undertaken to refine the proposed design, as well as the rationale behind some of the main design development solutions.

Amendments made throughout the preliminary design process included development of accommodation works via consultation with directly impacted landowners, refinement of local junctions and access arrangements in order to improve accessibility and performance. Horizontal alignment alterations were undertaken to minimise impact on property owners.

3.8.1 Alignment Alternatives

Following the identification of the Emerging Preferred Route, various alignment options were investigated with the aim to minimise impacts on residential properties.

The proximity of the Emerging Preferred Route to a private dwelling was raised as a concern through the Public Consultation process. The existing dwelling is located on the L6159 and the proposed N63 would be located to the south of the dwelling.

Reviewing the existing alignment and taking into consideration; horizontal curvature, overtaking sections, departures from standard and the local residents, it was proposed to realign a section of the mainline carriageway. The updated alignment would have horizontal curvature one step below desirable minimum for 100 km/h design speed (510 m radius) but would increase the distance from the residential properties of approximately 25 m. The original and revised alignment can be seen in Volume 03; Figure A3-7.

3.8.2 Junction Strategy

Five junction areas were identified along the Proposed Road Development. Three junction areas were located along the proposed mainline: a western tie in (Area 1), a crossroads with L6159 (Area 2), and an eastern tie in, which included the junction with the L6234 (Area 3). The layout of the existing junction between the existing N63 and the L3110 (Area 4) and the reclassification of the Liss Bridge (Area 5) were also considered during this Proposed Road Development refinement. The five junction areas noted above can be seen in Volume 3; Figure A3-6.

A review was carried out to identify and detail different junction options available for each area and select the preferred option. The junctions options for each area were considered in detail along with the proposed layout of the pedestrian and cycle facilities routes. The alternatives junction options considered and the preferred options are outlined below.

3.8.2.1 Area 1

The alternatives considered for this area were all roundabouts, with different locations and number of arms. There were four locations considered for the roundabout with the proximity to Abbeyknockmoy being the alternating factor, the location of the roundabout on a North-South plane was restricted by the horizontal geometry of the road. The number of arms varied with each location, with the minimum being two arms, the proposed mainline, and the maximum being four arms, with the additional arms being local road connections. The preferred location was selected based on ground conditions, land take and tie in points.

A number of options in Area 1 would not be able to provide pedestrian and cycle crossing points on traffic islands however the intention was to improve pedestrian and cyclist safety by using the N63 for pedestrian and cyclist facilities, introducing a clear segregation between the vehicular traffic on the National Road and the NMU route.

3.8.2.2 Area 2

A variety of alternatives were considered for this location, including closing off existing side roads, roundabouts and staggered junctions. Three arm, and four arm roundabouts were considered but were discontinued due to the impact on mainline vehicles travel time. Closing off existing roads was discontinued due to access arrangements. A staggered junction was chosen as the preferred option due to safety implications, traffic flows and access.

3.8.2.3 Area 3

The alternatives considered for this location included closing off existing side roads, retaining the existing layout and staggered junctions. Due to safety implications it was deemed unsafe to leave the junction in its current form. It was agreed that a staggered junction would be the safest option for this location.

The southern junction location would be limited due to the watercourse crossing.

3.8.2.4 Area 4

The alternatives for this location took into consideration the change of traffic flows and that the major movements would no longer be along the N63 old alignment. The alternatives for this location included a mini roundabout and a rearranged junction to change the priority of the junction. Due to traffic volumes a mini roundabout was discontinued, and it was accepted that a simple Give-Way junction with a new priority was the most appropriate option.

3.8.2.5 Area 5

Consideration was given to the existing Liss Bridge under the Junction Options review, and alternatives included closing the bridge completely, using it for pedestrian access only and introducing a one-way system across the bridge to mitigate safety issues. Due to access arrangements, closing the bridge to vehicular access was discontinued. Introducing a one-way yield system to the bridge was the preferred alternative as it mitigated the risk of collisions on the bridge.

3.8.2.6 Summary

The preferred junction option for each area are noted below:

- Area 1 – Western Tie-In: 3 Arm Roundabout;
- Area 2 – Central Tie-In: Right/Left Staggered Junction;
- Area 3 – Eastern Tie-In: Left/Right Staggered Junction;
- Area 4 – L3110 Tie-In: Realignment of priority at T-Junction; and
- Area 5 – Liss Bridge Options: Traffic Management (One-Way Yield).

The need for dedicated pedestrian and cycle facilities route was raised frequently during the Public Consultations and this was reviewed along with the junction options. It was deemed that a connection along the existing downgraded N63 between the residential area and the community facilities would be more beneficial than including the pedestrian and cycle facilities along the new section of road, as this would facilitate connection between the residential area and the community facilities of Abbeyknockmoy.

3.8.3 Bridge Options

Following identification of the Emerging Preferred Route and the preferred route alignment at the Abbert River crossing point, a Structural Options Report was developed to investigate the various bridge options which may be considered and to establish the most appropriate river crossing option based on a Multi Criteria Analysis (MCA) for a number of key constraints. The full report is included in Volume 04; Appendix A3-2.

There were three bridge options and they all assumed a Type 2 Single Carriageway as the minimum desirable cross-section at the bridge crossing location. The minimum bridge cross-section will be 14 m wide, comprised as follows:

- 0.5 m Parapet Edge Beam;
- 2.5 m Raised Verge;
- 0.5 m Hard Strip;
- 3.5 m Traffic Lane;
- 3.5 m Traffic Lane;
- 0.5 m Hard Strip;
- 2.5 m Raised Verge; and
- 0.5 m Parapet Edge Beam.

The three options considered for the bridge are outlined below.

The potential environmental impacts of the bridge construction were considered as part of project planning. The impacts on human health, biodiversity, the landscape and climate were just a few of the factors considered. The magnitude of the environmental effects was related to a number of factors such as the location, quantity and choice of materials, span and structural form etc.

3.8.3.1 Option 1 – Precast Portal Frame

Option 1 would be a buried precast portal frame solution. The frame would span perpendicular to the Abbert River with an internal span of 20.5 m.

Spanning perpendicular to the river results in large dead zone areas on either side of the carriageway alignment, it is assumed that no vehicular access would be provided to these dead zones with a vehicle restraint system provided parallel to the carriageway to retain accidental vehicles.

Precast gravity retaining wingwalls would also be provided to retain the earthworks on approach and departure to the structure. These earthworks would be significant and bulge outwards from the highway alignment due to the large width of the bridge. Large areas of exposed concrete at the wingwalls would be finished with a pattern profile finish to improve aesthetics and avoid large areas of plain concrete.

Pre-cast concrete solutions would be maximised where possible. Pre-cast solutions reduce the installation time onsite, reduce the transportation requirements involved with delivery of the wet concrete and steel rebar and lower the amount of personnel required onsite. Pre-cast concrete members are designed in highly optimised and efficient factories so the waste material associated with cast-in-place solutions can be combatted.

The pre-cast portal would have a smaller span than the other options therefore would be unlikely to clear span the Lough Corrib SAC so there is a potential for a greater biodiversity impact. There is also a potential for a greater impact to flood regime.

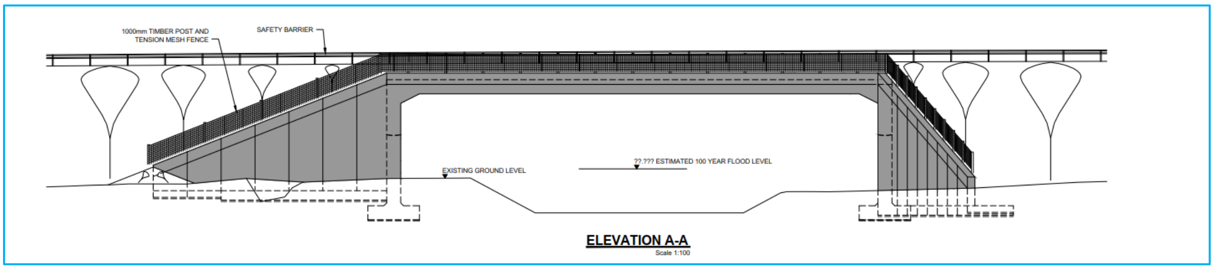

Figure 3-2 Precast Portal Frame Elevation

3.8.3.2 Option 2 – Steel Girder

Option 2 would comprise of a composite steel girder bridge spanning the Abbert River. The superstructure would be formed of 6 no. braced weathering steel I Girders at 2.53 m centres. The Option was developed with a skew angle of 35 degrees and a maximum span length of 60.5 m from centre of bearing to centre of bearing. The total bridge width would be 15.65 m which includes the minimum required cross sectional width plus additional verge widening to account for carriageway sightlines at the south west and north east corners.

In-situ cantilever wingwalls and gravity retaining walls would also be provided to retain the earthworks on approach and departure to the structure. Large areas of exposed concrete at the abutments and wingwalls would be finished with a pattern profile finish to improve aesthetics and avoid large areas of plain concrete.

Steel production and construction associate more with the release of volatile organic compounds and hard metal emissions (Cr, Ni, Mn) due to the painting, welding and fabrication involved. Steel solutions can be nearly completely fabricated and assembled in the factory with very high precision. This minimises the material waste and waste disposal requirements, lowers the time onsite and reduces the quantity of onsite labour in comparison to concrete. These factors all contribute to steel having a lower embodied carbon impact on the environment.

This bridge option clear spans the Abbert River and Lough Corrib SAC and as a result would have a lower potential impact on the SAC when compared to other bridge options. In addition, potential impacts on flood and hydrological regimes would likely be reduced in comparison to Option 1.

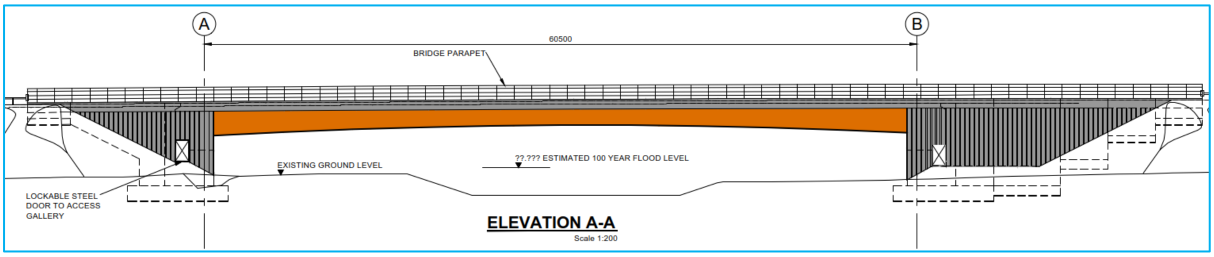

Figure 3-3 Steel Girder Elevation

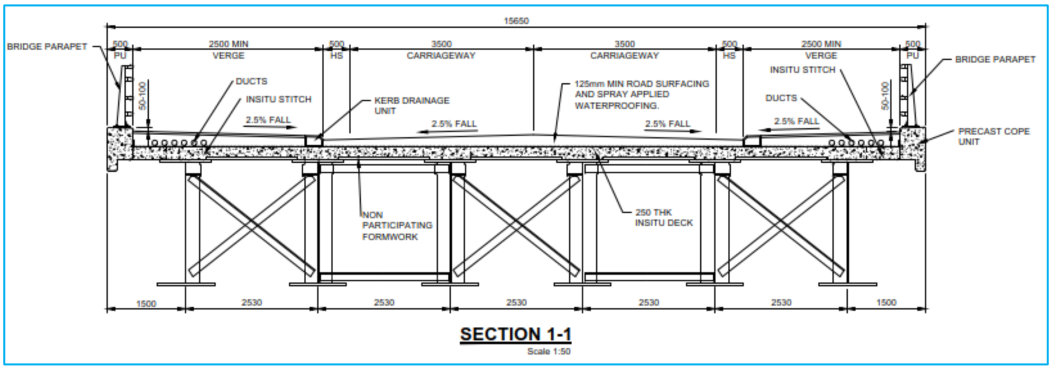

Figure 3-4 Steel Girder Cross Section

3.8.3.3 Option 3 – Precast Beam

Option 3 proposed fully integral single span precast prestressed beam bridge spanning the Abbert River. The bridge would be formed using 8 No. W19 precast concrete beams at a spacing of approximately 3 m. The option assumes a skew angle of 40 degrees between the abutment and highway alignment. This results in a beam span of 45 m from centreline of abutment to centreline of abutment. This is the maximum practical span length for a precast beam structure. The skew results in large areas of dead zone on either side of the carriageway alignment, it is assumed that these dead zones would be combined with the minimum required 2.5 m raised verge.

The substructure would be formed using full height concrete abutments supported on in-situ concrete foundations. The type of foundations would be determined at preliminary design based on the Ground Investigation data. The approaches to the bridge abutments would be formed of compacted acceptable 6N/6P backfill material. In-situ cantilever wingwalls and gravity retaining walls would also be provided to retain the earthworks on approach and departure to the structure. Large areas of exposed concrete at the abutments and wingwalls would be finished with a pattern profile finish to improve aesthetics and avoid large areas of plain concrete.

Option 2 and Option 3 would offer a larger clear span which reduces the risk of impact on the Abbert River and the Lough Corrib SAC.

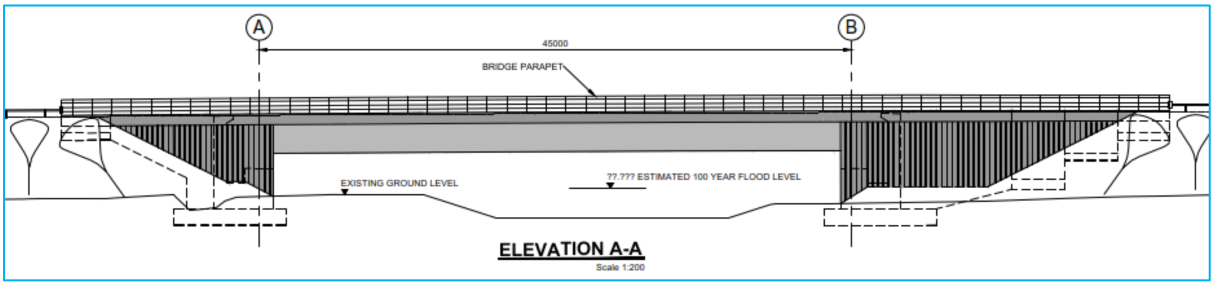

Figure 3-5 Precast Beam Elevation

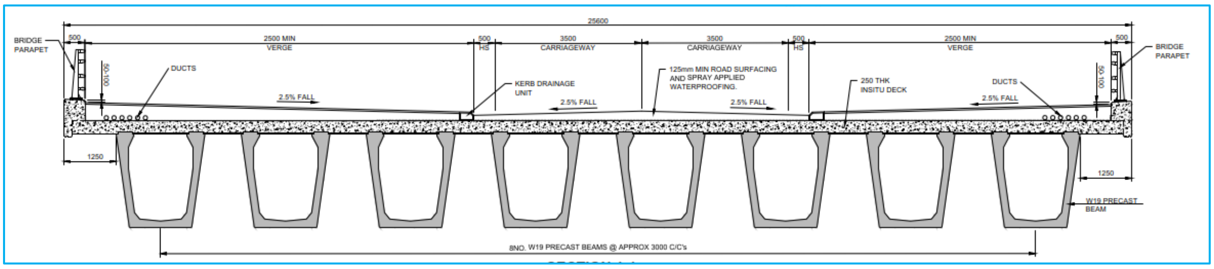

Figure 3-6 Precast Beam Cross Section

3.8.3.4 Summary

In summary, the following key assessment and considerations are noted:

- Technical – Option 2 while being a slightly more complicated design when compared to the other two options would ensure that the bridge design is lean with all structural elements aiming to achieve 100% utilisation. The large dead zones of the other two options are significant disadvantages;
- Economic – Option 2 would be the cheapest option to construct based on an all-in construction rate per m^2. The significant dead zones of the other two options substantial increase their construction cost;
- Aesthetics – Option 2, the steel option, would be the most aesthetically pleasing option due to the arched soffit profile. The other options also both have substantial dead zones on either side of the carriageways are a disadvantage coupled with the significant structural depth of Option 3;
- Durability and Maintenance – The use of weathering steel for Option 2 significantly improves its durability and maintenance requirements. The use of bridge bearings and expansion joints are a disadvantage;
- Environmental – All potential impacts of Options 1, 2 and 3 would likely be similar for cultural heritage assets, Air Quality, and Noise and Vibration. Options 2 and 3 would clear span the Abbert River potentially reducing potential impacts on the Lough Corrib SAC and would reduce potential impacts on flood regime. Option 2 has the lowest embodied energy of the three options considered making it the most advantageous option;
- Health and Safety – All three Options would require the transportation of large precast/prefabricated structures and would all be assembled onsite. Option 2 requires far less crane lifts when compared to the other options, in addition, the option has a far lower requirement for working over water when compared to Option 3;
- Construction and Buildability – Option 2 would require the least number of large structural elements to be delivered to site. In addition, this option would also have the lowest number of crane lifts when compared to the other options presented. The use of permanent formwork and lifting the beams in braced pairs would significantly reduce the temporary works required; and
- Ground Conditions – The use of bearings in this Option would result in all loads being transferred to the foundations axially without any additional horizontal loads or bending moments reducing the size of foundations compared to Option 3

The results of the MCA carried out on the three bridge options is presented in Table 3-3 below.

Table 3-3 Summary of MCA Ratings

Assessment Criteria	Option 1 Precast Portal Frame	Option 2 Steel Girder	Option 3 Precast W19 Beams
Technical	Moderately negative	Not significant or neutral	Major or highly negative
Economic	Not significant or neutral	Major or highly positive	Major or highly negative
Aesthetic	Moderately negative	Major or highly positive	Major or highly negative
Durability & Maintenance	Moderately positive	Moderately negative	Moderately positive
Environmental	Major or highly negative	Major or highly positive	Major or highly negative
Health & Safety	Moderately positive	Not significant or neutral	Moderately negative
Construction & Buildability	Moderately positive	Moderately positive	Moderately negative
Ground Conditions	Moderately negative	Not significant or neutral	Major or highly negative

Due to the reduced span of the portal frame in Option 1 and the cost concurred with Option 3, Option 2 Steel Girder was the most favourable option when compared to the alternatives and it is this option which was proposed for selection as the Emerging Preferred Bridge Option and was carried forward to the Preliminary Bridge Design.

3.9 References

- AECOM. (April 2020). N63 Liss to Abbey Realignment Scheme Phase 2 - Option Selection Report.
- AECOM (2020). N63 Liss to Abbey Realignment Phase 3 – Structures Options Report.
- AECOM. (2020). Memo 008 'N63 Liss To Abbey Realignment Scheme - Junction Strategy'.
- EU. (2014*).* Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, European Union.
- Government of Ireland. (1993). Roads Act 1993 (as amended).
- Government of Ireland. (1994). S.I. No. 119/1994 - Roads Regulations, 1994 (as amended).
- TII. (2016). Project Appraisal Guidelines for National Roads, Transport Infrastructure Ireland.

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 04: Description of the Proposed Road Development

Galway County Council

February 2022

Table of Contents

Figures

Tables

Volume 03 Figures

Volume 04 Appendices

Appendix 04: Description of the Proposed Road Development
Appendix A4-1 Outline Construction Environmental Management Plan

4. Description of the Proposed Road Development

4.1 Introduction

This chapter provides a description of the Proposed Road Development, including details of the engineering features, land requirements and construction and operation requirements.

It should be noted that surveys, assessments and information that form the basis of this Environmental Impact Assessment Report (EIAR) are based on the design of the project as described in this chapter, which has been developed to a stage that permits a fully informed Environmental Impact Assessment (EIA) to be carried out by the competent authority. Where mitigation measures have been identified in this EIAR, it will be a contractual requirement that the appointed Contractor implement those.

4.2 Background

As discussed in Chapter 03 Alternatives, there are a number of constraints within the study area and the refinement of the Proposed Road Development took cognisance of these constraints, such as the Abbert River, Lough Corrib Special Area of Conservation (SAC), Knockmoy Abbey (National Monument No.166), and the existing environment. Avoidance mitigation measures have been included in the design to reduce the direct and indirect impact on sensitive environmental receptors. These avoidance mitigation measures include:

- A clear span steel girder bridge to minimise visual impact on Knockmoy Abbey and flood culverts to minimise impact on the Abbert River (which forms part of Lough Corrib SAC);
- A closed drainage network to minimise the impact on the SAC and surrounding watercourses;
- The Preferred Route was chosen to minimise impact on the National Primary School;
- Regrading earthworks and introducing planting to minimise the impact for vehicle restraints and anti-dazzle screening.
- Updating the horizontal geometry to reduce impact on landowners; and
- Minimising visual impacts in the vicinity of the Knockmoy Abbey.

4.3 Summary of the Proposed Road Development

Galway County Council (GCC) are proposing to develop an approximate 2.3 km long national secondary road on 15.494 ha of land, the majority of which is on a predominantly greenfield site to the north-east of the village of Abbeyknockmoy, Co. Galway. The Proposed Road Development will comprise a rural all-purpose Type 2 Single Carriageway road, including a new crossing over the Abbert River. Provision of both pedestrian and cycle facilities have been included as part of the Proposed Road Development, predominantly along the route of the existing N63. The Proposed Road Development is located in the townlands of Culliagh North, Culliagh South, Liss, Abbey, Chapelfield, Clashard, Moyne and Newtown in Co. Galway.

The Proposed Road Development runs in a south-west to north-east direction across the Abbert River. Starting on the eastern edge of Abbeyknockmoy and running north-east to the proposed tie-in with the existing N63 at the L6234 junction.

Beginning at Abbeyknockmoy village, the Proposed Road Development will deviate offline to the north of the existing N63 and be connected to the existing road network through a three-armed roundabout. From there, it will continue in a north-easterly direction through agricultural land before crossing the Abbert River at a skewed angle of approximately thirty-five degrees. The proposed alignment will then sweep east and continue through more agricultural land, running parallel to the existing N63. The alignment then crosses the L6159 and continues east through an area of existing woodland until it ties in with the existing N63 at its junction with the L6234. The existing L6159 will be realigned to create a north/south staggered junction with the proposed alignment, and the L6234 will be realigned to tie in with the proposed alignment.

The immediate study area is characterised by the presence of open greenfield with some wooded (mixed broadleaf/conifer woodland WD2) areas along the Abbert River, which forms part of Lough Corrib SAC. The south side of the existing N63 is lined by residential properties, and several community facilities are located in proximity to the junction with the local road L3110. The Proposed Road Development is located in close proximity to Knockmoy Abbey, a National Monument, and the Galway County Scenic View Area.

The Proposed Road Development will facilitate a number of objectives in the Galway County Development Plan (2015-2021), including the provision of higher-quality national roads and the separation of a significant proportion of regional and local traffic. The Proposed Road Development will also meet a number of objectives of the Road Safety Authority's Road Safety Strategy.

Strategically, while the N63 itself does not form part of the TEN-T Network, the Proposed Road Development will support the objectives of the TEN-T in broad terms by improving the connectivity to Junction 19 on the M17 TEN-T network. The Proposed Road Development will provide an improved link for regional traffic to the M17 motorway and reduce traffic congestion at the Liss Bridge and the community facilities.

The Proposed Road Development will comprise the following major elements:

- Approximately 2.3 km of new Type 2 Single Carriageway road (predominantly offline);
- One new roundabout at the western end of the Proposed Road Development to provide connection with the existing N63;
- Two new priority junctions to provide connection to the existing L6159 and L6234, including some minor local road realignments;
- One new clear span steel girder bridge crossing of the Abbert River;
- Seven new piped culverts and two new box culverts over existing field ditches;
- Three new flood alleviation culverts (box culverts);
- New pedestrian and cycle facilities, predominantly located along the existing N63;
- Associated earthworks including excavation of unacceptable material (2000 m^3), excavation and processing of rock and other material, and recovery of unacceptable material for re-use in the works;
- Accommodation works, including the provision of access roads and accesses;
- Drainage works, including the construction of attenuation ponds in accordance with sustainable drainage design principles and guidance (See Section 4.5.2);
- Treatment of surface water run-off prior to outfall discharge, spill containment measures and attenuation treatment facilities;
- Utilities and services diversion works including medium voltage (10 kV/20 kV) overhead lines and EIR overheard lines;
- Safety barriers, public lighting, fencing;
- Viewing area for Knockmoy Abbey with parking;
- Landscaping planting works, signage, lighting and other works ancillary to the construction and operation of the Proposed Road Development;
- Construction of farm access tracks with accommodation works ancillary to the Proposed Road Development; and
- Environmental measures and other ancillary works.

The location and extent of the Proposed Road Development are shown in Figure A4-1 to Figure A4-6 contained in Volume 03 of this EIAR.

A description of the main elements of the design is presented in the following sections. The description includes references to chainages (Ch.) denoting the distance in metres along the proposed alignment, increasing, travelling from west to east. Chainages can be seen in Figure A4-1 to Figure A4-6 of Volume 03.

4.4 Geometric Design

4.4.1 Road and Junction Design Standards

The Proposed Road Development has been designed in accordance with the Transport Infrastructure Ireland (TII) Road Design Standards, the TII Environmental Assessment and Construction Guidelines (available on the TII Publications website[1]) and other best practice guidelines. The most relevant geometric design standards are:

- DN-GEO-03031 Rural Road Link Design (TII, 2017);
- DN-GEO-03036 Cross Sections and Headroom (TII, 2019);
- DN-GEO-03060 Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions) (TII, 2017);
- Design Manual for Urban Roads and Streets (DMURS), Department of Transport, Tourism and Sport (DTTAS, 2019); and
- National Cycle Manual (NCM), National Transport Authority (NTA, 2011).

4.4.2 Cross Section

The mainline single carriageway of the Proposed Road Development has been designed as a rural all-purpose Type 2 Single Carriageway road, in accordance with TII DN-GEO-03036 (TII, 2019).

The traffic volumes along the mainline of the Proposed Road Development for the assumed Opening Year and Design Year are described in Chapter 05 Traffic Analysis of this EIAR and highlight the need for a Type 2 Single Carriageway to achieve the desired traffic safety and performance. Table 6.1 of TII DN-GEO-03031 (TII, 2017) indicates that a Type 2 Single Carriageway will have a capacity of 8,600 annual average daily traffic (AADT). This capacity figure (expressed in AADT) represents the approximate two-way flows corresponding to Level of Service D in reasonably level terrain.

In general, the proposed cross-sections of side roads intersected as part of the Proposed Road Development have been designed to closely follow that of the existing road. Considering that some of the realigned side roads will be located within the proposed 50 km/h area, the DMURS design standard has been applied. TII standards have been considered, where possible, as a reference point for the definition of the horizontal and vertical alignment.

Table 4.1, below, indicates the carriageway, verge, and hard shoulder width appropriate for each road class that has been incorporated into the design of the Proposed Road Development. The cross-section for each classification of road is in accordance with TII Standard DN-GEO-03036 (TII, 2019) and, in general, the proposed width of a realigned local road will reflect the existing road width. However, where an existing road is less than 4 m, a minimum cross-section of 4 m carriageway with 1 m verges has been applied.

The cross-sections are detailed in Figure A4-7 and Figure A4-8 contained in Volume 03 of this EIAR.

[1] http://www.tiipublications.ie/

Table 4-1 Standard Road Cross-Section Dimensions

Road	Road Classification	Carriageway Width	Verge Width
Proposed N63 (mainline)	National Secondary Road	7.0 m carriageway	Without pedestrian/cycle facilities: 3.0 m verge including 0.5 m hard strip and 2.5 m grassed verge. With pedestrian/cycle facilities: 5.5 m verge, including 0.5 m hard strip, 1.5 m grassed verge, 3.0 m shared pedestrian and cycle facility and 0.5 m grassed verge.
Existing N63	Local Road (reclassification from National Secondary Road)	6.0 m carriageway	With pedestrian/cycle facilities: 3.0 m verge including 3.0 m shared pedestrian and cycle facility (and 0.5 m grassed verge where required).
L6159, L6234, L21821, L7138, L3110	Local Road	4.0 m to 6.5 m carriageway	1.0 m to 2.5 m verge

The design of the Proposed Road Development has been developed on the basis of providing a working space requirement of either 5 m or 8 m between the earthworks and the boundary fence line for the proposed main road and junctions, depending on whether road drains are required. A standard clear space of 3 to 5 m has also been adopted for other road developments. The overall land acquisition is increased further at other locations to allow for parallel access roads for farms, dwellings, attenuation ponds, etc. Where space constraints or construction and maintenance methodology demand, the working space has been respectively reduced or increased locally.

4.4.3 Mainline

This section describes the horizontal and vertical alignment of the mainline and how this relates to the existing environment and other significant elements of the Proposed Road Development.

The mainline alignment will compose two unique individual sections, running from the south-west to north-east for a total length of 2.30 km:

- Section A: Ch. 0+070 to 0+250 – From the western tie-in along the existing N63 in the village of Abbeyknockmoy to the proposed roundabout. This section of the mainline alignment was developed to achieve a design speed of 60 km/h, consistent with the posted speed limit of 50 km/h within the village of Abbeyknockmoy (DMURS 2019); and
- Section B: Ch. 1+000 to 3+120 – From the proposed roundabout to the eastern tie-in along the existing N63 east of the junction with the L6234. This section of the mainline alignment was developed to achieve a design speed of 100 km/h, consistent with the posted speed limit of 100 km/h for Type 2 Single Carriageway National Roads (TII DN-GEO-03031 Table 1.2 (TII, 2017)).

The mainline alignment (plan & profiles) is illustrated in Figure A4-9 and Figure A4-10 contained in Volume 03 of this EIAR.

Section A

The mainline alignment will commence to the west where it ties into the existing N63 in the village of Abbeyknockmoy. The alignment will run east before turning north-east with a left hand 136 m radii curve into some agricultural land to the north of the existing N63, where it joins the proposed roundabout at Ch. 0+250.

The mainline vertical alignment starts with a short section at grade where it matches the existing N63 profile and then slowly rises to an embankment section with a longitudinal gradient of +1.5% until it reaches the proposed roundabout at Ch. 0+250 with an embankment height of approximately 2 m.

Section B

From the proposed roundabout at Ch. 1+000, the mainline alignment runs east before turning north-east with a left hand 510 m radii curve and crossing the Abbert River with a skew angle of 35° and a span of 60.5 m at Ch. 1+600. The bridge will be designed to avoid disturbance to the SAC by clear spanning the Abbert River and maintaining minimum setbacks from the riverbanks of 5 m. Further details of the river bridge can be found in Section 4.5.1. The mainline alignment then turns east with a right hand 510 m radii curve and continues through agricultural land until it crosses the existing L6159 at Ch. 2+275. The L6159 will be realigned to the south to form a staggered right/left priority junction at Ch. 2+225 and 2+275. The mainline alignment continues east with a long right hand 8160 m radii curve and join the existing N63 at Ch. 2+600. The mainline alignment will turn north-east with a left hand 720 m radii curve, with the existing L6234 realigned to form a priority junction at Ch. 3+000. The mainline alignment will then continue to run north-east along the existing N63 until the proposed tie-in at Ch. 3+120.

From the proposed roundabout at Ch. 1+000, the mainline vertical alignment will start to descend with an embankment height of approximately 1.5 m and a constant -0.8% gradient. The vertical alignment presents a low point at Ch. 1+260 and then rises in level with a +1.9% gradient approaching the Abbert River crossing where the embankment height exceeds 6 m. From the high point at Ch. 1+620, the vertical alignment will descend with a constant -2.0% gradient and it presents another low point at Ch. 1+970. The vertical alignment will then rise in level with a constant +0.75% gradient and an embankment height of approximately 0.5 m, followed by a long K=400 crest curve (a vertical curve that connects an up gradient to a down gradient) which will then increase to approximately 1.5 m between Ch. 2+250 and 2+750, where a K=400 crest curve is proposed (high point at Ch. 2+250). The vertical alignment will then present a sag curve (a vertical curve that connects a down gradient to an up gradient) and a minor cutting section (0.5 to 1.0 m deep) between Ch. 2+725 and 2+875. From the low point at Ch. 2+810, the vertical alignment rises in level with a 0.55% gradient before tying-in at-grade with the existing N63 profile.

The majority of the Proposed Road Development will be offline so temporary traffic management, road closures and diversions will be minimised. There will be a requirement for temporary traffic management during the construction of the proposed Non-Motorised User (NMU) route along the existing N63, possibly with lane closures. There will be a requirement for full closures at the tie-in points between the new route and the existing N63, these will result in traffic having to be diverted through the surrounding local road network, but these closures should be minimised through good construction practices.

4.4.4 Side Roads

All non-mainline roads that will be affected by the Proposed Road Development are referred to as side roads. Each side road affected by the Proposed Road Development is detailed in Table 4-3, together with the existing and proposed cross section and the proposed length of road realignment. Side road alignments are illustrated in Figure A4-11 to Figure A4-18 contained in Volume 03 of this EIAR.

It is proposed that the side roads will be reconfigured to tie-in with existing or realigned roads, where necessary. Where side roads have been realigned, they have been designed to tie-in to the existing carriageway as quickly as possible to minimise the impact of the Proposed Road Development on the surrounding environment.

With due regard to the environmental and land-use constraints, the geometric design of the proposed alignments and layouts of realigned side roads have been developed using the design speeds in Table 4-2, to the extent appropriate and feasible at each location.

For the local roads, the design speeds are suitable to the existing low-speed character of these roads and will assist to minimise any impact on the environment at those locations. Where side roads have existing speed restrictions, proposed speed restrictions, or are in more built-up areas, the appropriate design speed has been established in accordance with Sections 1.1 and 10.2 of DN-GEO-03031(TII, 2017) and DMURS (2019) (DTTAS, 2019). The realigned local roads have been designed in accordance with Chapter 10 of DN-GEO-03031(TII, 2017) and DMURS (2019) (DTTAS, 2019).

Table 4-2 Side Road Class and Desirable Design Speeds

Road Class	Desirable Design Speed (km/h)
National Roads	NA
Regional Roads	NA
Local Roads	42-85
Access Roads	30

Table 4-3 Side Roads

Road Name	Townland	Mainline Chainage (m)	Figure Ref. No.	Existing			Proposed Sideroad treatment	Realigned/New Section	
				Paved Width (m)	Speed Limit (km/h)	Length (m)		Cross-Section	Design Speed (km/h)
1C – Existing N63 (East)	Liss	1+000	Figure A4-12	6.5 – 7.5 m	100	100	Significant upgrade to the existing carriageway and the provision of shared footway	6.0 m carriageway, 3.0 m verge + 3.0 m shared footway (0.5 m grass verge where required)	60
2A - L6159 (South)	Abbey	2+225	Figure A4-16	5.5 m	80	130	Upgrade section of road and tie in with existing carriageway	4.0 m to 6.5 m carriageway, 1.0 m to 2.5 m verge	70
2B - L6159 (North)	Abbey	2+275	Figure A4-16	5.5 m	80	70	Upgrade section of road and tie in with existing carriageway	4.0 m to 6.5 m carriageway, 1.0 m to 2.5 m verge	70
3A - L6234	Moyne	3+000	Figure A4-18	3 m	80	70	Upgrade section of road and tie in with existing carriageway	4.0 m to 6.5 m carriageway, 1.0 m to 2.5 m verge	70
3B – Access Road	Clashard/ Newtown	3+020	Figure A4-18	NA	NA	40	Upgrade section of road and tie in with existing carriageway	4.0 m to 6.5 m carriageway, 1.0 m to 2.5 m verge	30
4A - L21821	Liss	10+640 (existing N63)	Figure A4-13	3.5 m	80	20	Upgrade section of road and tie in with existing carriageway	4.0 m to 6.5 m carriageway, 1.0 m to 2.5 m verge	70
5A - L7138	Liss/ Chapelfield	11+310 (existing N63)	Figure A4-15	5.5 m	80	30	Upgrade section of road and tie in with existing carriageway	4.0 m to 6.5 m carriageway, 1.0 m to 2.5 m verge	70
6A -L3110	Chapelfield/ Clashard	11+450 (existing N63)	Figure A4-15	7 m	80	40	Upgrade section of road and tie in with existing carriageway	4.0 m to 6.5 m carriageway, 1.0 m to 2.5 m verge	70

4.4.5 Junctions

The proposed junctions and types along the mainline of the Proposed Road Development are detailed in Table 4-4 below and in Figure A4-11 to Figure A4-18 contained in Volume 03 of this EIAR.

Table 4-4 Junctions

Junction Name	Chainage	Type and Size	Comment	Figure Ref. No.
Junction 1 (N63 Roundabout)	N63 Mainline - Ch. 0+250 (or Ch. 1+000)	Roundabout (ICD=36 m)	Proposed new roundabout	Figure A4-12
Junctions 2A and 2B (L6159 North and South)	N63 Mainline - Ch. 2+225 and Ch. 2+275	Staggered Right/Left Priority Junction	Proposed new junction	Figure A4-16
Junctions 3A and 3B (L6234 and Access Road)	N63 Mainline - Ch. 3+000 and Ch. 3+020	Staggered Left/Right Priority Junction	Alteration and upgrade of existing crossroad junction	Figure A4-18
Junction 4 (L21821)	Existing N63 - Ch. 10+640	Priority Junction	Alteration and upgrade of existing priority junction	Figure A4-13
Junction 5 (L7138)	Existing N63 - Ch. 11+310	Priority Junction	Alteration and upgrade of existing priority junction	Figure A4-15
Junction 6 (L3110)	Existing N63 - Ch. 11+450	Priority Junction	Alteration and upgrade of existing priority junction with change of priority	Figure A4-15

4.4.6 Pedestrian and Cycle Facilities

At present, there are limited dedicated pedestrian and cycle facilities within the immediate and surrounding areas; however, project-specific objectives and feedback received from the public consultation process clearly outlined the need to provide dedicated pedestrian and cycle facilities and segregate the national and regional (high-speed) traffic, improving the connectivity between the community facilities and residential properties.

During the design of the Proposed Road Development, cognisance has been taken of these objectives and needs to ensure that the Proposed Road Development will complement specific requirements. The accessibility and permeability of the pedestrian/cycle facilities has been at the fore in the design. As such, connections to existing formal and informal pedestrian facilities have been incorporated into the design from the outset.

Along the length of the existing N63, between Ch. 10+080 and 11+450, a 3.0 m wide shared use pedestrian and cyclist facility will be incorporated on the south side. Un-controlled crossings will be provided at junctions with the existing L21821 (Ch. 10+640) and L7138 (Ch. 11+310). One new controlled pedestrian crossing of the existing N63 is proposed at Ch. 11+290, to provide connection with the Newtown National School and Abbeyknockmoy Community Centre.

A new crossing at the junction between the existing N63 and L3110 Monivea Road will be provided, and a shared use pedestrian and cyclist facility (with minimum width of 2.5 m) will continue on the east side of the existing N63, between Ch. 11+450 and 11+650, crossing over the Abbert River at the existing Liss Bridge, where some localised restrictions of the proposed pedestrian and cycle facility width will be required.

A 2.5 m wide shared use pedestrian and cyclist facility will be provided along the existing N63 between Ch. 11+650 and 12+000 where it will then continue parallel to the proposed N63 mainline between Ch. 2+600 and 3+120, making use of the paved surface of the existing N63 where possible.

Pedestrian and cycling facilities are presented in Figure A4-11 to Figure A4-18 contained in Volume 03 of this EIAR.

4.4.7 Public Transport

Several regional bus routes pass through the study area, provided by operator Bus Éireann and Bus 4U. There are four bus stops in the study area; two westbound and two eastbound. There are eastbound and westbound facilities at Abbey and Newtown Cross which are served by Bus Éireann service no. 425 (Galway – Longford). At Mannions Bar in Abbeyknockmoy, there are eastbound and westbound stop facilities, which service the 425 route and the Bus 4U 433 service (Roscommon-Galway Cathedral).

The introduction of the Proposed Road Development will assist the bus services. The locations of the bus stops mean they will not be by-passed by the new section of road, but the buses will be able to use the new section of road minimising their journey time along this section of national road.

4.4.8 Speed Limits

A speed limit of 100 km/h will be imposed on the realigned mainline section of the Proposed Road Development in line with existing conditions. In the interim, Galway County Council (GCC) have reduced the speed limit in the vicinity of the study area from 100 km/h to 80 km/h[2]. The extent of the imposed speed limit can be seen in Figure 4-1. Following consultation with GCC it was agreed that the design speed for the mainline section of the Proposed Road Development will remain as 100 km/h.

A 50 km/h speed limit will be applied to the short section of realigned N63 mainline to the west of the proposed roundabout towards Abbeyknockmoy village. The roundabout junction will introduce a combination of alignment deflection and speed control and will provide a suitable transition from higher posted speed zone to lower speed zones close to the Abbeyknockmoy village.

A 50 km/h speed limit will also be applied to the remaining section of the existing N63 between the proposed roundabout and the Newtown National School and Abbeyknockmoy Community Centre, and across the existing Liss Bridge, in combination with proposed pedestrian and cycle facilities.

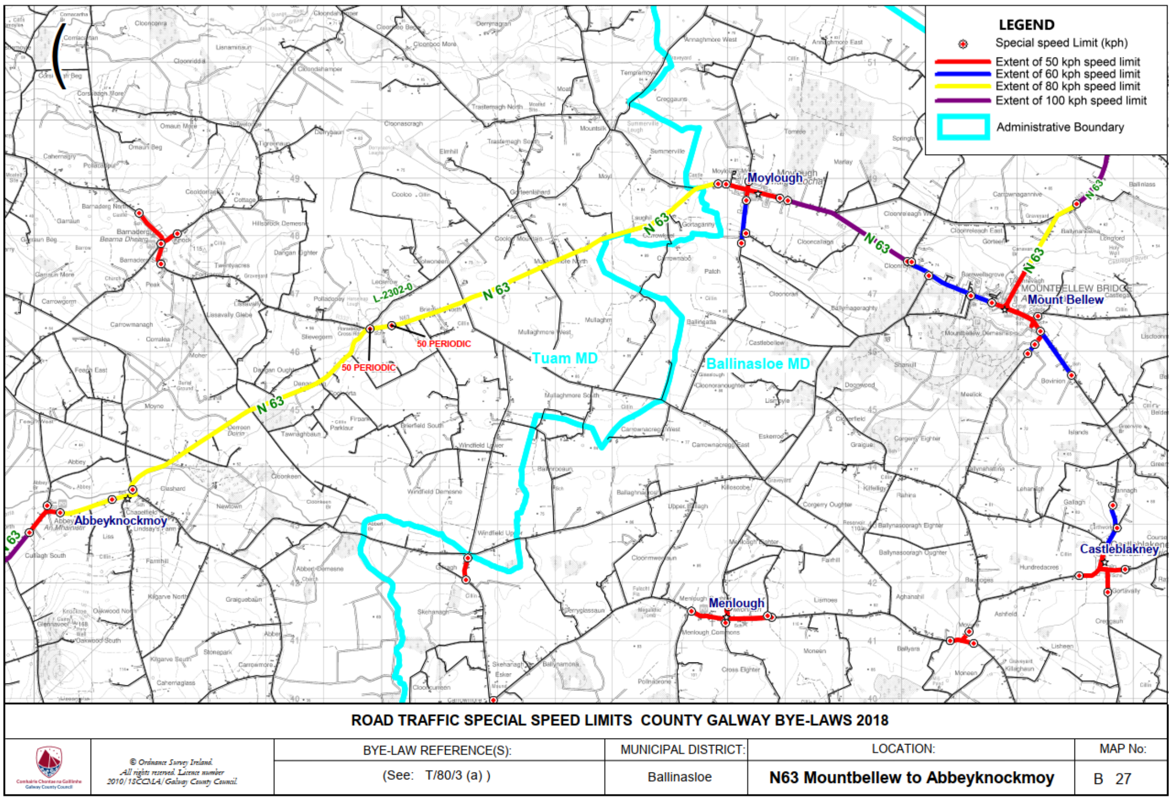

Figure 4-1 Updated Speed Limits - N63 Mountbellew to Abbeyknockmoy (County Galway Bye-Laws 2018)

[2] Road Traffic Special Speed Limits. County Galway Bye-Laws 2018: http://www.galway.ie/en/services/roads/trafficmanagement/speedlimits/

4.5 Other Design Aspects

4.5.1 Structures

The location of the bridge over the Abbert River was developed through careful consideration of the biodiversity constraints within Lough Corrib SAC. As a result of the SAC, the bridge will be single span to minimise the impact on the SAC and Abbert River itself.

Consideration was given to flooding along the river channel in consultation with the Office of Public Works (OPW). Arising from this, appropriate flood alleviation culverts will be included as part of the design.

To protect water quality in the river, a temporary drainage system will be provided at the works areas on the riverbanks, with all water directed away from the river and into a collection system that will be fitted with suitable pollution control measures prior to discharge to the existing drainage system. These measures will protect against accidental spillages from the construction machinery and processes from entering the river channel. Further measures will be adopted during the pouring of concrete for the bridge deck above the steel beams so as to prevent accidental spillages of pollutant materials directly into the river. Details of control measures for the construction stage are outlined in the Outline Construction Environmental Management Plan (see Appendix 4-1 in Volume 04 of this EIAR)

The Proposed Road Development will incorporate one main structure, the bridge over the Abbert River. The bridge is located north-east of Abbeyknockmoy at coordinates 551020, 743507 (ITM). The bridge crosses the Abbert River in a south-west to north-east orientation.

The steel bridge over the Abbert River consists of a single span of approximately 60.5 m, ensuring a clear span over the river channel and Lough Corrib SAC. The proposed underbridge alignment will cross the Abbert River at a skew of approximately 35° to the perpendicular.

The superstructure is formed of 6 no. braced weathering steel I Girders at 2.53 m centres. The total bridge width shall be 15.65 m which includes the minimum required cross sectional width plus additional verge widening to account for carriageway sightlines at the south-west and north-east corners. To improve aesthetics, the girders will be fabricated with a varying arched profile soffit with a maximum structural depth at the abutments of 2.5 m and a minimum structural depth of 1.8 m at the centre of the span. Freeboard provided at the lowest soffit point of the crossing is approximately 2.88 m. The freeboard provision is greatest at the centre due to the arched shape of the bridge beams. An in-situ concrete deck 250 mm thick is provided to span between the steel girders with parapet edge beams also provided to the edge of the deck. The details of the proposed bridge can be seen in the elevation and cross-sections shown in Figure 4-2 and Figure 4-3 respectively.

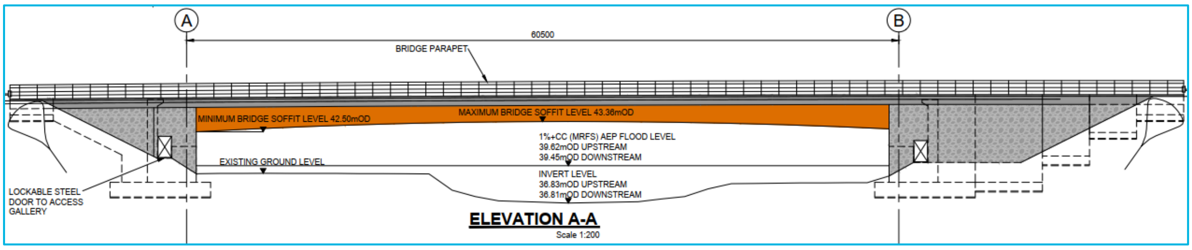

Figure 4-2 Proposed Bridge crossing of Abbert River - Elevation

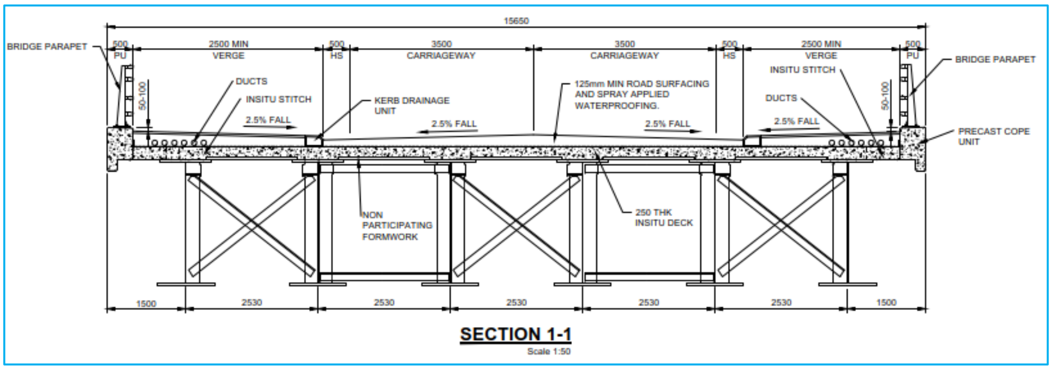

Figure 4-3 Proposed Bridge crossing of Abbert River – Cross-Section

The bridge abutments are located outside the river channel to minimise in-stream works for the construction of the bridge over Lough Corrib SAC. The bridge abutments will be finished with a locally sourced masonry cladding. Stone cladding was chosen over concrete as it was deemed to blend with the existing environment to a greater degree than in-situ concrete with a pattern profile finish.

This bridge is a key programme item for the construction, particularly in conjunction with seasonal constraints during the construction of drainage outfalls and earthworks in proximity to the river. The proposed bridge is illustrated in Figure A4-26 contained in Volume 03 of this EIAR.

The construction methodology and the measures adopted to mitigate the impact on Lough Corrib SAC are described in Section 4.6.4.5 below.

There are no structural culverts proposed along the Proposed Road Development as all culverts are drainage only with a span of less than 2 m. There are also no retaining walls within the Proposed Road Development as all boundary walls are less than 1.5 m in height.

4.5.2 Drainage

4.5.2.1 Drainage – General Principles

The proposed drainage design incorporates:

- Systems for the collection and conveyance of overland water and surface water run-off;
- Measures to treat and attenuate the surface water run-off from the new paved surfaces of the Proposed Road Development; and
- Treatment of existing watercourses crossed or affected by the Proposed Road Development.

This section should be read in conjunction with the drainage design Figure A4-20 to Figure A4-25 contained in Volume 03 of this EIAR.

The preliminary design of road drainage for the Proposed Road Development is in accordance with the principles outlined below and the following TII Publications:

- DN-DNG-03022 - Drainage Systems for National Roads (including Amendment No. 1 dated June 2015) (TII, 2015);
- DN-DNG-03064 – Drainage of Runoff from Natural Catchments (including Amendment No. 1 dated June 2015) (TII, 2015);
- DN-DNG-03065 - Road Drainage and the Water Environment (including Amendment No. 1 dated June 2015) (TII, 2015); and
- DN-DNG-03066 - Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control.(TII, 2015)

4.5.2.2 Cut-off Drains or Ditches

Cut-off Drains are required to intercept the overland flow from the natural catchment adjacent to the Proposed Road Development (both during construction and operational phases) and to prevent ponding of water adjacent to embankments. The use of cut-off drains is to prevent drainage from the road curtilage running onto adjacent lands and vice-versa. The cut-off drains are provided at the top of the cutting or the base of the embankment where land falls towards the Proposed Road Development to collect overland flow. The drains have been sized to cater for a 1 in 75-year return period as per DN-DNG-03064 - Drainage of Runoff from Natural Catchments (TII, 2015). All land drains that are intercepted by the proposed works will be discharged into a cut-off drain. Scour protection shall be provided where velocities exceed 2.5 m/s in the cut-off drains.

Cut-off drains, or channels will be provided at the following locations:

- Top of cutting slopes where the adjoining land slopes towards the cutting; and
- Bottom of embankment slopes where the adjoining land slopes towards the embankment.

These cut-off drains will discharge to existing watercourses where the topography permits and to the road drainage system in areas with no suitable outfall location. These locations can be seen on Figure A4.20 to Figure A4.25 contained in Volume 03 of this EIAR.

The drainage system has also been designed to offset risks to the Annex I habitat *Molinia* meadows, by allowing drainage beneath the carriageway between Chainage 1+950 and 2+050. In order to mitigate the impact of the Proposed Road Development, it is proposed to provide a layer of free-draining granular material at the base of the embankment to maintain the hydraulic connectivity across the embankment. It is also proposed to omit any pre-earthworks drainage/interceptor ditches within the area of the *Molinia* Meadow to prevent over drainage of the area. Further information on the *Molinia* Meadow can be found in Chapter 07 Biodiversity.

4.5.2.3 Proposed Road Drainage Networks

The Proposed Road Development involves the construction of a new drainage system which includes provision of a surface water collection system, earthworks drainage, sub-surface drainage, attenuation and pollution control, and the culverting of existing streams. 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. The drainage network will be designed to:

- Ensure the speedy removal of surface water from the road pavement in order to provide safe driving conditions;
- Mimic, in as far as is practical, the existing road drainage regime, particularly in relation to run-off rates and watercourse outfalls, while at the same time providing improved water quality treatment by means of wetland ponds prior to discharge;
- Ensure that the impact of the drainage outfalls on the receiving waters is negligible;
- Minimise the impact of runoff on the receiving environment; and
- Provide effective sub-surface drainage to maximise longevity of the road pavement and associated earthworks.

As the Proposed Road Development will cross Lough Corrib SAC, and due to the use of kerbs on the road section, it is proposed that a sealed drainage system is used. Road runoff will be collected through gullies located at regular intervals or kerb drains where necessary. Sealed pipes will convey the flows to the downstream attenuation systems.

The Proposed Road Development drainage system has been divided in to four separate networks. The road drainage will outfall at four locations into existing ditches, which eventually outfall into the Abbert River. The road drainage outfalls via a lined drainage ditch at one location and via attenuation ponds at three locations. The temporary and permanent land acquisition required to undertake these works and associated attenuation systems has been incorporated into the Compulsory Purchase Order (CPO). The outfalls and drainage requirements are shown in Figure A4.20 to Figure A4.25 contained in Volume 03 of this EIAR.

4.5.2.4 Surface Water Drainage

A surface water collection system has been provided so as to comply with the design requirements of DN-DNG-03022 – Drainage Systems for National Roads (TII, 2015). This includes providing suitably sized longitudinal carrier drains to accommodate a 1-year return period storm in-bore without surcharging, with no flooding of the proposed carriageway for a 1 in 5-year return period for filter drains. Where combined surface and ground water drains are proposed, a 1 in 5-year return period storm will not rise above the formation level, or sub-formation level where a capping layer is present. The drainage networks are designed to include an increase of 20% in rainfall depth to cater for the impact of climate change.

Groundwater vulnerability in the study area consists of a mix of 'Extreme', 'High' and 'Moderate' vulnerability. The Abbert River is classified as 'Rock at or Near Surface or karst' with the area to the south of the river varying between 'Moderate' and 'Extreme', and the area to the north of the river classified as 'Moderate'. For this Proposed Road Development all drainage is designed as sealed drainage to avoid impacting on the groundwater.

Minerex's geophysical survey concluded the karst risk to be low. However, it was indicated there may be a zone of weathered or karstified limestone crossing below the river in a south to north orientation.

Where gradients allow, the surface water run-off from side roads within the Proposed Road Development will be discharged via the proposed mainline drainage system. At locations where such arrangements are not possible, in particular due to existing road tie–in levels and gradients, the surface water run-off from side roads or sections thereof will continue to discharge to the local road drainage system or into the overland runoff drainage system.

In most cases, there will be no significant change for the drainage of side roads in terms of net road surface areas, but the discharge point and flow directions may be modified in a few locations where, for instance, the side road is realigned to tie into the Proposed Road Development.

In general terms, the proposed sealed drainage systems for the Proposed Road Development, as described in this section of the EIAR have been developed to protect groundwater resources from pollution by surface water run-off from the Proposed Road Development.

4.5.2.5 Sub-Surface Water Drainage

A sub-surface drainage system of the road pavement will be provided in order to control groundwater levels in the vicinity of the Proposed Road Development and to drain the road foundation. This is required in areas of cutting and low embankments (<1.5 m). In general, this will be achieved using a network of filter drains or narrow filter drains.

The Proposed Road Development will cross through a regionally important aquifer, this aquifer consists of the majority of land from Castlebar, to Carrick-on-Shannon, to Athlone and Maigh Cullinn.

The proposed drainage systems for the Proposed Road Development, as described in this section of the EIAR have been developed to protect groundwater resources from pollution by surface water run-off.

The potential impacts of the Proposed Road Development on the aquifer are discussed in Chapter 09 Water.

4.5.2.6 Structure Drainage

Drainage of the proposed bridge structure will be managed so as to achieve the requirements set out in DN-DNG-03022 – Drainage Systems for National Roads (TII, 2015). For the length of the bridge over the Abbert River, a combined kerb and drainage system will capture the runoff on the bridge deck, transport it along the length of the bridge and connect into the proposed carriageway drainage system.

4.5.2.7 Flow Attenuation Systems

Flows from the Proposed Road Development will be attenuated prior to discharge to the receiving watercourse so that the post development peak flow rate will not be greater than the original greenfield runoff rate. It is proposed to use three ponds and a lined drainage ditch upstream of the discharge point to the Abbert River for the greenfield section of the Proposed Road Development. A flow-restricting device, such as a vortex flow control device, will be placed upstream of the outlet to a receiving waterbody.

The attenuation systems have been designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. This design ensures that there is no increase in the risk of flooding in the receiving watercourse due to construction of the road up to the 100-year return period.

The attenuation ponds have been designed to accommodate the first flush surface water runoff within a forebay. First flush flows are those that arrive at the outfall first after a rainfall event. The first flush is defined as 10% of the five-year storm peak flow and contains the heaviest contaminant load. The plan area of the sediment forebay should be at least 10% of the total basin area. The connection from the forebay area to the main body of the pond will be via a permeable bund. Due to the environmentally sensitive nature of the area and because the ponds will be used for spillage containment, the ponds will be lined.

The attenuation systems will be located in land adjacent to the Proposed Road Development – see Figure A4-20 to Figure A4-25 contained in Volume 03 of this EIAR for locations of attenuation systems. Access for future maintenance will be accommodated by provision of a gated access and connected to the public road network.

The storage volumes required for the attenuation structures proposed for each drainage network are summarised in Table 4-5.

Table 4-5: Storage Volumes of Attenuation Structures

Drainage Network	Volume of Max Water (m^3) (1:100 yr Pond)	Full Pond Volume (m^3) (1:100 yr Pond)	Maximum Permissible Discharge (l/s)	Attenuation Structure
Network 1	N/A	N/A	5.00	Lined Drainage Ditch
Network 2	469.8	-	5.00	Pond
Network 3	414.9	742.2	5.00	Pond
Network 4	321.9	734.2	5.00	Pond

4.5.2.8 Spillage Risk

A preliminary risk assessment to quantify the likelihood of a serious accidental spillage has been carried out in accordance with the TII (NRA) DN-DNG-03065 (TII, 2015). When considering the risk of spillages from a road and potential pollution to the receiving environment, TII (NRA) DN-DNG-03065 (TII, 2015) recommends that the:

- Calculated spillage risk return period must not be greater than 1-in-100 years;
- Calculated spillage risk return period must not be greater than 1-in-200 years where spillage could affect: protected areas for conservation, important drinking water supplies or important commercial activities; and
- Spillage risk from existing outfalls must not be increased.

The Outline Construction Environmental Management Plan (OCEMP) for the construction phase of the Proposed Road Development (see Appendix 4-1 in Volume 04 of this EIAR) includes measures to address accidental spillages, should they occur during the proposed works.

The spillage assessment carried out on the Proposed Road Development demonstrates a very low magnitude of risk for individual outfalls as shown in the Table 4-6. Shut-down facilities at outfalls will be provided as a precautionary measure due to the presence of the SAC.

Table 4-6: Spillage Risk

Drainage Network	Return Period before mitigation (years)	Spillage Risk
Network 1	15748	1/15748
Network 2	15336	1/15336
Network 3	17036	1/17036
Network 4	21092	1/21092

4.5.2.9 Pollution Control

Pollution control measures are proposed at each outfall/discharge point from the carriageway drainage network to reduce the risk of watercourses or groundwater being contaminated by carriageway runoff. A range of pollution control measures have been adopted as part of the Proposed Road Development which include a sealed kerb and gullies, attenuation ponds, emergency spill containment areas and petrol and oil interceptors.

Oil and petrol interceptors will be provided upstream of the wetland and attenuation pond/infiltration basins 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 shut-down valve will be provided at the outlet to each outfall to allow any potential spillage to be accommodate within the attenuation system.

Along the mainline of the Proposed Road Development, a minimum emergency spill containment volume area equal to 25 m^3 will be provided at all outfall locations, as set out in the TII Drainage Standards.

4.5.2.10 Culverts

Streams and interceptor ditches crossed by the Proposed Road Development will be culverted. Culvert size and locations are shown on Figure A4-20 to Figure A4-25 contained in Volume 03 of this EIAR and are summarised in the Table 4-7.

Table 4-7 Proposed Culverts

Culvert	Chainage	Proposed Culvert Dimensions
PC01	N63 Mainline - Ch. 1+030	Piped Culvert – 525 mm Diameter
PC02	N63 Mainline - Ch. 1+415	Box Culvert – 2.0 m x 2.3 m
PC02A	N63 Mainline - Ch. 1+230	Piped Culvert – 1200 mm Diameter
FC01	N63 Mainline - Ch. 1+460	Box Culvert – 2.0 m x 2.3 m
FC02	N63 Mainline - Ch. 1+515	Box Culvert – 2.0 m x 2.3 m
FC03	N63 Mainline - Ch. 1+650	Box Culvert – 2.0 m x 1.5 m
PC03	N63 Mainline - Ch. 1+800	Box Culvert – 2.0 m x 1.6 m
PC04	L6159 North South – Ch. 70	Piped Culvert – 450 mm Diameter
PC05	N63 Mainline - Ch. 2+270	Piped Culvert – 450 mm Diameter
PC06	N63 Mainline - Ch. 2+340	Piped Culvert – 450 mm Diameter
PC07	N63 Mainline - Ch. 2+395	Piped Culvert – 450 mm Diameter
PC08	N63 Mainline - Ch. 2+530	Piped Culvert – 750 mm Diameter

All culverts have been designed to allow for the provision of natural bed material along their length.

All of the proposed structures over existing watercourses have been submitted to the OPW for approval under Section 50 of the Arterial Drainage Act and have been approved.

4.5.2.11 Watercourses Diversions

Where possible, watercourse diversions will be avoided, but some are necessary to avoid excessively long culvert crossings, and these are shown in Figures Figure A4-20 to Figure A4-25 contained in Volume 03 of this EIAR and are summarised in Table 4-8.

Table 4-8 Proposed Watercourse Diversions

Watercourse Diversion	Chainage	Proposed Dimensions
WD-01A	1+030 – 1+170	Length: 144 m
WD-01B	1+000 – 1+030	Length: 43 m
WD-02A	1+280 – 1+400	Length: 116 m
WD-02B	1+450 – 1+530	Length: 75 m
WD-02C	1+400 – 1+500	Length: 97 m
WD-03	1+590 – 1+650	Length: 65 m
WD-04	1+800 – 1+900	Length: 95 m
WD-05	2+250	Length: 20 m
WD-06	2+530 – 2+670	Length: 145 m

All of the proposed diversions of existing watercourses have been submitted to the OPW for approval under Section 9 of the Arterial Drainage (Amendment) Act 1995 and have been approved.

4.5.2.12 Flood Risk

The Proposed Road Development passes through a flood plain area associated with the Abbert River. The Abbert River Bridge described in Section 4.5.1 above incorporates a minimum vertical clearance of 3 m above the riverbanks to accommodate flood capacity.

The Stage 3 element of the Flood Risk Assessment (FRA) comprised the following tasks.

- Assessment of flow using industry standard best practice; A 1% Annual Exceedance Probability (AEP) flow estimate of 48.6 m^3/s was calculated using the FSR-6 method. A corresponding flow hydrograph was produced using the unit hydrograph method to allow unsteady hydraulic analysis to be undertaken. The resultant 0.1% AEP flow of 63.1 m^3/s was obtained through scaling.
- Baseline model development; A linked 1D-2D hydraulic model representative of the current/baseline conditions was developed in Infoworks ICM modelling software. This was developed from hydrographic survey data obtained by Murphy Surveys in May 2020. This included the existing N63 Liss Bridge and the L2128 bridge along with the substantial weir structure at the former corn mill.
- Determination of Flood Zones; Baseline model runs were undertaken for the 1% and 0.1% AEP flow events using the developed baseline model. This allowed determination of the extents of Flood Zones A, B and C.
- “Proposed without Mitigation” model development; The proposals were added to the baseline model which included the approach embankments, Abbert River bridge and other culverts based on a hydraulic and structural basis only. This model scenario was then run using the 1% and 0.1% AEP flows which demonstrated an increase in flood level and extents upstream of the crossing and a subsequent reduction downstream.
- “Proposed with Mitigation” model development; Alterations were made to the “Proposed without Mitigation” to reduce the impact of the proposals. This included the provision of additional flood connectivity culverts (2No. south of the bridge, 1No. north of the bridge) through the approach embankments and upsizing of 2No. watercourse culverts. This model scenario was then run using the 1% and 0.1% AEP flows which still demonstrated an increase in flood level and extents upstream of the crossing and a subsequent reduction downstream however this was much reduced in comparison with the “Proposed without Mitigation” scenario and within acceptable limits.
- The FRA prepared for the Proposed Road Development is provided in Volume 04; Appendix A9-1 and the aspects relating to flood risk are discussed in Chapter 09 Water.

4.5.3 Earthworks

4.5.3.1 Ground Investigations

Ground investigations were carried out in 2020 during design development for the Proposed Road Development. The scope of the investigations was to determine the soil, bedrock, and groundwater conditions and to establish the presence of any contaminants along the route. The results are discussed in Chapter 08 Land and Soils (see also Volume 04; Appendix A8-2) and the investigations comprised the following:

- Ten boreholes (BH01 to BH10) were advanced using a cable percussive rig, to between 2.2 and 7.9 m below ground level (bgl). In four of these locations (BH04, BH05, BH09 and BH10), shallow obstructions resulted in re-drilling of the boreholes (BH04A, BH05A, BH09A and BH10A);
- Standard penetration tests (SPTs) were undertaken at regular intervals and samples were taken for laboratory analysis;
- Rotary coreholes (RC02 to RC07 and RC10) were advanced to depths of between 12.0 m bgl and 21.1 m bgl adjacent to corresponding boreholes to investigate the presence of bedrock; and
- Ten trial pits (TP01 to TP10) were excavated to a maximum depth of 3.0 m bgl.

Excavation earthwork impacts will mainly relate to removal of topsoil and shallow subsoils, although piles for the bridge foundations will extend approximately 2 m into bedrock, while infill earthwork will mainly relate to the import and compaction of acceptable fill material for the construction of embankments to achieve the required engineering design and road grades.

To achieve the required engineering design, the Proposed Road Development will consist of approximately 21% at-grade (i.e. no cut as level with surrounding land), 6% cut and 73% formed along raised embankments created using fill.

Table 4-9 At-grade, Embankment and Cutting Requirements for the Proposed Road Development

	Overall Length [m]	%
At-grade	475	21
Embankment	1,685	73
Cutting	140	6
Total	**2,300**	**100**

The Proposed Road Development will have a gross earthworks deficit (i.e. more importation of fill is required than removal), with a total general fill requirement (excluding capping and pavement) of 78,000 m^3 consisting of an import volume of 77,000 m^3 required to be brought onto the Proposed Road Development site and a re-use volume of 1,000 m^3. The total fill requirement including capping material is approximately 84,100 m^3.

In addition to that, the construction of the proposed bridge structure, including associated abutment and foundation, will require the import of the following quantities of materials, 430 tonnes of structural steel, 2,200 m^3 of concrete and 350 tonnes of reinforcement.

The balance of materials is shown in the Table 4-10. The total volume of unacceptable material (U1) as defined in the Specification for Road Works Series 600 (TII, 2015) requiring disposal is also indicated. The disposal of waste soils is considered further in Chapter 16 Material Assets.

Table 4-10 Earthworks Volumes

Item	Earthworks Aspect	Volume (m^3)
1	Total General Cut Volume* - Underside of topsoil to base of capping	2500
2	Acceptable material for re-use bulked	1000
3	Unacceptable material bulked (U1)	2000
4	Fill requirements for embankments - underside of topsoil to base of capping	78000
5	Excavation and fill requirements to replace peat/alluvium below formation	0
6	Class 4 fill requirements (visual and noise bunds)	0

Item	Earthworks Aspect	Volume (m^3)
7	Total general fill required (excluding capping)	78000
8	Cut to fill (excluding capping)	77000
9	Disposal volume U1	2000
10	Import requirement including capping	84100
11	Import requirement including capping and pavement	93000
A	Total topsoil volume to be removed	18000
B	Capping volume	7100
C	Pavement volume (including sub-base)	8900
D	Total topsoil volume for re-use	4500

As indicated above, the fill required for the construction of embankments is not available in full, from the cut of existing soils present on the Proposed Road Development site and additional fill material will therefore be imported from offsite locations.

Excavation of soils (till and alluvium) will be required as part of the bridge foundation construction for the river crossing and in areas along the Proposed Road Development where levels need to be reduced. These excavations are likely to be limited in area and depth (approximately 6% of the Proposed Road Development will require soil removal).

Stockpiling of unsuitable soils will be undertaken prior to removal from site. In the absence of mitigation, this will have the potential to impact on soil and groundwater, through the leaching of contaminants.

The classification of groundwater vulnerability beneath the Proposed Road Development site varies from 'Moderate' to 'Rock at or near surface or karst'. Where subsoil removal is required, it will be replaced by fill material and paved road surfaces, therefore groundwater vulnerability is unlikely to change. Where soils are to be imported for embankment purposes, fill material will be used where possible and this will increase the soil cover above groundwater bodies beneath the Proposed Road Development site, reducing groundwater vulnerability in these areas. It is also noted that the drainage system for this Proposed Road Development has been designed as a sealed system.

4.5.4 Pavement

The proposed pavement is a fully flexible pavement with a design life of 40 years with a low noise surface course incorporated to minimise traffic-generated noise impacts on the surrounding communities.

The design traffic loadings have been calculated in accordance with TII PE-SMG-02002 Pavement Design (TII, 2010) and Maintenance Traffic Assessment. The future cumulative pavement traffic loading, in terms of million standard axles (msa) are as detailed in Table 4-11.

Table 4-11 Design Traffic - Mainline

Section	Carriageway	AADT (Opening Year)	Commercial Vehicle (%)	Design Traffic (msa)
A	Proposed N63, west of proposed roundabout	5500	6.0%	7
B	Proposed N63, between proposed roundabout and proposed junction with L6159	3500	6.7%	5
C	Proposed N63, east of proposed junction with L6159	3900	6.9%	6

For the purposes of the design, the highest loading has been assumed throughout.

It has been derived from the design traffic loadings provided in that the pavement thickness will vary from between 240 mm to 270 mm depending on the stiffness of the binder content for the Proposed Road Development.

The sub-base layer, using granular material (crushed rock) will be 150 mm thick and is likely to be founded on a 300 mm thick capping layer (of crushed rock) for the majority of the Proposed Road Development to provide a stable foundation for the road pavement, particularly where weaker sub-soils are encountered.

4.5.5 Boundary Treatment

Where boundaries at residential properties are removed as part of the works, they will generally be replaced on a like-for-like basis, subject to final agreement on accommodation works with individual property owners.

At the beginning of the construction phase, the land to be acquired as per the Proposed Road Development boundary will be fenced and access restricted. Temporary fencing or hoarding may be required during construction prior to the installation of permanent fencing to secure the site and prevent unauthorised access.

Fence types will vary across the Proposed Road Development depending on the different requirements. Fence types include timber post and rail fencing, masonry walls, steel palisade fencing, noise barriers, parapets etc. Fencing, safety barriers and parapets on the Proposed Road Development will be provided to meet the requirements of the current TII Publications and guidance documents.

Standard detailed fencing typically used on schemes of this nature will be used. Where the Proposed Road Development traverses' agricultural lands, the road boundary fencing will typically be timber post and tension mesh fencing, in accordance with TII CC-SCD-00320 – Fencing: Timber Post and Tension Mesh Fence (TII, 2018).

4.5.6 Roadside Equipment and Safety Barriers

The Proposed Road Development has been designed in accordance with the principles of forgiving roadsides and with cognisance of the requirements of the latest TII DN-REQ-03034 (Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges) (TII 2019) and TII DN-REQ-03079 (Design of Road Restraint Systems for Constrained Locations (Online Improvements, Retrofitting and Urban Settings)) (TII 2019).

In general, hazards have been eliminated within the design, or relocated outside the clear zone. However, safety barriers will be required on the approach to the bridge parapets. These will be designed in accordance with the requirements of TII DN-REQ-03034 (TII 2019).

4.5.7 Signage

Directional Signs and Regulatory Signs shall be provided in accordance with the 'Traffic Sign Manual' as published by the Department of Transport (2019) (DTTAS, 2019). The Proposed Road Development will be provided with Advanced Direction Signs (ADS) at the approaches to each junction, to advise drivers on directions to regional and local destinations. Text on signage will be in both Irish and English in accordance with the Traffic Signs Manual.

White-on-brown tourist signage panels will be provided, where appropriate, in the standard form, with the name of the town/village and symbols to highlight facilities and features likely to be of interest to tourists. The design of tourist signage and the confirmation of destinations to be included along the Proposed Road Development shall be agreed in conjunction with GCC and in accordance with the TII 'Policy on the Provision of Tourist and Leisure Signage on National Roads' (2011)(TII, 2011).

Road Markings, Reflective Markings and Road Studs shall be provided in accordance with the 'Traffic Signs Manual' (DDTAS, 2019) and in accordance with TII Specification for Road Works - Series 1200 (CC-SPW-01200) (TII, 2019). Temporary traffic signs during construction will comply with Chapter 8 of the Traffic Signs Manual, and the TII Specification for Road Works - Series 1200 (CC-SPW-01200). Brown tourist signs will be included to advertise Knockmoy Abbey and the Knockmoy Abbey Viewing Area.

4.5.8 Lighting

The rural road sections of the Proposed Road Development shall not be lit, and road lighting shall be confined to:

- N63 roundabout (Junction 1) and immediate approaches, including tie-ins with existing road lighting in the village of Abbeyknockmoy;
- The existing road lighting in proximity to Newtown National School and Abbeyknockmoy Community Centre, between Junction 5 (L7138) and Junction 6 (L3110); and
- The proposed pedestrian and cycle facility along the existing N63 between the village of Abbeyknockmoy and Newtown National School/Abbeyknockmoy Community Centre.

The locations of road lighting are shown in Figure A4-33 contained in Volume 03 of this EIAR.

The lighting will be full cut-off type lanterns with shielding where adjacent to residential properties to minimise light spillage as far as practicable. The lighting shall be of an energy efficient design, incorporating LED (light-emitting diode) and dimmable technologies.

Public lighting will be provided within the design in accordance with TII Standard DN-LHT-03038 - Design of Road Lighting for National Roads, BS5489-1:2020, and the Institution of Lighting Professionals (ILP) Professional Lighting Guide PLG02 – The Application of Conflict Areas on the Highway. In addition, the lighting design shall include the following:

- Lighting columns in the design shall be of either slim galvanised steel construction or the equivalent passive safe column;
- Mounting height of columns will typically be 5 or 8 m and no higher than 12 m;
- Lanterns on lighting columns will be full cut off type, with shielding when adjacent to residential properties to minimise light spillage;
- The luminaries shall comprise an LED lighting system with a Correlated Colour Temperature (CCT) of between 3000-4000 Kelvin (K) dependent on each luminaire location and incorporate dimmable switching technology;
- The proposed lanterns, and the limitation of their mounting angle to 5 degrees or less above the horizontal, will limit spillage of light as far as practicable; and
- All cabling associated with lighting will be located underground.

4.5.9 Utilities/Services

The Proposed Road Development intercepts various utility services along the mainline and side roads. Locations where conflicts with significant trunk and distribution services occur along the route have been identified, and preliminary designs and budget costs for the necessary service diversions have been developed following discussions with the utility providers. Effects on local domestic connections will be addressed at the detailed design stage. The provision of the Proposed Road Development shall ensure there are no permanent disruptions to services and that temporary disruptions must be kept to a minimum. Where service diversions are required, all design works, and construction works must be carried out in co-ordination with the relevant statutory bodies and services providers. The locations of significant existing utility services are shown in Figure A4-27 to Figure A4-32 contained in Volume 03 of this EIAR.

These services are being developed and expanded on an ongoing basis, to avoid trenching in the new road for services after completion, provision must be made at construction stage for future crossing by services where agreed with the local authority.

The utilities and services identified include:

- Electricity;
- Water; and
- Telecommunications.

Additional information on the locations of existing services, as well as proposed works in relation to the utilities/services affected by the Proposed Road Development are covered in Chapter 16 Material Assets - Non-Agriculture.

4.5.10 Service Areas and Lay-bys

No service area is proposed along the length of the Proposed Road Development, which is too short for such consideration. Drivers may avail of existing services in Abbeyknockmoy village.

A Viewing Area Lay-by for Knockmoy Abbey will be provided on the western side of the proposed roundabout with parallel parking spaces for four cars. This will be located to the northern side of the Proposed Road Development to allow for unobstructed views of Knockmoy Abbey. It is proposed at Ch 0+ 160 and is located within a 50 kph posted speed limit. The viewing area parking lay-by will also be connected to the village of Abbeyknockmoy by the provision of a 2.5 m wide footpath on the north side of the proposed mainline.

4.5.11 Landscaping

Where possible, disturbance of existing vegetation has been kept to a minimum in the design of the Proposed Road Development. Planting proposals as outlined in Volume 03, Figure A13-2 to Figure A13-7 and discussed in Chapter 13 Landscape and Visual will help to integrate the Proposed Road Development into the surrounding landscape. This will be achieved by reflecting vegetation patterns of local habitat, re-connecting hedgerows to re-establish field patterns and provide screening where needed.

4.5.12 Land Acquisition

Provision of the Proposed Road Development requires the acquisition of land for construction and operation of the development. The area of land required has been determined by a number of different purposes, including:

- Construction of the road;
- Landscaping and boundary treatments;
- Temporary road realignments and diversions;
- Working space to facilitate the safe construction;
- Accommodation works and access roads;
- Acquisition of severed plots; and
- Other road engineering, safety, and environmental considerations.

The land acquisition has been sub-divided into temporary acquisition and permanent acquisition. Temporary acquisition has been sought where the lands are required temporarily to facilitate the construction/demolition of discreet elements of the works. Permanent land acquisition has been sought where the lands are required permanently to enable the operation of the Proposed Road Development through its lifetime.

The total land take including both permanent and temporary acquisition comprises approximately 15.494 ha of land. The permanent acquisition for the Proposed Road Development totalling 15.161 ha is categorised below (areas are approximate):

- 2.942 ha classified as Public Road;
- 12.184 ha classified as Agricultural Land; and
- 0.035 ha classified as Residential Land.

The proposed land acquisition is necessary for the construction, operation, and maintenance of the Proposed Road Development.

The acquisition of land is discussed in more detail in the following chapters of the EIAR:

- Chapter 06 Population and Human Health;
- Chapter 16 Material Assets - Non-Agriculture; and
- Chapter 17 Material Assets – Agriculture.

4.6 Construction Phase

4.6.1 Introduction

This section outlines the significant factors that need to be considered for the planning of the construction phase of the Proposed Road Development. While progressing to the construction phase is dependent on both planning and funding approvals, the following descriptions were prepared on the presumption that these approvals will be in place, in order to inform the EIA.

4.6.2 Appointment of Contractor

The design of the Proposed Road Development has been developed to a stage where all potential environmental impacts can be identified, and a fully informed environmental impact assessment can be carried out. It is likely that the Proposed Road Development will be constructed by a contractor appointed under a Design and Build Contract (D&B). The contractor engaged will be responsible for finalising the design of the Proposed Road Development in compliance with the Employer's Requirements, including compliance with the requirements of the EIAR and Natura Impact Statement (NIS) (including all mitigation measures) and any development consent conditions. Minor modifications may be made to the current design at the detailed design stage to avail of opportunities to improve the design in light of experience on the ground or other innovations.

4.6.3 Duration of Works

It is likely that construction of the Proposed Road Development will be progressed as a single construction contract with the construction phase potentially lasting between 15 - 18 months.

4.6.4 Description of Construction Works

4.6.4.1 Pre-Construction Works

Archaeological investigation works, including testing and any follow-on resolution works, will be undertaken prior to the main works contract commencing onsite.

Pre-construction works are likely to include certain diversion works of services and utilities, including electricity, telecommunications, and water mains. Due to the nature of some of the diversions, and their location under existing road space, a number of these service diversions will only be possible during the main construction works.

Advanced tree clearance, hedgerow clearance, and fencing contracts may be undertaken as these activities are dependent on the anticipated seasonal timing of the award of the main contract.

Measures to ensure that there is no potential for the introduction or spread of invasive species during construction are outlined in the OCEMP (see Volume 04; Appendix A4-1 for details, also see Chapter 07 Biodiversity). These include biosecurity measures and should be implemented during pre-construction works.

4.6.4.2 Preliminary Construction Works

Establishment of the construction compounds and connection of services for their operation will likely be undertaken at the start of the works. This shall then be followed by site clearance and topsoil stripping of the site in stages. It is likely that this will be phased to keep just ahead of the major earthwork movements. Initial works on permanent and temporary boundary fences may also be undertaken as a preliminary operation, with further boundary works required on completion of the main construction works. Accommodation works where required for access, as well as temporary access routes and haul routes through the site will be key early activities.

4.6.4.3 Main Construction Works

The main construction works consist predominantly of structures, earthworks, and road pavement construction.

The structures will involve construction of the bridge over the Abbert River, including foundations, abutments, the delivery and installation of steel gilder beams, construction of retaining walls, piling works and other reinforced concrete works.

The earthworks construction will involve the excavation and placement of materials for the construction of embankments as well as the hauling of materials and importation of materials to complete the road formation and sub-formation. Materials for the road construction will include those that will be brought to site including gravels, crushed rock and bituminous pavement and surfacing materials.

In addition to the structures, earthworks and pavement construction, the main activities will involve the following:

- Drainage the installation of pipes, culverts, surface water channels, filter drains, ditches, and attenuation systems;
- The diversion and construction of utilities and services;
- Environmental mitigation including landscaping and habitat creation;
- Ancillary roadworks including the installation of safety barriers, public lighting, signage, and road markings; and
- Accommodation works for affected landowners such as access roads, entrances, fences, gates, walls, ducting and reconnection of severed services.

Due to the size and scope of the works, it is envisaged that all construction works will be carried out in one phase. During the construction phase, there will be temporary noise barrier/screening used to protect properties from noise pollution from the works.

All side roads intersected by the Proposed Road Development are at-grade crossings. During the construction period, all side road accesses will be required to be maintained. Alternative access to agricultural land will be required during the construction phases.

4.6.4.4 Drainage

The Contractor will need to construct elements of the permanent drainage system as early as practicable, such as the interceptor drains, to facilitate earthworks haul routes and control drainage from the works, to avoid flows onto adjacent land and/or untreated discharges to watercourses. The piped culvert, including the headwalls, is proposed to be constructed during the summer months, when the ditch is dry or there is standing water only. This culvert shall be constructed in accordance with the Inland Fisheries Ireland (IFI) guidelines, Construction Erosion and Sediment Control Plan (CESCP), OCEMP and to the EIAR requirements in relation to works on or near watercourses. Details of the proposed drainage identified outfalls and treatment are provided in Section 4.5.2 of this EIAR.

4.6.4.5 Bridge over the Abbert River

There is one river crossing proposed as part of the Proposed Road Development involving a single span (60.5 m) crossing of the Abbert River (see Volume 03; Figure A4-2).

The minimum bridge cross-section shall be 14 m wide, comprised as follows:

- 0.5 m parapet edge beam;
- 2.5 m raised verge;
- 0.5 m hard strip;
- 3.5 m carriageway;
- 3.5 m carriageway;
- 0.5 m hard strip;
- 2.5 m raised verge; and
- 0.5 m parapet edge beam.

A steel girder is the preferred option for the bridge design. It shall comprise a composite steel girder bridge spanning the Abbert River. The superstructure will be formed of 6no. braced weathering steel girders at 2.53 m centres. The skew angle will be 35 degrees and a maximum span length of 60.5 m from centre of bearing to centre of bearing. The total bridge width will be 15.65 m which includes the minimum required cross sectional width plus additional verge widening to account for carriageway sightlines at the south-west and north-east corners.

In-situ cantilever wingwalls and gravity retaining walls shall be provided to retain the earthworks on approach and departure to the structure. Large areas of exposed concrete at the abutments and wingwalls will be finished with a locally sourced masonry cladding to improve aesthetics and avoid large areas of plain concrete. Stone cladding was chosen over concrete as it was deemed to blend with the existing environment to a greater degree than in-situ concrete with a pattern profile finish. The steel girders will be fabricated offsite and transported to site then lifted into place.

4.6.4.6 Bridge Construction Methodology

The proposed construction methodology considers the temporary and permanent impact on the surrounding environment. The bridge is a single span structure formed of a 6 no. braced weathering steel girders. The bridge spans the Abbert River and is supported on full height reinforced in-situ concrete abutments. Offsite fabrication will be maximised for the construction of the steel girders. The structural members will be fabricated in a controlled factory environment to ensure high precision and efficiency. This reduces material waste and limits the environmental impacts from the harmful emissions created in production. The use of offsite fabrication of the beams will limit construction time onsite, construction traffic moving to and from the site and the risks associated with working at height and near live watercourses. The superstructure will be transported to site in sections and assembled onsite. Onsite assembly will aim to avoid the impacts of construction in inclement weather conditions and ensure high quality welds and connections minimising maintenance requirements over the service life of the bridge. In-situ reinforced concrete abutments have been proposed for the substructure. The abutments will retain suitable backfill material up to the finished deck level.

Prior to construction commencing, temporary fencing will be erected a suitable set-back from the river embankments. This will create an exclusion zone, protecting the riverbanks during construction and maintaining a safe passage for wildlife during construction. The fences will further act as a safe working zone for construction personnel and prevent the storage of material too close to the crest of the slope, mitigating the risk of run-off and pollution to the Abbert River.

The foundation type will be finalised at detailed design stage, at this stage a piled foundation is preferred to limit differential settlements, excavation dimensions and minimise the surcharge transferred to the fill slopes over the service life of the bridge. Sufficient space will be required within the lands made available boundary to ensure that delivery of the structural elements is facilitated, such as the prefabricated weathering steel girders. In addition, areas should be identified for piling platforms and crane lifting platforms within the lands made available. These locations may require local excavation and replacement with structural fill to support the piling rig or crane. When the foundation work is complete, the abutments can be built-up to bridge soffit level including in-situ cantilever wingwalls and gravity retaining walls on the approach and departure of the bridge. Bridge bearings will then be installed on each abutment and the bridge superstructure can be lifted into place with a mobile crane. To transport the girders to site it is suspected an Abnormal Load Permit will need to be granted from An Garda Síochána. Once the superstructure of the bridge has been lifted into place the abutment diaphragms and deck slab can be cast. The parapet edge beam may then be erected, and waterproofing will be applied to the deck slab and any other area of exposed concrete.

Once the superstructure and abutments are in place, the backfill to the abutments will be laid and compacted to the required road level. Finally, the finishes of the bridge will be completed including the construction of any required verged/service ducts, erecting the parapet system and applying the road surfacing.

4.6.5 Construction Materials

The main materials that will be imported to/from the Proposed Road Development site or hauled within the Proposed Road Development site in bulk are:

- Earthworks, including topsoil, general fill, and fill material, rock, capping materials, peat, and soft soils;
- Pavement materials, including granular sub-base material and bituminous pavement materials;
- Concrete, including both in-situ and precast units such as pipes, culverts, and headwalls;
- Steel, including steel bridge beams, reinforcement for concrete works and steel safety barriers; and
- Other materials will be required including fencing material, plants, ducting etc.

4.6.5.1 Earthworks Materials

Details of the existing ground conditions and proposals for earthworks design based on data obtained from the preliminary site investigations are outlined in Chapter 08 Land and Soils of this EIAR. The quantities are based on site investigations and are indicative only, as actual conditions may differ. A summary of the earthwork quantities is given in Table 4-10 in Section 4.5.3. During construction and excavation, additional details regarding the condition of the materials may be established which may lead to further development of the earthworks design to improve the import requirement for the Proposed Road Development. The development involves the excavation, transportation and importation of material excavated from within the Proposed Road Development site. The earthworks have been designed to minimise the amount of material requiring importation from external quarries as far as practicable. The exact strategy for the earthworks will depend, to a certain extent, on the strategy adopted by the successful Contractor.

It is estimated that a small volume (approximately 5,500 m^3) of soils from the Proposed Road Development site will be suitable for re-use within the Proposed Road Development. The remaining fill material requirement will be sourced where possible from local quarries, providers of recycled aggregates or suitable donor sites under Article 27 of the European Communities (Waste Directive) Regulations 2011. A number of local quarries have been identified, and prior to construction, these shall be reviewed and only those quarries that conform to all necessary statutory consents will be used in the construction phase. Soils/fill material to be brought to the Proposed Road Development site will be vetted with chemical soil testing if necessary, in order to check that it is of a reputable origin and that it is 'clean' (i.e. will not introduce contamination to the environment; soil and groundwater). All potential suppliers will be vetted for the following criteria:

- Environmental management status; and
- Regulatory and legal compliance status of the company.

'Clean' fill material will be sourced from suppliers which comply with the above requirements. If recycled aggregate is used as imported fill, chemical testing will be undertaken to confirm that it is 'clean' (i.e. would not introduce contamination to the environment).

According to the Geological Survey Ireland (GSI) Spatial Resources website, the following active quarries are located within a 20 km radius of the Proposed Road Development:

Table 4-12 Active Quarries Identified within 20 km of the Proposed Road Development

Quarry Name	Resource	Distance from Proposed Road Development Site (approximately)
Cortoon Pit	Sand and gravel	13 km north
Mortimers Quarry	Limestone	14 km west
Coshla Quarries	Limestone	15 km south-west
Cathill Pit	Sand and gravel	18 km north
Esker Readymix Quarry	Limestone	19 km south

Source: Geological Survey of Ireland Spatial Resources Website (January 2021)

Only quarries that conform to all statutory consents will be used in the construction phase. The construction contract will require the contractor to develop a detailed Waste Management Plan (WMP) with respect to all other waste materials arising from the works.

4.6.5.2 Pavement Material

It has been calculated that the volume of pavement materials, excluding capping material, to be hauled to the site will be approximately 8,900 m^3 (including sub-base). Quarries that could be considered as potential sources for pavement materials, particularly for bituminous materials, are detailed in Table 4-13.

Table 4-13. Pavement Plant Locations and Details

Pavement Plant	Pavement Plant Location	Approximate Distance from Abbeyknockmoy	Products
Colas Bitumen Emulsions	Deerpark Industrial Estate, Oranmore, Co. Galway	Circa 28.8 km south	Surface Dressing Emulsions Bond & Tack Coat Emulsions Asphalt & Macadam Binders Pothole Patch Emulsion
Carlington Ltd	Ballykillmurray, Tullamore, Co. Offaly	Circa 120 km south	Road Recycling Asphalt & Macadam Works Surface Dressing

4.6.5.3 Concrete Material

The Proposed Road Development includes the construction of one river bridge, culverts, and footpaths. These structures contain both pre-cast concrete units and in-situ concrete. Precast concrete elements will be sourced from specialist producers. Sources for in-situ concrete that could be considered as potential sources for concrete materials are detailed in Table 4-14.

Table 4-14. Quarry Locations and Details

Quarry Name	Quarry Location	Approximate Distance from Abbeyknockmoy	Products
Coshla Quarries	Cashla, Athenry, Co, Galway H65EE33	Circa 21.5 km south	Concrete Blocks Stone & Aggregates
CMC Quarries	CMC QUARRIES Ballygaddy Road, Tuam, Co. Galway. Rep. of Ireland H54 YH48	Circa 22 km north	Readymix Concrete Blocks Stone Fill Sand & Aggregates
Frank Harrington Limited	Frank Harrington Limited, Ardgaineen, Claregalway, Co. Galway, Ireland	Circa 18.2 km west	Readymix Concrete
Roadstone Galway	Roadstone Tuam Road Galway	Circa 23.9 km south	Concrete Blocks Kerbs Stone fill
Mc Tigue Quarries	Ballaghbaun, Belclare, Co. Galway, H54 VX32, Ireland	Circa 23 km north	Stone & Sand
Mortimer Quarries	Cartron, Belclare, Co. Galway, Ireland	Circa 26.1 km north	Readymix Concrete Stone fill Building Stone

4.6.5.4 Steel Material

Steel will be required for in-situ concrete reinforcement and for the bridge beams. Steel elements will be sourced from specialist producers. Sources for steel material that could be considered as potential sources for steel materials are detailed in Table 4-15.

The haulage route for access into the Proposed Road Development has been determined to be restricted to use of the regional roads that are connected to the site, and other unsuitable local roads may not be used for such traffic.

Table 4-15. Steel Manufacturer Locations and Details

Steel Manufacturer Name	Steel Manufacturer Location	Approximate Distance from Abbeyknockmoy	Products
Lydon Steel	Brownville, Bushypark, Galway, Ireland H91 R8X8	Circa 43.2 km west	Rebar Mesh Accessories
Pat Rynn Engineering Ltd	Harbour Enterprise Park, New Docks, Galway, Ireland	Circa 37.6 km west	Structural Steel
Kennedy Commercials Ltd	Carnakelly North, Co. Galway, Ireland	Circa 28.8 km south	Steel Fabricator

Steel Manufacturer Name	Steel Manufacturer Location	Approximate Distance from Abbeyknockmoy	Products
Barrett Engineering Specialist Steel.	Barna, Newcastle west, Co. Limerick V42 FW28	Circa 156 km south	Mild Steel High Tensile Strength Steels Corten Weathering Steel, Grade A Aluminium

4.6.6 Temporary Traffic Management

A Traffic Management Plan (TMP) shall be produced to identify the impact of the works on the existing traffic and proposed mitigation.

In general, the majority of the mainline (Ch. 0+070 to Ch. 2+600) traverses greenfield (including agricultural lands) and can be constructed without significant impacts on the existing road network. However, there are likely to be traffic management impacts during the construction of the online section of the mainline (Ch. 2+600 to Ch. 3+120), the side road realignments and other tie-in points.

Temporary works and traffic management of the existing road network will be required to facilitate the traffic movements during the construction phase of the project, with particular attention to operation of the existing N63 (national secondary road network) and the L3110.

Due to the at-grade nature of the junctions on the Proposed Road Development, the existing road network will not require extensive traffic management during the construction phase, except for the aforementioned at-grade junctions located at the north and south ends of the Proposed Road Development (Ch. 0+000 and Ch. 1+150). All temporary diversions, lane closures, one-way systems, signage, and temporary safety measures will be carried out in accordance with Chapter 8 of the Traffic Signs Manual (2019) (DTTAS, 2019). The detailed traffic management plans and diversions to be implemented at the interface between the works and traffic will, however, be the Contractor’s responsibility. The Contractor will also be responsible for acquiring the necessary licensing and permissions for use of these roads with regard to temporary closures and traffic management.

4.6.7 Construction Traffic

4.6.7.1 Site Access Routes

The haulage of materials to and from the Proposed Road Development site could create nuisance to both road users and residents living along haul routes. To minimise this, it is important that only authorised site access points, as directed by the Local Authority, are used by construction vehicles.

It is proposed that access points to the site for the mainline works will be restricted to the following roads:

- N63 Eastbound; and
- N63 Westbound.

The condition and width of alternative access through local road should be assessed as these roads may not be suitable for use by heavy construction traffic.

4.6.7.2 Construction Traffic Routing

To construct the earthworks, materials will need to be hauled between different sections of the site.

In general, materials will be hauled along the route of the Proposed Road Development between the various sections without the need to use the public road network. The imported fill materials will be brought to the site on the public road network, prior to being distributed along the path of the Proposed Road Development via the haul roads.

In general, the contractor will move materials via the public road network only where necessary as it is more efficient to utilise the haul roads and it is envisaged that the existing road network will only be utilised for the delivery of materials. The use of the public road network is also less desirable to the contractor due to potential traffic delays along these routes and potential delays for construction vehicles needing to join and exit the public road network, including additional delays to clean vehicles exiting the site onto the public road.

Temporary crossing points will be required for each of the national and local roads crossed by the Proposed Road Development. The crossings will require local traffic management, in accordance with the issued TMP, the Traffic Signs Manual and the Safety, Health & Welfare at Work (Construction) Regulations.

The additional construction traffic on the public road network has been estimated on the following basis:

- The entire Proposed Road Development will be constructed in one phase;
- Construction traffic is distributed over a construction period of 18 months;
- Works will be undertaken on a five-day working week x 48 working weeks = 360 working days;
- Construction traffic movements are based on one full load and one empty load (i.e. two movements for each load of materials);
- Steel, pavement, and concrete materials may be sourced from the quarries identified in Section 4.6.5.2 to 4.6.5.4 respectively;
- The transport of fill material will be through the site via haul roads, as well as along the roads in close proximity to the site; and
- The increase in traffic takes account of the additional trips required for the transportation of all additional fill material, pavement, and concrete materials.

4.6.8 Construction Compound

A minimum of one construction compound will be required along, or in the vicinity of the Proposed Road Development to provide storage of construction equipment and materials, as well as for offices, parking, and welfare facilities for staff.

The main and primary construction compound will be accommodated within the lands located to the north of the existing N63 (Ch. 2+500). An alternative and secondary compound is proposed to the north of the existing N63 (Ch. 0+200), in proximity of the proposed roundabout. The locations and extents of the construction compounds are presented in Figure A4-19 contained in Volume 03 of this EIAR.

The main compound will be 4000 m^2 (0.4 ha) in size and shall include stores, offices, material storage areas, plant storage and parking for site and staff vehicles. The potential secondary compound will also be 4000 m^2 (0.4 ha) in size. This site is proposed to remain in place for the duration of the contract but may be scaled up or down during particular activities onsite. The layout of the construction compounds shall, however, incorporate the protection and control measures outlined in the EIAR, and conform to the requirements outlined in the Outline Construction Environmental Management Plan (see Section 4.6.9 below), NIS and planning conditions. Following completion of construction, these areas shall be cleared and re-instated; temporary buildings and containers, parking areas and material such as rubble, aggregates and unused construction materials will be removed as appropriate.

4.6.9 Outline Construction Environmental Management Plan

During the construction phase of the Proposed Road Development, the works will comply with all relevant legislation and guidelines that aim to reduce and minimise environmental impacts. Construction-related impacts are generally of short-term duration and localised in nature. These impacts will be reduced, as far as possible, by complying with the mitigation measures outlined in this EIAR, the corresponding NIS, construction industry guidelines, TII Environmental Construction Guidelines (outlined below) and the OCEMP, as described in this section.

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

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

- Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes (NRA[3]);
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes (TII, 2005);
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (TII, 2008);
- Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes (TII, 2008);
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (TII[4]);
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (TII, 2011);
- Guidelines on the Management of Noxious Weeds on National Roads (TII, 2010);
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII, 2004);
- Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes (TII, 2008);
- Guidelines for the Management of Waste from National Road Construction Projects (TII, 2017); and
- Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan (TII, 2007).

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

As a minimum, the CEMP will include the following, as they relate to the proposed works:

- All environmental commitments/mitigation measures, as prescribed in the EIAR and/or NIS and conditioned by the Competent Authority (An Bord Pleanála) or any other statutory body (e.g. National Parks and Wildlife Service (NPWS));
- Methodologies for implementation of the above-stated environmental commitments/measures, where required;
- A list of all applicable environmental statutory requirements, the corresponding legislation, and a methodology for documenting compliance with same; and
- Methodologies by which construction work will be managed to avoid, reduce, or remedy potential adverse impacts on the environment.

An OCEMP has been appended to this EIAR as Appendix A4-1 in Volume 04 of this EIAR. The OCEMP will include a number of sub sections which identify the approach in respect of the following for the construction stage of the Proposed Road Development, as follows:

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

[3] Available online at https://www.tii.ie/tii-library/environment/construction-guidelines/Guidelines-for-the-Treatment-of-Badgers-prior-to-the-Construction-of-a-National-Road-Scheme.pdf. Accessed 14/09/21
[4] Available online at https://www.tii.ie/technical-services/environment/construction/Guidelines-for-the-Protection-and-Preservation-of-Trees-Hedgerows-and-Scrub.pdf. Accessed 14/09/21

4.6.9.1 Construction, Erosion and Sediment Control

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

- Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages);
- Details of construction plant storage, temporary offices, and onsite chemical toilet areas;
- Traffic Management Plan (to be developed in conjunction with Galway County Council) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; onsite parking for vehicles and workers; road cleaning; other traffic management requirements;
- Truck wheel wash details (including measures to reduce and treat run-off);
- Dust management to prevent nuisance (demolition and construction);
- Site run-off management;
- Noise and vibration management to prevent nuisance (demolition and construction);
- Landscape management;
- Management of demolition of all structures and assessment of risks for same (where applicable);
- Lighting details (construction and operation);
- Signage;
- Stockpiles;
- Procedures and method statements for;
  - Demolition and removal of buildings, services, pipelines (including risk assessment and disposal);
  - Diversion of services;
  - Excavation and blasting (through soils and bedrock);
  - Piling
  - Construction of pipelines;
  - Temporary hoarding and lighting;
  - Borrow Pits and location of crushing plant (where applicable);
  - Storage and Treatment of peat and soft soils;
  - Deposition of surplus geological material (peat, soils, rock etc.);
  - Protection of watercourses from contamination and silting during construction; and
- Site Compounds, layouts, and protective measures.

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

4.6.9.2 Construction and Demolition Waste Management Plan (WMP)

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

- Details of waste storage (e.g. skips, bins, containers) to be provided for different waste and collection times;
- Details of where and how materials are to be disposed of - landfill or other appropriately licensed waste management facility;
- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of where necessary; and
- Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner.

4.6.9.3 Incident Response Plan (IRP)

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

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

4.6.9.4 Invasive Species Management Plan (ISMP)

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

4.6.9.5 Implementation of the CEMP

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

4.7 References

- AECOM (2021). N63 Liss to Abbey Realignment Scheme Flood Risk Assessment.
- DTTAS (2019) Traffic Signs Manual, Department of Transport, Tourism and Sport, Dublin Ireland.
- DTTAS (2019). Design Manual for Urban Roads and Streets, Department of Transport, Tourism and Sport, Dublin Ireland.
- NTA, (2011) National Cycle Manual, National Transport Authority, Dublin, Ireland.
- TII (2004) Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2005) Guidelines for the Treatment of Bats during the Construction of National Road Schemes, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2007) Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2008) Guidelines for the Treatment of Bats during the Construction of National Road Schemes, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2010) PE-SMG-02002 - Traffic Assessment, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2010) Guidelines on the Management of Noxious Weeds and Non-Native Invasive Plant Species on National Road Schemes, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2011) Policy on The Provision of Tourist and Leisure Signage on National Roads, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2011) Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2015) DN-DNG- 03022- Drainage Systems for National Roads, Transport Infrastructure Ireland, Dublin Ireland.
- TII (2015) DN-DNG-03064- Drainage Runoff from Natural Catchments, Transport Infrastructure Ireland, Dublin Ireland.
- TII (2015) DN-DNG-03065- Road Drainage and the Water Environment, Transport Infrastructure Ireland, Dublin Ireland.
- TII (2015) DN-DNG-03066- Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2015) CC-SPW-00600 - Specification for Road Works Series 600 - Earthworks, Transport Infrastructure Ireland, Dublin, Ireland.
- TII. (2017) DN-GEO-03031- Rural Link Road Design, Transport Infrastructure Ireland, Dublin, Ireland.
- TII. (2019) DN-GEO-03036- Geometric Design of Junctions, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2017) Guidelines on the Management of Waste from National Road Construction Projects, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2018) CC-SCD-00320 - Fencing - Timber Post and Tension Mesh Fence, Transport Infrastructure Ireland, Dublin, Ireland.
- TII. (2017) DN-GEO-03060- Cross Sections and Headroom, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2019) DN-REQ-03034 - The Design of Road Restraint Systems (Vehicle and Pedestrian) for Roads and Bridges, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2019) DN-REQ-03079 - Design of Road Restraint Systems for Constrained Locations (Online Improvements, Retrofitting and Urban Settings), Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2019) CC-SPW-01200 - Specification for Road Works Series 1200 - Traffic Signs and Road Markings, Transport Infrastructure Ireland, Dublin, Ireland.
- TII (2008) Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes, Transport Infrastructure Ireland, Dublin, Ireland.

- TII (2008) Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes, Transport Infrastructure Ireland, Dublin, Ireland.

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 05: Traffic Analysis

Galway County Council

February 2022

Table of Contents

Figures

Tables

5. Traffic Analysis

5.1 Introduction

This chapter presents an assessment of the impacts and associated effects of the Proposed Road Development on the existing road network. It defines the study area; the methodology used for developing the baseline and impact assessment; provides a description of the baseline environment in relation to traffic and presents the findings of the impact assessment.

It outlines the development of the traffic models used to analyse the Proposed Road Development and the future year traffic growth factors used to generate projected Annual Average Daily Traffic (AADT) on all key roads in the study area. Existing and projected traffic figures are presented for both the Do-Minimum and Do-Something scenarios. These figures provide a basis for the engineering design presented in Chapter 04 Description of the Proposed Road Development and the assessments presented in Chapter 10 Air Quality, Chapter 11 Climate and Chapter 12 Noise and Vibration. An overall commentary on the predicted changes in traffic conditions is provided as a setting for all the other assessments undertaken in this Environmental Impact Assessment Report (EIAR).

5.2 Legislation, Policy and Guidance

This chapter has been prepared with reference to the following guidance notes:

- Transport Infrastructure Ireland (TII) (2016). Project Appraisal Guidelines, Transport Infrastructure Ireland, Dublin, Ireland.
- TII. (2017). Project Management Guidelines, Transport Infrastructure Ireland, Dublin, Ireland.
- Environmental Protection Agency (EPA) 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017a); and
- Advice Notes for Preparing Environmental Impact Statements (EPA, 2017b).

5.3 Methodology

5.3.1 Traffic Modelling Overview

A simple model (link-based projections) approach has been used for the traffic assessment of this Proposed Road Development. As per TII Project Appraisal Guidelines (TII, 2016), this approach can be adopted for minor projects (costing between €5 m and €20 m) where significant re-routing does not take place, instead of building a full traffic assignment model (zone-based projections). In order to calculate the number of vehicles which will use the Proposed Road Development (regional traffic), the number of vehicles that will remain on the existing route (local traffic) were determined first. Based on the traffic survey data, a simple model was created which calculated the percentage of local and regional traffic.

For simple models, traffic flows are generally represented as vehicular traffic flows on links, with limited information on origin, destination, or trip length. In such cases, future year traffic growth is projected using growth rates which describe likely traffic growth that may occur over the appraisal period of the Proposed Road Development.

The derivation of link-based growth rates is based on an aggregate projection of growth in vehicle kilometres within a defined geographical area, with appropriate classifications by vehicle type and projected period. This allows the specification of a series of growth rates which can be applied directly to traffic flows on simple networks to generate an appropriate estimate of future traffic flows.

5.3.2 Study Area

The study area includes the existing road network in the environs of the Proposed Road Development as illustrated in Figure 5-1. Key roads of interest are those listed below.

- L3110 (Monivea Road) is a local road to the south of the existing N63 which leads to Mullagh Hill. It forms a priority junction with the existing N63, and in cross-section consists of a single carriageway with a footway on the western side leading from the GAA Club to the junction with the existing N63. There is a GAA Club, creche and numerous private accesses on this road.
- L7138 (Lisch Road) is a local road to the south of the existing N63 that leads to Monivea. It forms a priority junction with the existing N63, and in cross-section consists of a single carriageway (no centre line) with a footway connecting the church to the N63 mainline. There is a church and numerous entrances to private dwellings on this road.
- L6159 is a local road located to the north of the existing N63 that leads to Carrogorm. It forms a priority junction with the existing N63, and in cross-section consists of a single carriageway (no centre line) with no footway or cycleway provisions. There are a limited number of private accesses along the road.
- L6234 is a local road located to the north of the existing N63. It forms a priority junction with the existing N63, and in cross-section consists of a single carriageway (no centre line) with no footway or cycleway provisions. This road intersects L6159 to the north of the study area. There are a limited number of private accesses along the road.

Other roads in proximity of the study area are:

- L21821 is a local road situated to the south of the existing N63. It forms a priority junction with the existing N63 and ends approximately 1 km south of the existing N63. In cross section, it consists of a single carriageway (no centre line) with no footway or cycleway provisions. There are a limited number of private accesses along the road;
- L2182 is a local road situated to the north of the existing N63. It connects to the N63 in Abbeyknockmoy village with a priority junction and crosses the Abbert River approximately 1.5 km west of the existing Liss Bridge. In cross section, it consists of a single carriageway (no centre line) with no footway or cycleway provisions. There is a playground and a few entrances to private dwellings on this road; and
- L6159 (Old Road) is a local road located to the north of the Abbert River that connects the L2182 to the west with the L6159 to the east. In cross section, it consists of a single carriageway (no centre line) with no footway or cycleway provisions. There is a cemetery, the Knockmoy Abbey, and some private accesses on this road.

Figure 5-1 Existing Road Network

The study area for the traffic assessment has considered the portion of road network that encompasses the likely impacts of the Proposed Road Development and is illustrated in Figure 5-2.

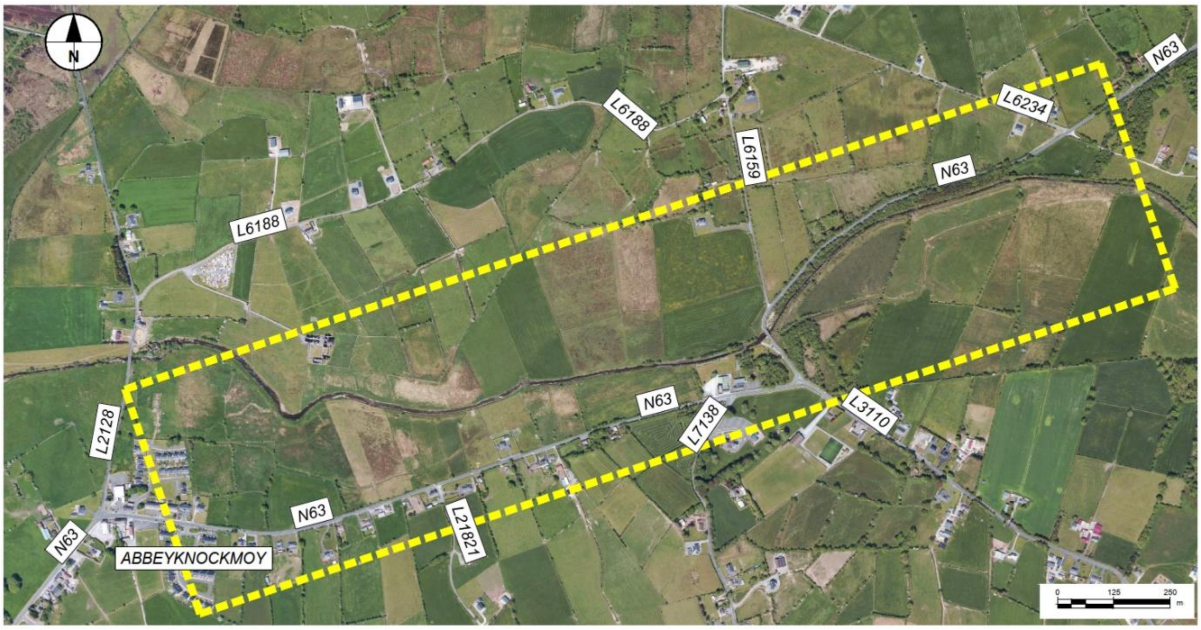

Figure 5-2 Traffic Assessment Study Area

5.3.3 Data Sources

Traffic survey data was required to develop and validate the Base Year traffic model. This traffic survey data is presented and discussed herein.

Traffic Surveys

A baseline review was undertaken to determine the existing traffic conditions in the area surrounding the Proposed Development. This included commissioning a series of detailed traffic surveys to determine the existing traffic levels and conditions and to inform the development of the scheme. The surveys undertaken include:

- Junction Turning Counts (JTC)
  - Classified JTC data gives an indication of the turning movements observed at key junctions in the network. These were commissioned in the 5 locations shown in Figure 5-3, and recorded in 15-minute intervals between 07:00 and 19:00 on Tuesday 21st May 2019.
- Automatic Traffic Counts (ATC)
  - ATC data provides link count data over a longer time period, which smooths out any day-to-day variations that may not be picked-up when undertaking a single day count. ATCs were also used to assess the speed distribution of the traffic along the existing N63. ATC data was collected at the 3 sites shown in Figure 5-3. Each site was active for two weeks, with the majority of sites actively collecting data between 21st May and 3rd June 2019.
- TII Traffic Monitoring Units (TMU)
  - TII maintains a network of permanent traffic counters (TMU - Traffic Monitoring Units) on the National Road Network. One such traffic counter (Ref. TMU N63 080.0W) is located on the N63 between Roscommon and Galway at Derreen, Co. Galway. This location is shown also in Figure 5-3.

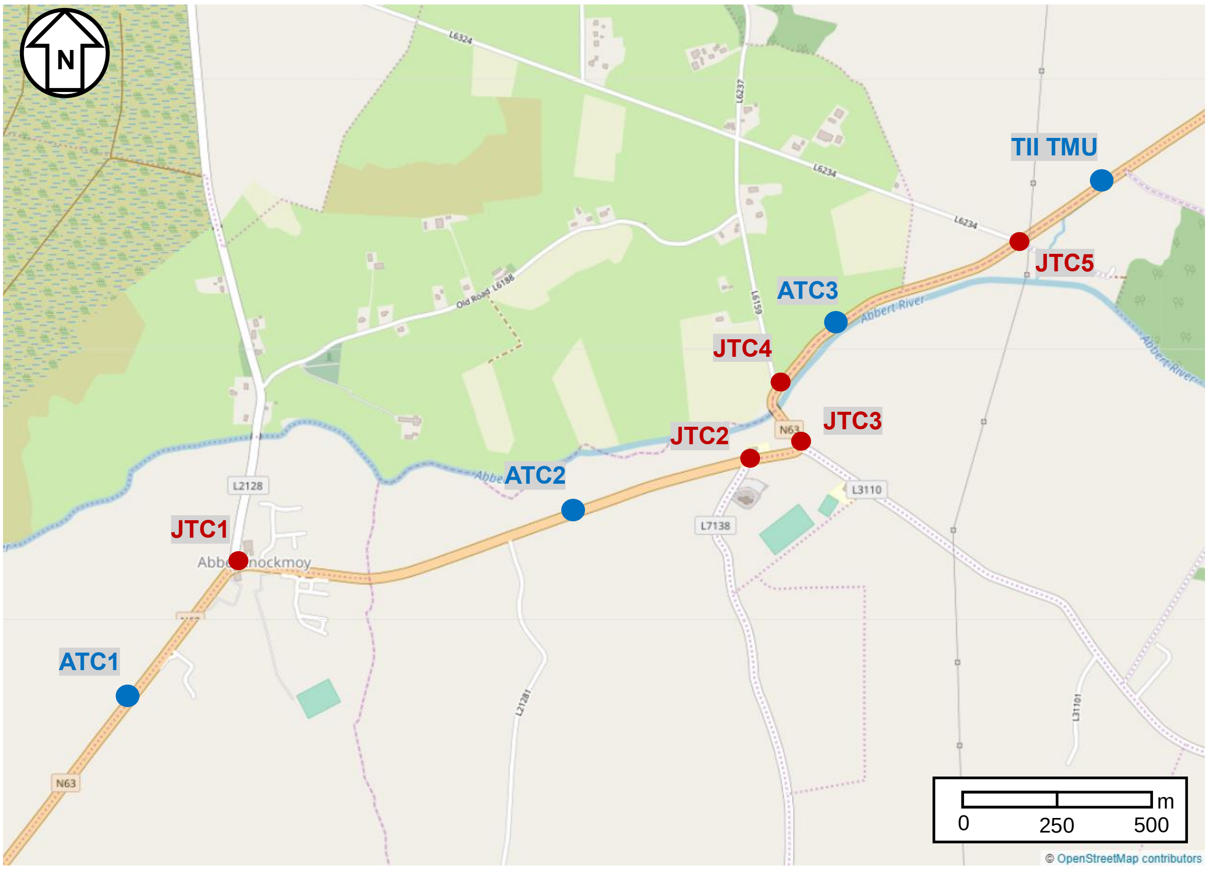

Figure 5-3 JTC, ATC and TII TMU Locations Map

5.3.4 Determination of the Baseline Environment

5.3.4.1 Base Year Traffic Model (2019)

As mentioned previously in Section 5.2.2, for minor projects (costing between €5 m and €20 m) where significant re-routing does not take place, a simple model (link-based projections) approach can be used instead of building a full traffic assignment model (zone-based projections). A simple model using traffic survey data from 2019 was created to determine the number of vehicles which will use the Proposed Road Development. The model was developed in accordance with the methodology as set out within the TII Project Appraisal Guidance (PAG).

5.3.5 Construction Phase

5.3.5.1 Construction Traffic Model

The traffic volumes on the surrounding road network during the construction phase of the Proposed Road Development were assessed. Two different traffic components have been assessed, namely (a) the 'Base' (2023 assumed Opening Year Do-Minimum) traffic characteristics and (b) the 'Construction' (Do-Something) traffic characteristics.

The 'Construction' traffic flows resulting from the construction of the Proposed Road Development are then added to the network's 'Base' traffic flows to establish the Construction Phase traffic flows. In summary, the following scenarios were considered:

1. 2023 Opening Year AADT + Construction AADT + Construction Traffic (access from existing N63 west of the Proposed Road Development); and
2. 2023 Opening Year AADT + Construction AADT + Construction Traffic (access from existing N63 east of the Proposed Road Development).

It is noted that this represents the worst-case assessment, as the entirety of construction traffic will travel from/to the Proposed Road Development from east or from west, while a more realistic scenario would be a combination of the two.

5.3.6 Operational Phase

5.3.6.1 Future Year Traffic Models

5.3.6.1.1 Network Development

The future year 'Do-Minimum' road network which forms the basis of the future traffic models, should include the existing road network plus any committed infrastructure improvements in the study area. As there are no significant road improvements committed currently within the study area, the 'Do-Minimum' future road network for the Proposed Road Development consists of only the existing road network, which is assumed to be maintained over time. The 'Do-Minimum' road network is shown in Figure 5-4.

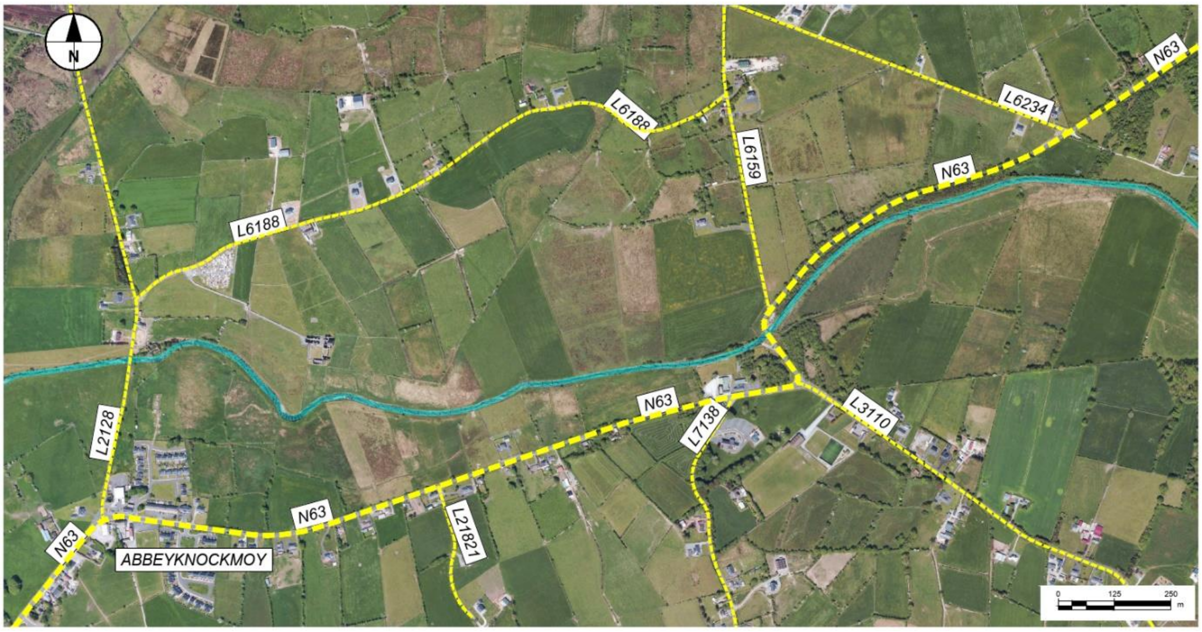

Figure 5-4 'Do-Minimum' Road Network

The future year 'Do-Something' road network includes all the assumptions of the Do-Minimum network plus the Proposed Road Development. The 'Do-Something' road network is shown in Figure 5-5.

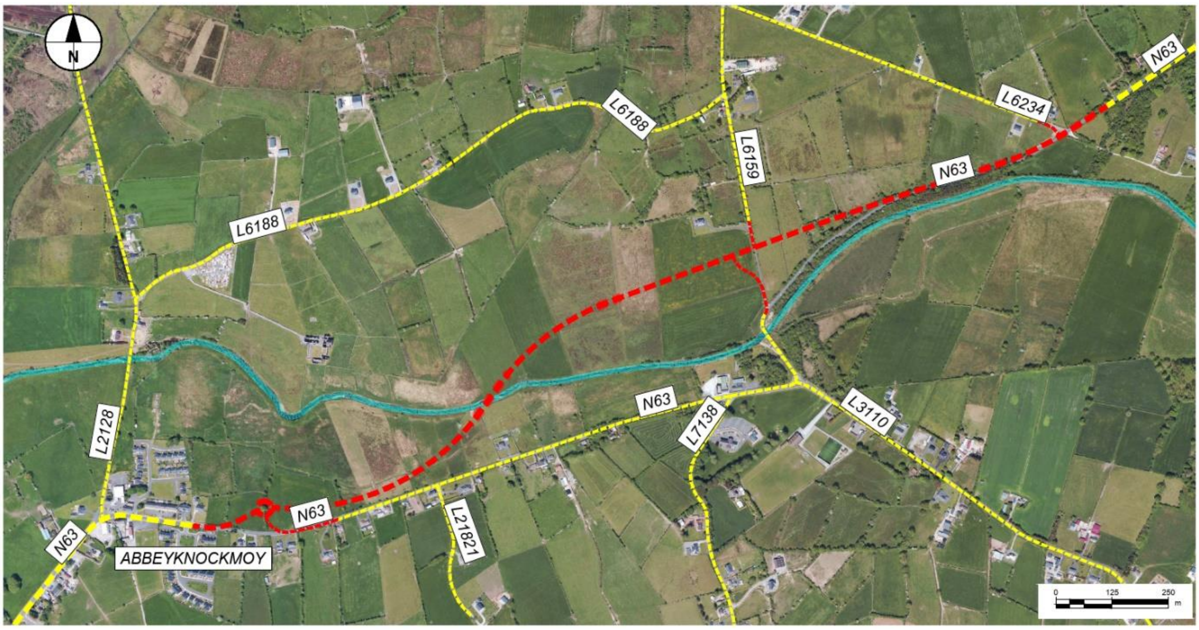

Figure 5-5 'Do-Something' Road Network

5.3.6.1.2 Future Traffic Growth

The development of the traffic growth forecasts for the future year has been based on the requirements set out in TII PAG Unit 5.3 - Travel Demand Projections (May 2019).

Future Year traffic has been forecasted for the following years in accordance with TII PAG Unit 5.1 – Construction of Transport Models:

- Assumed Opening Year - 2023; and
- Design Year - 2038 (assumed Opening Year + 15 years).

The TII PAG specifies that the Proposed Road Development should be assessed using three future traffic growth scenarios, namely the TII central growth scenario and two sensitivity scenarios (low and high). The TII central traffic growth scenario is based on the population and employment projections from the National Planning Framework. The TII low and high traffic growth projections assume the same distribution of population and employment as the National Planning Framework but with lower and higher total growth projections. The model and scenarios outlined above were used to assess the traffic impacts of the Proposed Road Development.

The link-based growth rates for Galway from Table 6.2 of TII Project Appraisal Guidelines for National Roads Unit 5.3 - Travel Demand Projections (PE-PAG-02017 - May 2019) were applied to the model. An extract from PAG Unit 5.3 can be seen in Table 5-1.

Table 5-1 Link-Based Growth Rates (Galway)

Area	Growth Sensitivity Scenario	2016-2030		2030-2040		2040-2050		2050+	
Galway	Low Sensitivity Growth	LV	HV	LV	HV	LV	HV	LV	HV
		1.0243	1.0430	1.0087	1.0177	1.0088	1.0218	1.0000	1.0000
	Central Growth	LV	HV	LV	HV	LV	HV	LV	HV
		1.0259	1.0446	1.0109	1.0198	1.0105	1.0236	1.0000	1.0000
	High Sensitivity Growth	LV	HV	LV	HV	LV	HV	LV	HV
		1.0294	1.0480	1.0148	1.0236	1.0181	1.0336	1.0000	1.0000

Source: Table 6.2 of TII PE-PAG-02017 Project Appraisal Guidelines for National Roads Unit 5.3 - Travel Demand Projections

Using the link-based growth rates that have been provided for County Galway, the future AADT flow was determined for the Do-Minimum and Do-Something scenarios, for both the assumed Opening Year (2023) and Design Year (2038).

Traffic growth projections were developed for each of the three TII growth scenarios in line with methodology set out in TII PAG Unit 5.3 - Travel Demand Projections (May 2019).

5.3.6.2 Network Statistics

Network statistics were extracted from the traffic models and a comparison made against the Do-Minimum option for the Design Year (2038). The key network statistics comprise the following:

- Total Vehicle km;
- Total Network Travel Time (hrs); and
- Average Vehicle Speed (kph).

5.3.6.3 Safety Assessment

The safety assessment for the Operation Phase has been based on the requirements set out in TII Project Appraisal Guidelines (PAG) Unit 6.4 - Guidance on using COBALT (October 2016).

The assessment has been carried out using COBALT (Cost and Benefit to Accidents – Light Touch), a computer program developed by the UK Department for Transport (DfT) to assess and quantify the change in the number of collisions and casualties as a direct result of a new road scheme. The outputs of COBALT have been used to inform both the economic and safety impacts assessment of the Proposed Road Development.

5.3.6.4 Active Travel Modes

To estimate future use of the new active mode facilities, the population of three different Central Statistics Office (CSO) Census boundary areas in the vicinity of the Proposed Road Development were considered. This approach was taken to account for the fact that residents of Abbeyknockmoy village are on average more likely to use the new facilities than residents of other areas. Figure 5-6 shows the main boundary areas for which potential use of the Proposed Road Development by residents of these areas was estimated. These areas include:

- The CSO Settlement of Abbeyknockmoy (i.e. Abbeyknockmoy village);
- The CSO Electoral Division of Abbey West excluding Abbeyknockmoy village (the population of settlement was subtracted from the total Electoral Division (ED) population in order to avoid double-counting of potential Proposed Road Development users), and;
- CSO Small Area 067001002.

Residential address points (sourced from Geodirectory) are also displayed on Figure 5-6. These were used to aid understanding of how the population within each boundary area is distributed in terms of the proximity of residents to existing and proposed facilities.

In addition to the above areas, the overall estimate of daily use includes for some use by residents from a wide area beyond these boundaries. All estimates presented are ‘trips’ rather than ‘users’ except where otherwise stated. With the exception of users from the wider area who will make recreational round trips using the facilities, all other users are assumed to make return trips.

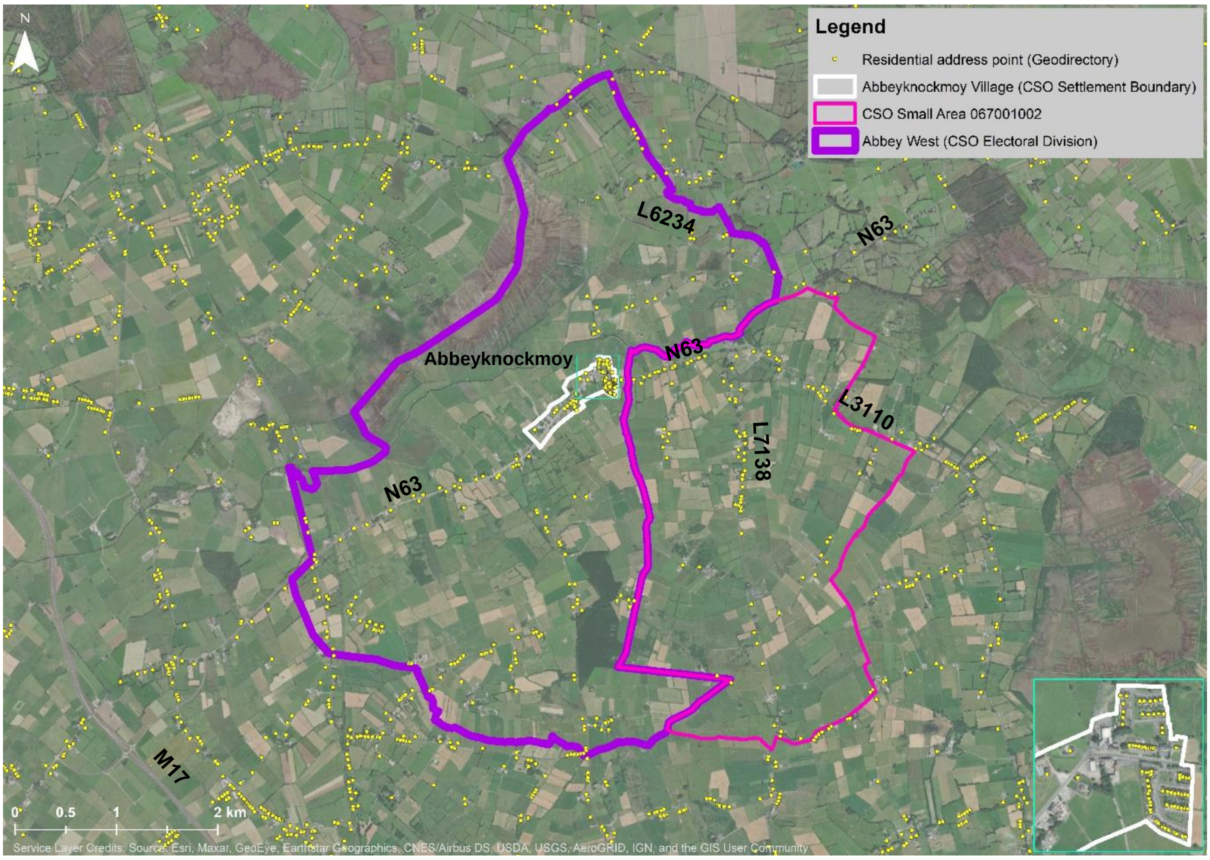

Figure 5-6 Relevant CSO Boundaries and Distribution of Residential Address Points

Average daily use was estimated based on a seven-day week. Use of the facilities is anticipated to be higher on weekend days than on weekdays. Commuting to work will not make up a large proportion of overall trips among Proposed Road Development users due to the rural nature of the area, the number of important non-work destinations/community facilities which are served by the route and the fact that the new facility will also attract a significant number of purely recreational trips. Only potential use of the Proposed Road Development among the adult population was estimated, as trips made by children are not included when calculating any of the currently monetised benefits of increased active mode use.

It is assumed that once the new facilities are in place, their use will be well promoted by relevant stakeholders and that a programme of relatively low cost behavioural change measures could be implemented involving, for example, the creation of a community walking group, the organisation of occasional events throughout the year and free cycle training being made available.

The estimates of future use of the new facilities by residents for each of the four separate areas mentioned above were derived, along with relevant demographic information which was referred to in order to support the development of these estimates. Estimates for each area were combined to make up the overall estimates for average daily use of the Proposed Road Development by adults, average journey times and the average proportion of new or extended trips which would take place on the new facilities.

These estimates represent one scenario under which the overall estimated level of use could be achieved. However, there are potentially many different feasible scenarios under which a similar level of additional physical activity, or a greater level could be achieved. For example, it is possible that people living in Abbeyknockmoy village will not use the Proposed Road Development as much as has been assumed here, but that people living in other areas may use them more frequently than anticipated.

5.3.7 Selection of Preferred Cross-Section

As required under the TII Project Management Guidelines (TII, 2017) an incremental analysis of the carriageway type was undertaken to inform the selection of the cross-section for the Proposed Road Development. As part of the incremental analysis, an assessment of the operating capacity of the N63 Liss to Abbey section of the Proposed Road Development was undertaken.

The notional traffic capacity of the various road cross-sections is defined in Table 6.1 of TII Standard DN-GEO-03031. A Type 2 Single Carriageway is appropriate for flows of up to 8,600 AADT, which will have sufficient capacity to comfortably cater for the projected traffic demand in the Design Year (2038).

In consideration of the expected level of traffic volumes along the N63 mainline, the rural nature of the Proposed Road Development and to maintain a route consistency with road improvement already completed to the west of Abbeyknockmoy, a Type 2 Single Carriageway has been selected (in compliance with TII Standard Construction Detail CC-SCD-00002). The proposed cross-section along the N63 mainline is shown in Figure A4.7 contained in Volume 03 of this EIAR.

It is proposed to include facilities for non-motorised users along the existing N63, by provision of a footway/cycleway along the south side of the existing N63. As such, the provision for non-motorised users will not be required along any realigned section of the N63 mainline.

It is not proposed to include bus lanes as part of the Proposed Road Development as there is no current requirement for a dedicated bus route within the study area. However, it is noted that the Proposed Road Development will facilitate public transport modes via connection to existing routes along the existing N63. This will be in the form of a dedicated pedestrian/cycle route.

5.3.8 Determination of Sensitive Receptors

The sensitivity of the existing environment identifies the ability of the receptor to respond to potential effects and can be determined by describing changes to the environment that could affect traffic on the road network. For the purpose of this assessment, the sensitive receptors are regarded as the existing road network, and road network users within the study area.

Terminology used to describe the sensitivity of the receptor are as per the EPA draft ‘Guidelines on the Information to be Contained in Environmental Impact Assessment Reports’ (hereafter referred to as the ‘EPA draft guidelines’) (EPA, 2017). As descriptors for sensitivity are not outlined within Irish guidance, the descriptors are based on professional judgement.

Criteria used when applying a sensitivity for the traffic analysis within this chapter are outlined in Table 5-2.

Table 5-2 Examples of Sensitivities Assigned to Different Traffic Types

Sensitivity	Description
High	• National traffic, or long distance
Medium	• Regional traffic, or medium distance
Low	• Local traffic, or short distance
Negligible	NA

5.3.9 Describing Potential Effects

The methodology used for evaluating impact levels and the terminology for describing the quality, significance, extent, probability and duration of effects on traffic is in line with the EPA draft guidelines (EPA, 2017). The process to determine potential effects is described in Chapter 01 Introduction. In summary, it involves combining a sensitivity of a receptor with a description of an impact on that receptor (its quality, type, frequency, duration, probability and magnitude) to determine a significance of an effect.

Specific assessment criteria are outlined in the following sections. As specific criteria are not outlined within Irish guidance, the criteria are based upon professional judgement.

5.3.10 Significance of Effects

As outlined in Chapter 01 Introduction, once the description of the effect, including magnitude, character, duration etc. has been identified, this can be cross-referenced with the importance of the sensitivity of the receptor to derive the overall significance of effect as per the EPA draft guidelines (EPA, 2017).

Positive effects will improve existing conditions while negligible effects are those such that they are of low importance and are not material to decision making.

5.4 Limitations and Assumptions

This traffic assessment has been based on information about the Proposed Road Development available at the time when the chapter was drafted.

It is also noted that the traffic surveys were completed in 2019 and as such, the results are not affected by the more recent changes in traffic volumes and pattern associated with the Government COVID-19 Restrictions. In relation to trip generation during the construction phase of the Proposed Road Development, the following conservative assumptions were made:

- Private vehicles owned and driven by site construction staff and by full time supervisory staff.
  - Onsite employees will generally arrive before 08:00, thus avoiding the morning peak hour traffic, and will generally depart after 16:00. Based upon the experience of similar developments, a development of this type and scale will necessitate approximately 25-30 staff onsite at any one time. Given the rural setting, it is noted that a vast majority of construction workers will arrive in private car, subsequently 25-30 two-way vehicle trips over the day over the period of the construction works. Night-time working is not generally anticipated and will be generally avoided for this Proposed Road Development. However, night-time working shifts could be necessary during certain critical stages of the construction phase.
- Excavation plant and dumper trucks involved in site development works and material delivery vehicles for the importation and exportation of fill and road materials.
  - Deliveries will arrive at a steady rate during the course of the day. An estimated 95,000 m^3 of material will be brought onto the Proposed Road Development site or will be exported offsite over the entire duration of the construction stage of the Proposed Road Development. The estimated 95,000 m^3 of imported/exported material equates to approximately 15,200 truckloads (with some variance depending upon vehicles characteristics). Even considering a worst-case assessment where the truckload movement are concentrated over half of the entire construction period (195 days – 9 months), this will result in 78 truckloads per day. This equates to approximately 8 loads per hour over a 10-hours working day.

These trip rates were based on conservative assumptions utilising experience from similar projects. The rates specified in Table 5-3 summarise the conservative scenario of a peak daily rate for vehicle movements during the construction phase.

Table 5-3 Trip Rates Assumed for the Construction Phase

Trip Generator Type	Trip Rate per Day
Staff (Light Vehicles)	50 trips (25 arrivals/25 departures)
Importation/Exportation of Materials (Heavy Vehicles)	78 trips (39 arrivals/39 departures)

It is anticipated that vehicles working on the Proposed Road Development will exit and enter the Proposed Road Development site at limited access/egress points and travel east or west along the existing N63 and to/from their respective destination.

5.5 Baseline Environment

As noted in Chapter 02 Need for the Scheme and Planning Policy Context, the existing N63 is generally narrow with no hard shoulders. Alignment of the road is poor in both the horizontal and vertical planes. There is no off-carriageway provision for pedestrians or cyclists. The existing Liss Bridge is narrow and significantly restricts traffic flows, with two Heavy Goods Vehicles (HGV's) travelling in opposite directions unable to safely pass on the Liss Bridge. Given the rural nature of the study area, agricultural vehicles conflict with local road traffic on the Liss Bridge on a regular basis, which in turn generates localised traffic issues and journey time reliability issues.

5.5.1 Traffic - Base Year (2019)

Following analysis of traffic surveys and building the traffic model, the following represents traffic volumes for the Base Year (2019) scenario and are shown in Table 5-4. The traffic flows are illustrated graphically in Figure 5-7.

The AADT flows within the study area were supplied to the design team including environmental experts and used to assess the potential environmental impact of the traffic from the Proposed Road Development.

Table 5-4 AADT Summary for Base Year (2019)

No.	Link	2019 Base AADT (%Heavy Goods Vehicle)
1	Existing N63 between the eastern end of Abbeyknockmoy and L7138	4859 (5.9% HGV)
2	Existing N63 between L7138 and L3110	3764 (6.8% HGV)
3	Existing N63 between L3110 and L6159 (at Liss Bridge)	3499 (6.5% HGV)
4	Existing N63 between L6159 and L6234	4859 (5.9% HGV)

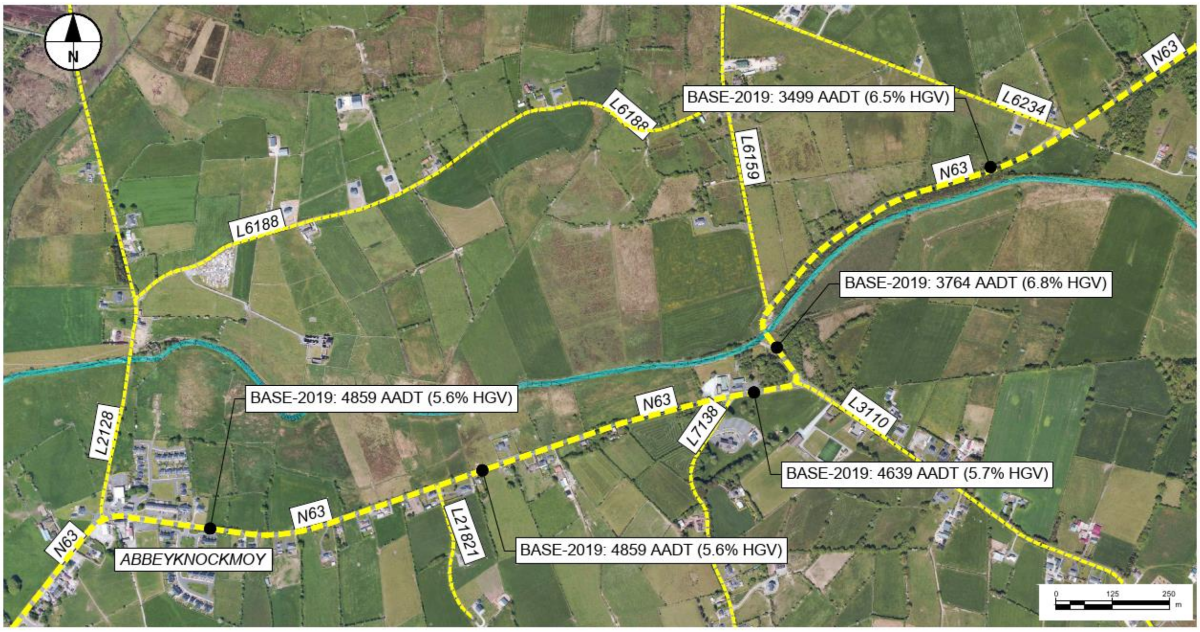

Figure 5-7 AADT Values: Base Year 2019

5.5.2 Active Travel Modes

There is currently no safe route for active modes between Abbeyknockmoy village and five important community facilities to the east including: Newtown National School; Abbeyknockmoy Community Centre; Abbeyknockmoy GAA Club; St. Bernard's Church and the amenity area at the Abbert River.

5.5.3 Safety – Existing Conditions

The existing N63 within the study area has poor horizontal and vertical alignment in the vicinity of the Liss Bridge, adding to the safety concerns raised due to the narrow cross-section of the Liss Bridge. Safety is also compromised by the number of at-grade junctions and private accesses.

Road collisions maps and data the road network surrounding the Proposed Road Development are presented in in Chapter 02 Need for the Scheme and Planning Policy Context. There are safety concerns with the existing road network. The accident data is twice that expected and results from the road collisions data shows there have been a number of incidents in the vicinity of the Liss Bridge and along the section of N63 between the community facilities and the residential area.

5.6 Assessment of Impacts

5.6.1 Construction Phase

5.6.1.1 Traffic Impact – Construction Phase

This section outlines the approach and the likely traffic impact to the surrounding road network during the construction phase of the Proposed Road Development. Chapter 04 Description of the Proposed Road Development of this EIAR provides further details in relation to the construction phase and outlines measures set to ensure that construction traffic impacts are minimised through the control of site access/egress routes and site access locations. It is noted that exact compound locations, import/export destinations and detailed traffic management and construction routing will be developed further by the appointed Contractor for the Proposed Road Development and will be detailed in a Construction Environmental Management Plan (CEMP). All exports/imports of material will be to be a suitably licenced facility.

The resulting percentage increase in traffic flows (AADT) as a result of the construction traffic generated by the Proposed Road Development were established based on the aforementioned methodology. The daily percentage impacts are summarised in Table 5-5.

Table 5-5 2023 Opening Year AADT vs 2023 Opening Year AADT + Construction AADT

Scenario	Location	2023 Opening Year (Do-Min) AADT	2023 Opening Year (Do-Min) AADT + Construction Traffic AADT	% Difference AADT
1	Existing N63 (west of the Proposed Road Development)	5405	5533 (+128)	+2.4%
(or)				
2	Existing N63 (east of the Proposed Road Development)	3895	4023 (+128)	+3.3%

It is noted that the impacts shown in Table 5-5 is based on the worst-case assessment where the entirety of construction traffic will travel from/to the Proposed Road Development from east or from west, while a more realistic scenario would be a combination of the two.

5.6.2 Operational Phase

5.6.2.1 Traffic Impact - Opening Year (2023) and Design Year (2038)

Forecast traffic flows in the Do-Minimum and Do-Something scenarios for the assumed Opening Year (2023) are outlined in Table 5-6 alongside the Base Year (2019) traffic flows.

Forecast traffic flows in the Do-Minimum and Do-Something scenarios for the Design Year (2038) are outlined in Table 5-7 alongside the Base Year (2019) traffic flows.

The traffic flows in each of these scenarios are illustrated graphically in Figure 5-8 and Figure 5-9.

Results for both the Opening Year (2023) and Design Year (2038) show that implementation of the Proposed Road Development will cause a substantial decrease in AADT on the following sections:

- Existing N63 between the proposed roundabout and the L7138;
- Existing N63 between the L7138 and L3110 (at the Newtown National School and Abbeyknockmoy Community Centre); and
- Existing N63 between L3110 and L6159 (across the existing Liss Bridge).

Table 5-6 AADT Summary for Assumed Opening Year (2023)

No.	Link	2019 Base AADT (%Heavy Goods Vehicle)	2023 Do-Minimum AADT (%Heavy Goods Vehicle)	2023 Do-Something AADT (%Heavy Goods Vehicle)	Change between Do-Some and Do-Min AADT	% change between Do-Some and Do-Min AADT
1a	Proposed N63 between the eastern end of Abbeyknockmoy and proposed roundabout *(Base/Do-Min: Existing N63 between the eastern end of Abbeyknockmoy and L7138)*	4859 (5.9% HGV)	5405 (6.0% HGV)	5405 (6.0% HGV)	0	0%
1b	Existing N63 between proposed roundabout and L7138 *(Base/Do-Min: Existing N63 between the eastern end of Abbeyknockmoy and L7138)*	4859 (5.9% HGV)	5405 (6.0% HGV)	1994 (4.9% HGV)	-3411	-63%
2	Existing N63 between L7138 and L3110	4639 (5.7% HGV)	5161 (6.1% HGV)	1750 (5.1% HGV)	-3411	-66%
3	Proposed local link between L3110 and N63/L6159 junction (at Liss Bridge) *(Base/Do-Min: Existing N63 between L3110 and L6159 (at Liss Bridge))*	3764 (6.8% HGV)	4190 (7.2% HGV)	484 (8.8% HGV)	-3706	-88%
4	Proposed N63 between L6159 and L6234	3499 (6.5% HGV)	3895 (6.9% HGV)	3895 (6.9% HGV)	0	0%

No.	Link	2019 Base AADT (%Heavy Goods Vehicle)	2023 Do-Minimum AADT (%Heavy Goods Vehicle)	2023 Do-Something AADT (%Heavy Goods Vehicle)	Change between Do-Some and Do-Min AADT	% change between Do-Some and Do-Min AADT
	(Base/Do-Min: Existing N63 between L6159 and L6234)					
5	Proposed N63 between proposed roundabout and L6159 *(New Link)*	-	-	3411 (6.7% HGV)	3411	+100%

Table 5-7 AADT Summary for Design Year (2038)

No.	Link	2019 Base AADT (%Heavy Goods Vehicle)	2038 Do-Minimum AADT (%Heavy Goods Vehicle)	2038 Do-Something AADT (%Heavy Goods Vehicle)	Change between Do-Some and Do-Min AADT	% change between Do-Some and Do-Min AADT
1a	Proposed N63 between the eastern end of Abbeyknockmoy and proposed roundabout *(Base/Do-Min: Existing N63 between the eastern end of Abbeyknockmoy and L7138)*	4859 (5.9% HGV)	7142 (7.2% HGV)	7142 (7.2% HGV)	0	0%
1b	Existing N63 between proposed roundabout and L7138 *(Base/Do-Min: Existing N63 between the eastern end of Abbeyknockmoy and L7138)*	4859 (5.9% HGV)	7142 (7.2% HGV)	2629 (5.9% HGV)	-4513	-63%
2	Existing N63 between L7138 and L3110	4639 (5.7% HGV)	6822 (7.4% HGV)	2309 (6.1% HGV)	-4513	-66%
3	Proposed local link between L3110 and N63/L6159 junction (at Liss Bridge) *(Base/Do-Min: Existing N63 between L3110 and L6159 (at Liss Bridge))*	3764 (6.8% HGV)	5551 (8.7% HGV)	643 (10.5% HGV)	-4908	-88%
4	Proposed N63 between L6159 and L6234 *(Base/Do-Min: Existing N63 between L6159 and L6234)*	3499 (6.5% HGV)	5157 (8.3% HGV)	5157 (8.3% HGV)	0	0%
5	Proposed N63 between proposed roundabout and L6159 *(New Link)*	-	-	4513 (8.0% HGV)	+4513	+100%

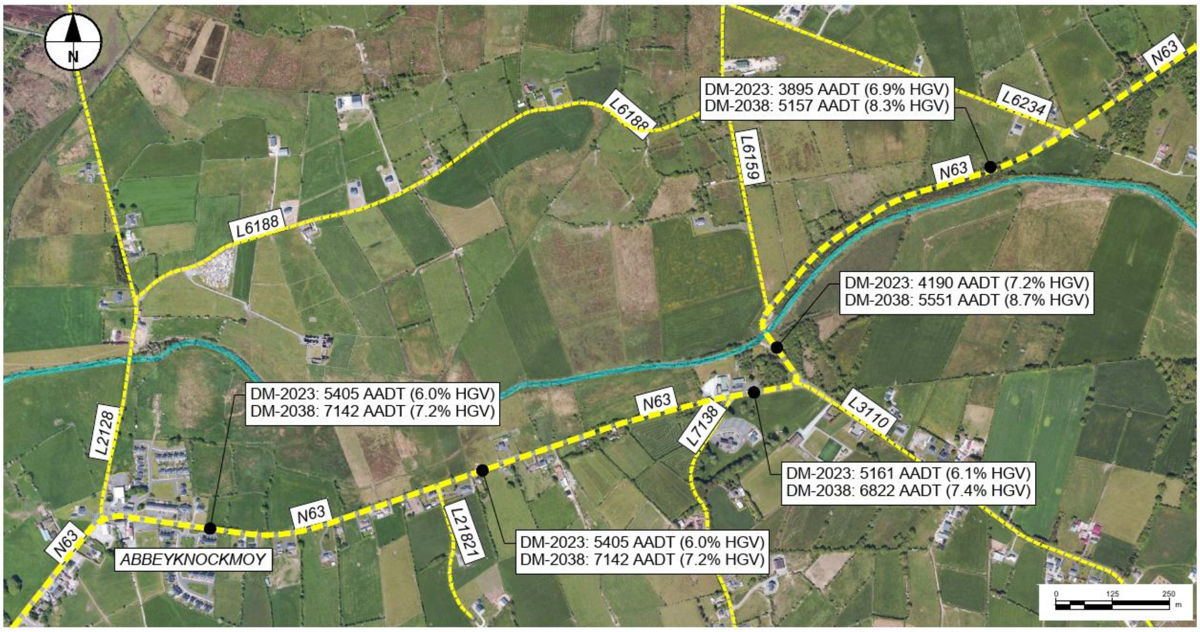

Figure 5-8 **AADT Values: Do-Minimum 2023 and Do-Minimum 2038**

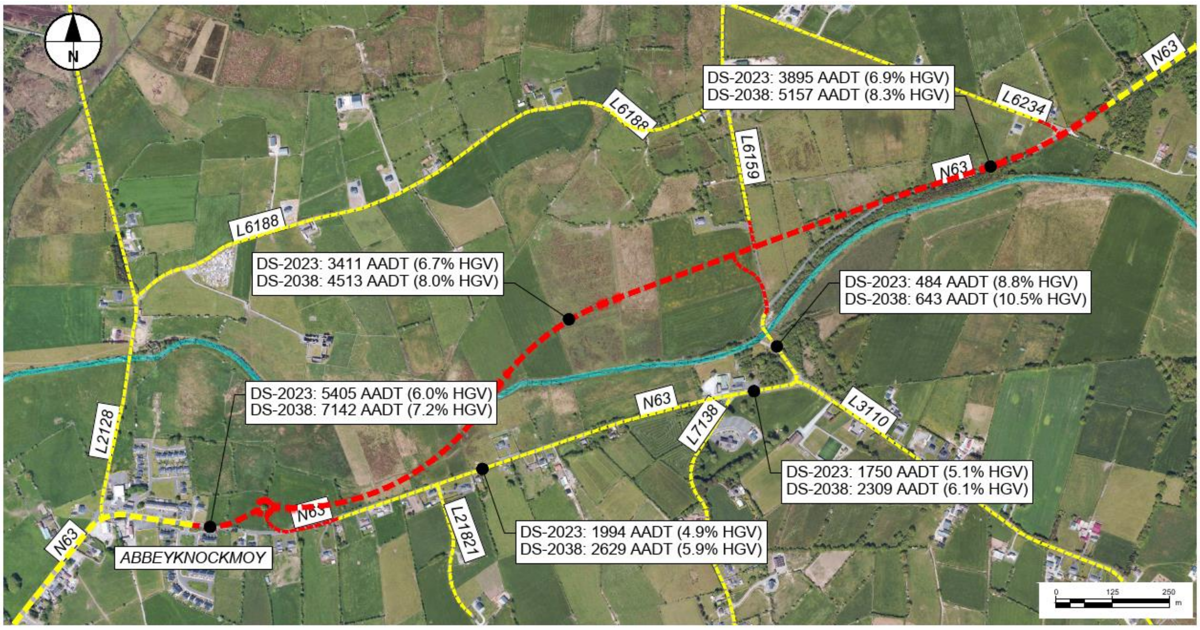

Figure 5-9 **AADT Values: Do-Something 2023 and Do-Something 2038**

Figure **5-10** also illustrates the relative differences in traffic volumes between the Do-Minimum and Do-Something scenarios for the Opening Year (2023) and Design Year (2038); where the positive figures indicate increased traffic volumes as a consequence of the Proposed Road Development implementation and negative figures indicate reduced traffic volumes as a consequence of the Proposed Road Development implementation.

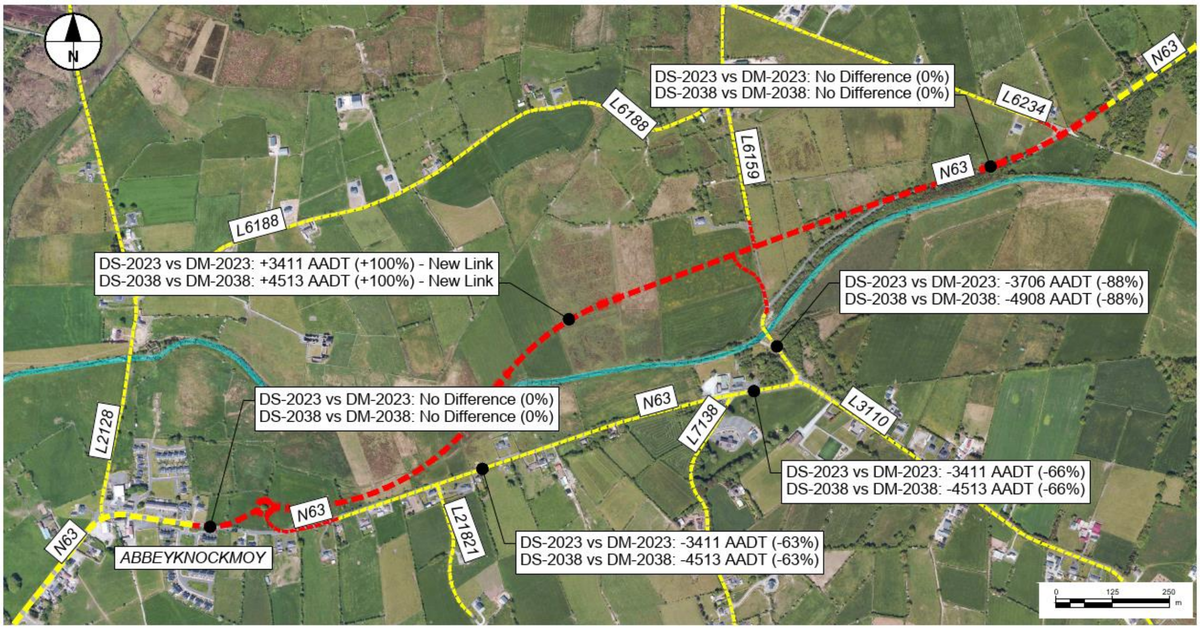

Figure 5-10 AADT Difference between Do-Something and Do-Minimum

5.6.2.2 Network Statistics

Table 5-8 outlines the key daily network statistics, including a comparison made against the Do-Minimum option for the Design Year (2038). Overall, the table shows that the Proposed Road Development (Do-Something) will provide benefits for the entire network compared to the Do-Minimum option.

The network statistics outlined below illustrate that the Proposed Road Development will provide a reduction in total distance travelled, a reduction in travel time and an increase in average speed throughout the entire modelled road network.

Table 5-8 Daily Network Statistics (All Vehicles)

Route Option	Total Vehicle km	Total Network Travel Time (hrs)	Average Vehicle Speed (kph)
2038 Do-Minimum	15455.6	249.3	62.0
2038 Do-Something	14769.3	198.3	74.5
Relative Difference	-4.4%	-20.4%	+20.1%

5.6.2.3 Safety Impact

The Proposed Road Development will be of a higher safety standard than the existing road network and will therefore contribute to a network-wide reduction in collisions.

This is reflected in the COBALT model which forecasts a reduction of 15 collisions over the 30-year design life appraisal period. This equates to a reduction of 27 casualties categorised as follows:

- 1 Fatal;
- 2 Serious; and
- 24 Slight.

Table 5-9 Safety Assessments (COBALT Results)

	Proposed Road Development
Total Collision Benefits Saved by Proposed Road Development	€ 1.354m
Total Collisions Saved by Proposed Road Development	15
Total Casualties Saved by Proposed Road Development (Fatal, Serious, Slight)	1, 2, 24

5.6.2.4 Active Travel Modes

The Proposed Road Development will provide a dedicated walking and cycling facility on the south side of the existing road, connecting the village with these community facilities. New pedestrian and cycle crossings will be provided at the school and at the junction of the N63 and local road L3110. The new facility and the removal of regional traffic from the existing road will enable a significant increase in the use of active modes. The new link will also provide access to and from the existing facility to the west which connects the village to the junction of the N63 and R347.

The provision of a continuous dedicated facility will enable pupils living in the village to walk or cycle to school regularly. Some pupils from the wider area will also be enabled to walk or cycle some or all of the way to school by the new facility and/or by the reduced traffic in the vicinity of the school and the new pedestrian crossings. The school already actively participates in the An Taisce Green Schools Programme which supports the use of active travel modes as part of the 'Travel Theme'.

In addition to school trips, the Proposed Road Development will enable both children and adults to travel to activities at the GAA club, community centre and church and to access the river amenity area using active modes. Only residents of the village and residents living along the N63 to the west of the village (i.e. the section of road which has already been upgraded) will have access to a continuous dedicated route to the community facilities. However, some residents of the wider area to the west are still likely to increase their use of active modes, as although they will need to travel on a local road without dedicated facilities to access the Proposed Road Development, these local roads have significantly lower traffic volumes and speeds compared to the N63. Similarly, the Proposed Road Development will enable some residents living along L7138 Lisch Road and the L3110 Monivea Road in the eastern part of the Proposed Road Development to use active modes to access businesses, other facilities and bus stops in Abbeyknockmoy village.

The Proposed Road Development will enable a wide variety of recreational trips. Although residents living in the village and other areas to the west of the village already have access to a dedicated facility between Abbeyknockmoy and Crossard, this new facility will be more attractive for recreational trips as regional traffic will not be travelling adjacent to the facility on the same alignment. Recreational cyclists using the existing facilities to the west of Abbeyknockmoy will also be able to extend their trip and there will be new loop route options involving the use of local roads in combination with the dedicated facilities. The existing facilities on the N63 also intersect with the proposed 'Quiet Man Greenway' route (the Western Rail Corridor) at Derrintogher, just 3 km west of Abbeyknockmoy village. A feasibility study on the Quiet Man Greenway is currently ongoing, and therefore, in the longer term, it is possible that there will be a continuous cycle facility from the eastern end of this Proposed Road Development to Athenry, Milltown and beyond.

There is significant potential for recreational trips using the new facility to be made in conjunction with a visit to any of the community facilities or services to the east or west, including by people who may continue to drive to one end of the Proposed Road Development for another purpose. For example, an adult dropping or collecting a child to/from school or doing some shopping or personal business in the village may choose to go for a walk or run before or after they complete their tasks. Individuals or groups will be able to go for a walk before or after attending activities in the community centre, church services or while waiting for family members who are engaged in an activity for a short period such as GAA practice.

It is difficult to forecast the potential future use of infrastructure for active modes with any level of certainty as the demand for these modes in general is suppressed due to a lack of a comprehensive, safe, attractive network. However, a number of reasonable assumptions were developed with reference to the population of the surrounding catchment and the age structure of this population, the distribution of the population throughout the area and the range of community facilities and businesses served by the route. The main assumptions developed from this process were:

- By the third year after opening, the Proposed Road Development will generate a daily average of 90 adult walking trips with an average duration of 20 minutes and 54 adult cycling trips with an average duration of 7 minutes per day;
- That the facility would be used for approximately 70 percent of the distance of an average new walk trip and 60 percent of the distance of an average new cycle trip; and
- Most trips are made by people who make return trips and approximately half of new walkers and cyclists are employees.

The new facilities will provide a means of access to important community facilities for individuals without access to a car. While there are relatively few households without at least one car, access to alternative modes will open up opportunities in cases where a car is not available for a particular trip because it is being used by another member of the household for another purpose or the driver of the vehicle is not available. The fact that walking or cycling will become a viable option for many frequent local trips may also enable some households to reduce the number of cars they own from two to one which will have financial benefits.

The new facility will provide opportunities for social interaction and will enhance community cohesion and social networks. Intercept surveys undertaken on greenways in Limerick and Waterford found that social benefits such as 'meeting people' were one of the things users liked most about these facilities. Social benefits are likely to particularly strong for this new facility considering the number of community facilities located along the route and the lack of alternative safe places to walk or cycle near these facilities, as well as the variety of different users and trip types the Proposed Road Development will attract. The infrastructure can also facilitate organised community walking and/or cycling events and in this case, there is potential for both school and/or the GAA club to organise mass participation events and/or set up lower key regular weekly walking groups, potentially with the support of the Galway Sports Partnership and/or the 'Get Ireland Walking' initiative .

Older children, particularly those living in the village, will enjoy enhanced opportunities for independent mobility as a result of the new facility. As well as increasing physical activity, the ability to travel independently and interact with the environment and other members of the community can contribute to the social, cognitive and personal development of children and to helping them to build friendships. There are also large potential time savings which can be gained for adults if they no longer need to accompany children on every trip.

As the Proposed Road Development would enable more local trips to be made by active modes instead of by car, there is potential to achieve reductions in greenhouse gas emissions associated with regular local trips. However, the facility will attract some recreational users from the wider community who will drive to their starting point. Although many of the users who drive will already be in the area for another reason (as identified previously), it is also possible that some residents from the wider area will drive specifically to access the facility. This could potentially counterbalance some or all of the emissions savings associated with modal shift for regular trips.

5.6.3 Significance of Effects

5.6.3.1 Construction Phase

Based on assessment presented in the section above, impact of construction traffic will likely result in a **negative**, **short-term**, **low** effect on the existing environment, the significance of effect on the surrounding road network is considered **not significant**.

5.6.3.2 Operation Phase

Based on assessment presented in the section above, impact of traffic during the operation phase will likely result in a **positive**, **long-term**, **medium** effect on the existing environment, the significance of effect on the surrounding road network is considered **positive**.

5.6.4 Do-Nothing Scenario

Without the Proposed Road Development, traffic delays will continue along this section of the N63 national secondary route, particularly at the Liss Bridge.

Without the Proposed Road Development there will continue to be negative environmental impacts (impacts on population and human health, high noise levels and increases in air quality pollutant concentrations) due to high traffic volumes along the section in proximity to the Newtown National School and Abbeyknockmoy Community Centre.

In the Do-Minimum Scenario, with no Proposed Road Development, the traffic volume passing along the section in proximity to the Newtown National School and Abbeyknockmoy Community Centre will increase from approximately 4,639 AADT (with 5.7% Heavy Goods Vehicle (HGV)) at present (2019) to approximately 6822 (with 7.4% HGV) in the Design Year (2038), which is an increase of 47%.

Clearly such an increase in traffic volumes and HGV traffic will have negative impacts for the local communities along the route in terms of safety, security, amenity, noise, and air quality, and particularly so in the case of vulnerable road users. Road safety on the N63 route particularly in proximity of the existing Liss Bridge will diminish due to growing traffic flows. Likewise, the road safety rating on the N63 will worsen due to the increase in traffic volumes and HGV traffic and corresponding likelihood of increased incidents.

5.7 Mitigation and Monitoring Measures

5.7.1 Construction Phase

The construction phase of the Proposed Road Development will cause short-term traffic impacts on the existing road network. As indicated in Chapter 04 Description of the Proposed Road Development, the enforcement of a CEMP and a Construction Traffic Management Plan (CTMP) will ensure that construction traffic impacts are minimised through the control of site access/egress routes and site access locations and any necessary temporary lane closure requirements.

The CTMP will incorporate any specific additional requirements of statutory authorities and any conditions imposed by An Bord Pleanála. The CTMP will clearly set out any temporary traffic restrictions and will be prepared during the detailed design phase. The CTMP will include the following measures:

- Traffic control would be in place for all vehicles entering and exiting the site;
- Parking would be allowed only in designated parking areas onsite;
- Segregated pedestrian walkways would be introduced;
- Public pedestrian access would be restricted throughout the proposed works;
- Access to the site would be strictly controlled with all personnel being required to have a Solas Safe Pass and to have undergone a specific Site Safety Induction before being allowed into the site;
- Traffic on the Proposed Road Development site would remain on hardcore areas wherever possible. Where this is unavoidable, traffic exiting the site would go through a wheel wash;
- All plant and equipment would be fitted with flashing amber warning lamps and hazard lights and would be required to have reversing alarms for operations within the work site;
- The need for reversing vehicles, would be reduced by introduction of one way system;
- Speed limit of 15 km/h would be put in place on the construction site;
- Safe working procedures would be followed by plant and vehicles required to enter and leave the construction site into trafficked lanes;
- All workers would be required to wear high visibility reflective protective clothing; and
- Site foreman and supervisors would be in two-way communication with each other and the traffic controllers for the duration of the work shift.

5.7.2 Operational Phase

The traffic modelling indicates that for the assumed Opening Year (2023) and Design Year (2038), there are no traffic impacts of major significance and therefore no mitigation measures are required.

No monitoring measures or further surveys are required.

5.8 Residual Impact and Effects

5.8.1 Construction Phase

With implementation of the mitigation measures identified, there will be no major effects during the construction phase of the Proposed Road Development.

5.8.2 Operational Phase

The Proposed Road Development will see localised changes to the local and national road network and traffic flows. The modelling work undertaken to assess the traffic impacts of the Proposed Road Development indicates that there will be an overall positive traffic benefit associated with the Proposed Road Development. Further, the Proposed Road Development will provide benefits to pedestrian and cycling facilities on the adjoining local road network. Therefore, there are no residual negative traffic effects anticipated.

5.9 Cumulative Impacts and Effects

A planning search of granted and pending planning applications made within 5 km of the Proposed Road Development site boundary within the last ten years is presented in Chapter 01 (Introduction). The majority of planning applications within 5 km of the Proposed Road Development site are related to development of and alterations to residential properties and are considered to be small in scale. The following Part 8 Application of relevance has been recorded:

Table 5-10 Summary of Relevant Part 8 Applications

Ref. No.	Summary of Development	Address	Application Received	Distance	Review of Cumulative Impacts
LA1014	The proposed development includes for improvement and widening of the existing N63 as well as off-road realignment of the existing N63. The development comprises a Type-2 Single carriageway road type – 7.0 m carriageway with 2 x 0.5 m hard strips. Additionally, a 2.5 m verge will be provided on the north side of the road, and a 2 m footway will be provided on the south side. Junctions to link the proposed realignment with the existing road infrastructure, drainage works, rail-bridge replacement works, utility diversion works, and landowner accommodation works will also be included as part of this development.	Abbeyknockmoy to Annagh Road	02/10/2014	c.1 km southwest	This was consented in 2014 and it is now operational. As such it was considered as part of the baseline traffic flow data collected and where relevant to the study area for this chapter.

Following review of the above proposed and consented projects there were no cumulative effects on the traffic as a result of the Proposed Road Development identified.

5.10 Summary

There will be no traffic negative impacts of major significance as a result of the Proposed Road Development. The traffic analysis carried out in the previous sections shows that the Proposed Road Development results in significant benefits in terms of network performance and journey time savings. The network statistics show that the Proposed Road Development will lead to a 20% reduction in the journey times on N63 routes along the section included within the study area.

By providing a realigned route for the N63 corridor, the Proposed Road Development will result in reduced traffic levels and congestion in proximity of the Abbeyknockmoy Community Centre and Newtown National School. The Proposed Road Development will alleviate traffic along the existing N63 and will provide a better quality of life for the local community and provide a much safer environment for all users. By reducing the number of vehicular traffic on the existing N63 between the Abbeyknockmoy village and the Community Centre, and providing pedestrian and cycle facilities, workers and school children are facilitated to commute using active modes and on the public transport system. As a result, more sustainable travel will be supported and encouraged.

Without the Proposed Road Development, traffic delays will continue along this section of the N63 national secondary route, particularly at the Liss Bridge. Without the Proposed Road Development there will continue to be negative environmental impacts due to high traffic volumes through the section in proximity of the Newtown National School and Abbeyknockmoy Community Centre. These traffic volumes will have negative impacts for the local communities along the route in terms of safety, security, amenity, noise, and air quality, and particularly so in the case of vulnerable road users where there are no existing facilities. Road safety on the N63 route particularly in proximity of the existing Liss Bridge will diminish due to growing traffic flows. Likewise, the road safety rating on the N63 will worsen due to the increase in traffic volumes and HGV traffic.

5.11 References

TII. (2016). Project Appraisal Guidelines, Transport Infrastructure Ireland, Dublin, Ireland.

TII. (2017). Project Management Guidelines, Transport Infrastructure Ireland, Dublin, Ireland.

(EPA, 2017a). EPA's 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports'

(EPA, 2017b). Advice Notes for Preparing Environmental Impact Statements

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 06: Population and Human Health

Galway County Council

February 2022

Table of Contents

Figures

Tables

6. Population and Human Health

6.1 Introduction

This chapter presents an assessment of the impacts of the Proposed Road Development on population and human health. It defines the study area; the methodology used for developing the baseline and impact assessment; provides a description of the baseline environment in relation to population and human health and presents the findings of the impact assessment.

Impacts of the Proposed Road Development on population and human health have potential to arise during the construction and operational phases of the development. The following chapter provides an assessment of impacts on:

- Land-use and accessibility;
- Community Severance;
- Employment; and
- Human health.

Many of the potential population and human health effects of the Proposed Road Development arise from air quality, noise and vibration, visual and traffic effects. Therefore, the human health impact assessment relies on the assessments and draws on the findings of the following chapters as necessary to assess the impacts on human health: Chapter 05 Traffic Analysis, Chapter 10 Air Quality, Chapter 11 Climate, Chapter 12 Noise and Vibration, Chapter 13 Landscape and Visual.

6.2 Legislation, Policy and Guidance

This chapter has been prepared with reference to the following:

- Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment (here after referred to as the (EIA Directive);
- Environmental Protection Agency (EPA) Draft Guidelines on the Information to be Contained in Environmental Assessment Reports (EPA, 2017);
- 'Advice Notes for Preparing Environmental Impact Statements' (EPA, 2017);
- 'Guidelines on the Information to be contained in Environmental Impact Statements' (EPA, 2002);
- 'Advice Notes on Current Practice in the Preparation of Environmental Impact Statements' (EPA, 2002);
- Healthy Urban Development Unit (HUDU) guidance Fourth Edition, October 2019 (National Health Service (NHS, 2019); and
- Guidelines on the Treatment of Tourism in an Environmental Impact Statement (Fáilte Ireland, 2011).

In addition, reference is made to the guidelines provided in the UK Department for Transport publication 'Design Manual for Roads and Bridges' (DMRB) (Highways England, 2020). Although these guidelines have not been adopted in Ireland, they provide further guidance that can be used to quantify community impacts. In particular in modules LA104 and LA112.

6.3 Methodology

6.3.1 Study Area

The Proposed Road Development is situated in Galway in a predominantly rural area close to the settlements of Liss and Abbey. It is located within the electoral divisions of Abbey West and Abbey East.

The study area for the population and human health assessment has considered the land that encompasses the likely impacts of the Proposed Road Development between Liss and Abbey. The study area therefore includes the construction footprint/project boundary (including compounds and temporary land take). The area used for the baseline analysis also comprises the two electoral divisions of Abbey East and Abbey West.

However, there is potential for effects to occur on receptors outside of this area. For example, it is not always possible to determine the catchment area for community facilities as residents of an area may utilise facilities located within different districts, counties, or regions without regard for statutory boundaries.

6.3.2 Data Sources

A population and human health impact assessment requires that an understanding of the community is built up through background research and site visits. Specifically, in the case of this study, data has been collected from the following sources:

- Central Statistics Office data from Census 2016;
- Drawings of the Proposed Road Development, including junctions;
- Maps of the surrounding area;
- Other relevant Environmental Impact Assessment Report (EIAR) data, including traffic, noise, air quality, and visual amenity impacts; and
- Relevant planning documents including the local and county development plans including Galway County Development Plan 2015-2021.

6.3.3 Determination of the Baseline Environment

The types of effects considered in the assessment of population and human health covers land-use and accessibility, community severance, employment, and human health. In order to assess the associated potential effects of the Proposed Road Development, it is necessary to determine the environmental or baseline conditions, resources and receptors that currently exist onsite and in the surrounding area. The identification of the baseline conditions therefore involves predicting changes that are likely to happen in the intervening period, for reasons unrelated to the Proposed Road Development.

The methodology for determining the baseline environment for the population and human health assessment involved desktop review of publicly available information. The baseline includes a description of local communities within the study and a profile of the people which reside within these communities. This profile includes an analysis of population and population growth, age, demographics, and health determinants. The presence of any vulnerable groups which could be disproportionately affected by the impacts of the Proposed Road Development are also identified in the baseline.

In addition to the above the baseline includes a description of land uses in the local area, including the presence of:

1. Private residential properties (e.g. a house) and commercial properties;
2. Community land (e.g. common land, village greens, open green space, allotments, sports pitches etc) and amount of land which will be required/access affected by a development such as the Proposed Road Development;
3. Community facilities (e.g. village halls, healthcare facilities, education facilities, religious facilities etc); and
4. The location of land allocated for employment and residential development by local authorities.

A planning search of granted and pending planning applications made within the vicinity of the Proposed Road Development (approximately 500 m from the Proposed Road Development site boundary) within the last five years was also completed within the baseline by consulting the National Planning Application Database[1]. This was used to determine how the area may change between now and the time when the Proposed Road Development is expected to start. The relevant planning applications and outcomes are listed in Vol 4; Appendix A1-1. Withdrawn, incomplete and small-scale planning applications e.g. extensions on residential properties within the study area, were not included.

6.3.4 Determination of Sensitive Receptors

The sensitivity of the existing environment identifies the ability of the receptor to respond to potential effects. Receptors in the population & human health assessment are members of the local and wider community which have potential to be impacted by any of the effects described. The following section identifies the methodology for defining the sensitivity of receptors for each type of potential effect identified. Terminology used to describe the sensitivity of the receptor are as per the EPA draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (hereafter referred to as the 'EPA draft guidelines') (EPA, 2017). The assessment of human health is assessed using London Healthy Urban Development Unit (HUDU) guidance (National Health Service (NHS), 2019).

6.3.4.1 Land Use and Accessibility

The value and typical descriptors which have been applied to determine sensitivity to impacts as a result of the Proposed Road Development have been based on professional judgement utilising information outlined in the DMRB (Highways England, 2020). Examples of the sensitivities typically assigned to different land uses are identified in Table 6-1. It is important to note, however, that other criteria are also used to inform the sensitivity of a resource to potential change. This includes how often the resource is used, how many users the resources have and whether the resource is maintained.

Table 6-1 Examples of Sensitivities Assigned to Different Land Uses

Sensitivity	Description
High	Private residential buildings, or land allocated for development of housing. Buildings used for employment use, and land allocated for development of employment uses. Regularly used community buildings which have only limited alternatives available nearby. National or regional walking, cycling and horse-riding routes, and other routes regularly used by vulnerable travellers such as the elderly. Designated public open spaces, or open spaces which attract users nationally e.g. national parks. Religious sites and cemeteries.
Medium	Land associated with private residential buildings e.g. gardens. Community buildings which are regularly used or where there are only limited alternatives available in the local area. Open spaces which span over a regional area and attract visitors from a regional catchment e.g. country parks, forests. Public rights of way and other routes close to communities which are used for recreational or utility purposes, but for which alternative routes can be taken.
Low	Community buildings which are infrequently used or where there are many alternatives available in the local area. Open spaces which are used for informal recreation (e.g. dog walking), and where there are alternative open spaces available. Locally used community land e.g. local parks and playing fields. Walking, cycling and horse-riding routes which have fallen into disuse through past severance or which are scarcely used because they do not currently offer a meaningful route for either utility or recreational purposes. Agricultural land which is used semi-regularly but where the enterprise is not dependent on the spatial relationship of land to key agricultural infrastructure.
Negligible	Derelict or unoccupied buildings.

Source: Based on professional judgement utilising information outlined in the DMRB (Highways England, 2020)

[1] National Planning Application Database Accessed 24/09/2020

6.3.4.2 Community Severance

The receptors which have potential to experience severance effects are residents of the local community which use the roads to travel in and around the study area to commercial properties, community facilities, places of work and educational facilities. No sensitivity values are assigned to receptors with potential to experience severance effects.

6.3.4.3 Employment

The receptor which has potential to experience employment effects is the workforce in the Abbeyknockmoy and the surrounding area. This includes the construction industry and the local supply chain. Receptors within the construction workforce/local supply chain are likely to have different sensitivities to change due to the range of circumstances which may apply. Therefore, no single sensitivity value is assigned in the construction employment effects assessment. No employment land occurs within the 500 m study area and therefore no sensitivity values are assigned for this land use.

6.3.4.4 Human Health

The assessment of human health is informed by guidance set out in the HUDU Rapid Health Impact Assessment Tool Fourth Edition 2019 (NHS, 2019). Sensitivities are not defined for receptors.

6.3.4.5 Agricultural Landholdings

An assessment of the impact of the Proposed Road Development on agricultural landholdings has been completed in Chapter 17: Material Assets – Agriculture and Vol 4; Appendix 17-1. To avoid duplication, an assessment of agricultural landholdings has been scoped out of this chapter.

6.3.5 Describing Potential Effects

Effects on land use and accessibility, community severance and employment are described using the criteria provided in EPA guidance (EPA, 2017). The process to determine potential effects is described in Chapter 01 Introduction. In summary, it involves combining a sensitivity of a receptor with a description of the effect on that receptor (its quality, type, frequency, duration, probability, and magnitude) to determine a significance of an effect. Detail on the criteria used to determine the sensitivity of a receptor is included in the section above. This section describes, for each type of effect, the assessment criteria which informs the description of the effect. This includes the parameters which define a direct or indirect effect, and how a magnitude of effect is determined.

Specific assessment criteria are outlined in the following sections. As specific criteria are not outlined within Irish guidance, the criteria are based upon the DMRB (Highways England, 2020) and professional judgement.

Since EPA do not provide extensive guidance on assessing human health, the assessment of human health is instead based on guidance set out in the HUDU Rapid Health Impact Assessment Tool Fourth Edition 2019 (NHS, 2019). The assessment method used to determine human health effects is also identified below.

6.3.5.1 Land Use and Accessibility

The land use assessment includes all direct and indirect effects on community resources and private assets in the study area. Direct effects include land-take and/or impacts on access, i.e. properties and/or facilities being cut off or split. Depending on the type of land use effect being assessed, the magnitude of the effect is determined by:

- The amount of land to be taken or the number of properties to be demolished; and
- The extent to which access to community resources or private property is impacted.

This assessment draws upon the assessment findings in Chapter 05 Traffic Analysis, Chapter 10 Air Quality, Chapter 11 Climate, Chapter 12 Noise and Vibration, Chapter 13 Landscape and Visual, Chapter 16 Material Assets - Non-Agriculture and Chapter 17 Material Assets - Agriculture. For example, direct, physical impacts on private property and housing and commercial properties, as well as agricultural land holdings are addressed in Chapter 16 and Chapter 17. However, the population and human health assessment draws on the findings from the aforementioned chapters and therefore, the results are noted throughout.

6.3.5.2 Community Severance

Community severance is defined as the separation of residents from facilities and services they use within their community caused by changes to roads and/or walking and cycling facilities, and/or changes in traffic flows. For example, the Proposed Road Development could lead to severance effects by changing levels of traffic on existing roads and/or introducing traffic management measures. This may lead to separation of residents from facilities and services which they use.

The assessment of magnitude is informed by the assessment results presented in Chapter 05 Traffic Analysis. It is determined by:

- The extent of the physical changes caused by the Proposed Road Development;
- The consequent changes in traffic levels on existing roads;
- The number of people whose journey would be affected;
- The type of road involved; and
- The provision of mitigation.

Table 6-2 outlines the criteria used to determine the magnitude of effect on community severance.

Table 6-2 Criteria used to assess Magnitude of Effect on Community Severance

Magnitude of Effect	Description
High	People are likely to be deterred from making trips to an extent enough to induce reorganisation of their habits. Considerable hindrance would be caused to people who experience such severance on trips which they regularly carry out.
Medium	Some people are likely to be dissuaded from making trips. Other trips would be made longer or less attractive.
Low	In general, the current journey pattern is likely to be maintained, but there would probably be some hindrance to movement.
Negligible	There would be a very limited impact on people’s movement and current journey patterns will be maintained.

Source: Based on DMRB and EPA guidance and professional judgement

6.3.5.3 Employment

This assessment includes all potential direct, indirect, and induced effects on the workforce in Abbeyknockmoy and the surrounding area. There is no consolidated methodology or practice for assessing the impact on employment in the EPA’s draft guidelines (EPA, 2017). The impacts of the Proposed Road Development on employment have therefore been assessed qualitatively based on an estimate of the number of jobs which the Proposed Road Development will create. The Proposed Road Development may cause direct and indirect jobs. Direct jobs include the workforce required to complete the Proposed Road Development. Indirect jobs include those created in the supply chain to provide material, specialist labour and services for the workforce.

6.3.5.4 Human Health

The human health assessment includes impacts on the health of residents of properties and users of community resources in the study area. Whilst relevant guidance from the Institute of Public Health in Ireland (IPH), specifically the Health Impact Assessment Guidance (IPH, 2009), has been considered, there is no consolidated methodology or practice for describing effects on human health in the EPA’s draft Guidelines on the information to be contained in Environmental Assessment Reports (EPA, 2017). The impacts of the Proposed Road Development on human health will therefore be assessed qualitatively using the human health determinants set out in the ‘London HUDU Rapid Health Impact Assessment Tool’ (NHS, 2019). The approach provides a broad overview of the potential health impacts and is applicable to a wide range of proposals. The checklist is split into 11 broad determinants and is based on the World Health Organisation (WHO) publication ‘Healthy Urban Planning’ (WHO, 2006)).

The WHO Europe defines health as “*a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*”. Consequently, public health encompasses general wellbeing, not just the absence of illness. Some effects are direct and obvious, others are indirect, while some may be synergistic, with different types of impact acting in combination. In keeping with this definition, this assessment considers the potential impacts of the Proposed Road Development on physical, mental, and social health.

Factors that have the most significant influence on the health of a population are called ‘determinants of health’; these include an individual’s genetics and their lifestyle, the surrounding environment, as well as political, cultural, and societal issues. The interrelationship between these factors is shown in Figure 6-1.

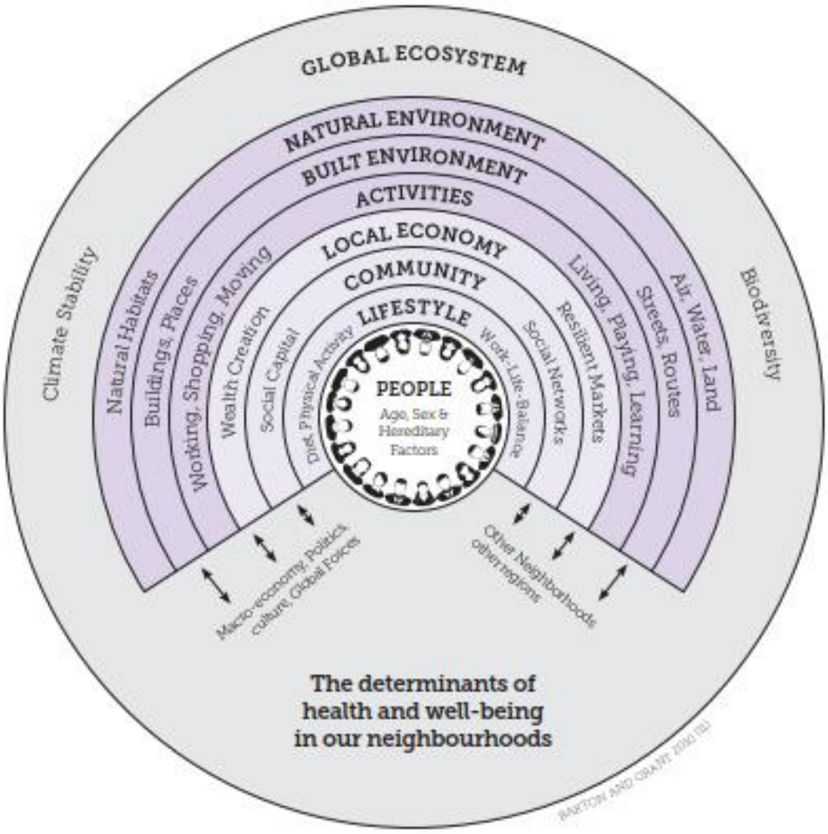

Figure 6-1 Social Determinants of Health

Source: Barton and Grant (2006) (WHO, 2006)

An initial scoping exercise was undertaken to determine the criteria within the HUDU guidance (NHS, 2019) which is relevant to this assessment. The criteria assessed as part of this chapter are listed below. Other criteria in HUDU guidance (NHS, 2019) but not in the list below, have been scoped out:

- Access to healthcare services and other social infrastructure;
- Access to open space and nature;
- Air quality, noise, and neighbourhood amenity;
- Access to work and training;
- Accessibility and active travel; and
- Climate change.

The assessment of human health is a qualitative rather than quantitative assessment, due to the diverse nature of health determinants and health outcomes which are assessed. Although the assessment of human health effects describes the likely qualitative health outcomes, it is not possible to quantify the severity or extent of the effects which give rise to these impacts. As such, the potential health impacts are described as outlined in Table 6-3, based on broad categories for the qualitative effects identified. Where an effect has been identified, actions have been recommended to mitigate negative impact on health, or opportunities to enhance health benefits. It should be noted that in many cases, embedded controls to reduce these effects or measures to enhance certain benefits already form part of the Proposed Road Development and the assessment has considered these impacts as such.

Table 6-3 Effect Categories in the Assessment of Human Health

Effect Category	Effect Symbol	Description
Positive	+	A beneficial effect is identified
Neutral	0	No discernible health effect is identified
Negative	-	An adverse effect is identified
Uncertain	?	Where uncertainty exists as to the overall impact

Source: Based on HUDU guidance

6.3.6 Significance of Effect

As outlined in Chapter 01 Introduction, once the description of the effect, including magnitude, character, duration etc. has been identified, this can be cross-referenced with the importance of the sensitivity of the receptor to derive the overall significance of effect as per the EPA guidance draft Guidelines on the information to be contained in Environmental Assessment Reports (EPA, 2017). The diagram below shows how comparison of the sensitivity of a receptor and the description of impact determine overall significance as per this guidance.

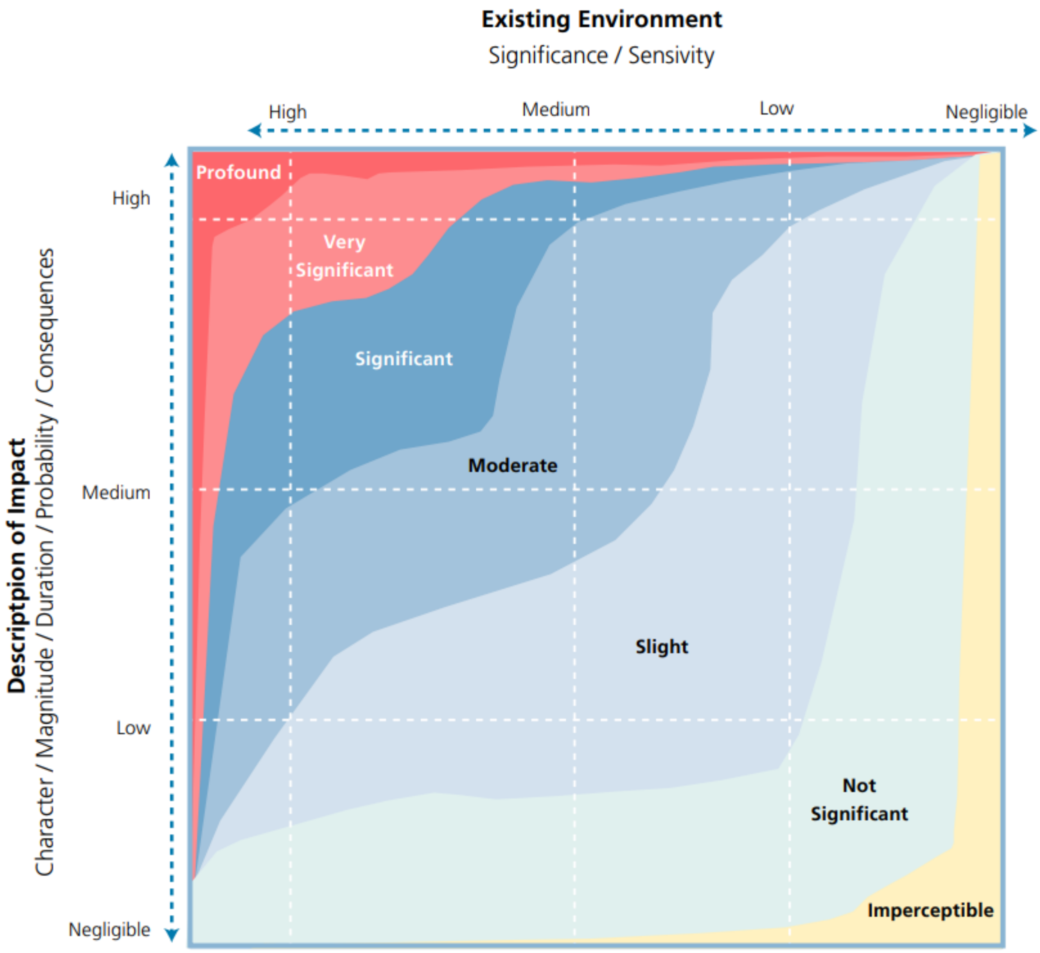

Figure 6-2 Typical Classifications of the Significance of Impacts

Source: EPA (2017) Guidelines on the information to be contained in EIARs. Figure 3.5.

The human health assessment is based upon the 'London HUDU Rapid Health Impact Assessment Tool' (NHS, 2019) and does not describe effects as per the EPA guidance draft Guidelines on the information to be contained in Environmental Assessment Reports (EPA, 2017).

6.4 Limitations and Assumptions

This population and human health assessment is based on professional judgement and considers both the negative and positive effects that the Proposed Road Development can have upon existing and surrounding receptors. It provides a broad, high level indication of effects, reporting on the potential effects to people and the local community.

The assessment is based on information about the Proposed Road Development available at the time of drafting the chapter. It draws upon other specialist topic inputs to aid the assessment of the impact of the Proposed Road Development on population and human health receptors.

Community resources are mentioned expressly in the environmental baseline only where they contribute to the local context or where they may be affected by the Proposed Road Development. Consequently, not all community resources within the study area are mentioned.

Information in the baseline related to demographics and the health profile of the population in the study area uses statistics from the Census. Five years have passed since the Census was published (2016).

The population and human health assessment does not include an assessment of effects on farm holdings in the study area as a result of temporary and permanent acquisition of agricultural land due to the lack of information available on existing farm holdings at the time of writing.

6.5 Baseline Environment

This section establishes a comprehensive and coherent socio-economic profile of the area, including consideration of the labour market and health indicators. Baseline analysis in this section sets the context for the potential impacts of the Proposed Road Development.

This section establishes the current baseline with regards to the following characteristics relevant to the potential impacts of the Proposed Road Development:

- Population;
- Local community facilities and land uses;
- Travel Patterns and Existing Transport Network; and
- Human health.

6.5.1 The Local Community

6.5.1.1 Overview

The following section gives a broad overview of the wider community, primarily based on data from the latest census in 2016. This section describes information on population, age profile, employment, and social class of residents in the local area.

Abbeyknockmoy is the largest settlement in proximity to the Proposed Road Development. According to figures from the Central Statistics Office (CSO) 2016, the total population was 262, and the total housing stock was 109. Abbeyknockmoy is defined in the Galway County Development Plan 2015-2021 settlement hierarchy as; *settlement and countryside*.

The Proposed Road Development is situated within two Electoral Divisions (EDs), which themselves are situated within County Galway:

- Abbey West; and
- Abbey East.

Table 6-4 shows recent population growth in the study area and its comparator areas. The population in the study area has seen a significant increase over the last ten years. The CSO census 2016 reports that the population grew by approximately 16.4% from 1,206 in 2006 to 1,407 in 2016. Most of this population growth occurred between 2006 and 2011, with an increase of only 99 residents between 2011 and 2016. The population growth rate in the study area between 2006 and 2016 is higher than all its comparator areas.

Table 6-4 Population and Population Growth in the Study Area and its Comparator Areas

Area	2016	2011	2006	Change between 2011-2016 (%)	Change between 2006-2011 (%)
Study area	1,407	1,380	1,206	2	14.4
County Galway*	179.390	175,124	159,256	2.4	10
Ireland	4,761, 865	4,588,252	4,239, 848	3.8	8.2

Source: CSO, census 2016; Small Area Population Statistics 2016[2].

**Note: Excluding Galway city administrative area.*

Table 6-5 shows the age profiles of the population of the study area and its comparator areas in 2016. The age profile is representative of, amongst other things, the available labour force and demand for the different types of community facilities in the local area. Approximately 16% of the population in the study area is aged 65 or over. This is higher than County Galway (15%) and at State level (13%).

Table 6-5 Percentage of Total Population in each Age Band for the Study Area and its Comparator Areas

Area	% of Total Population by Age Band						
	0-4	5-12	13-18	19-24	25-44	45-64	65+
Study area	9	12	6	6	28	23	16
County Galway*	7	13	8	6	26	26	15
Ireland	7	12	8	7	30	24	13

Source: CSO, census 2016; Small Area Population Statistics 2016.

**Note: Excluding Galway city administrative area.*

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

6.5.1.2 Local Community Facilities and Land Uses

The area surrounding the Proposed Road Development is considered rural in nature. The predominant land use is not explicitly zoned but is defaulted as agricultural in terms of land use. There are areas of established agricultural lands with adjoining hedgerows. The existing N63 is lined by residential properties, with dispersed residential units and community facilities in the surrounding area (Volume 03; Figure A6-1). The Abbert River, which is part of the Lough Corrib Special Area of Conservation (SAC) has been identified as making a significant contribution to wild brown trout stocks in the Clare River system and Lough Corrib and is noted as being a local angling river fishery.

Several community facilities are located in proximity to the junction between the N63 and L3110, both on the north and south side of the existing N63. These facilities include:

- Abbeyknockmoy Community Centre;
- Handball Court;
- Newtown's National Primary School;
- Newtown's Creche;
- Saint Bernard's Church;
- Frank Manion Longue Bar;
- O'Donohoes Service Station;
- The Abbey Inn; and
- Abbeyknockmoy Health Centre.

[2] http://census.cso.ie/sapmap/ Accessed 11/11/2020

In addition, the following club/groups and cultural heritage sites are located within the study area:

- Abbeyknockmoy GAA Club;
- Newtown Kids Club;
- Saint Bernard's Soccer Club;
- Knockmoy Abbey; National Monument No. 166; GA058-004001) and one National Monument subject to Preservation Order (earthworks and buildings associated with the Abbey; NM No. 166 & PO No. 4/1989; GA058-004004); and
- Abbeyknockmoy Cemetery.

In Abbeyknockmoy village centre, there are several commercial properties including:

- Spar;
- Ab Tyres;
- EM Hair;
- Delicious Catering;
- Sean O'Donohoe Pub;
- The Abbey Inn; and
- Crystal Pizza.

6.5.1.3 Open Spaces/Amenity Areas

Open spaces and amenity areas in the study area include Handball Court, Abbeyknockmoy Cemetery and Abbeyknockmoy GAA Club. The majority of the northern section of the study area is located within a designated Focal Point/View (No. 26), which is associated with Knockmoy Abbey; this abbey is the main tourist attraction pertaining to the study area.

There are no designated scenic driving routes, national walking routes, including looped walks, on road cycling and waymarked ways, located within the study area.

At present there are no dedicated cycle facilities within the area, and there are no planned works in this area. There is currently one footpath along the south side of the existing N63 in front of St. Bernard's Church. There are currently no pedestrian facilities outside of the community facilities, including the Abbeyknockmoy Community Centre and Newtown National School. It is recognised that there is an overall poor level of pedestrian provision in this area, and there are no planned works in this area.

6.5.2 Labour Force

6.5.2.1 Education and Skills

Table 6-6 shows that 20% of residents within the study area are qualified to Ordinary Bachelor's degree/professional qualification and above, which is lower than in County Galway (28%), and the recorded national average (29%). The study area also recorded an equal proportion of residents with no formal education to County Galway and at state level (2%).

Table 6-6 Highest Level of Education Completed, 2016

Indicator	Study Area		Galway		Ireland	
	No.	%	No.	%	No.	%
No formal education	16	2%	2,070	2%	52,214	2%
Primary	130	14%	14,489	12%	334,284	11%
Lower secondary	154	16%	16,335	14%	449,766	14%
Upper secondary	210	22%	22,221	19%	573,643	19%
Technical/vocational	80	9%	10,196	9%	271,532	9%
Advanced certificate/completed apprenticeship	53	6%	7,160	6%	182,318	6%
Higher certificate	47	5%	5, 836	5%	153,351	5%

Indicator	Study Area		Galway		Ireland	
	No.	%	No.	%	No.	%
Ordinary bachelor degree/professional qualification or both	49	5%	9,498	8%	237,117	8%
Honours bachelor degree/professional qualification or both	82	9%	11,733	10%	331,293	11%
Postgraduate diploma or degree	51	5%	10,478	9%	284,107	9%
Doctorate (Ph.D.)	4	1%	1,194	1%	28,759	1%
Not stated	61	7%	5,614	5%	198,668	6%
Total	938	-	116,824	-	3,097,052	-

Source: Census 2016 (CSO, 2016).

6.5.2.2 Occupational Profile

The census provides a breakdown of the total population by 'social class'. These groupings are based on the level of skill and education attainment of their occupation. For the population which does not work, the social class of the person which they are deemed to depend on is attributed to them (as per guidance issued by the CSO).

Approximately 39% of the population of the study area are either in 'Non-Manual' and 'Skilled' social classes, which is slightly higher than for County Galway (36%) and Ireland (36%). Only 4% of the population of the study area are in the unskilled social class, which is similar to State level (also 4%) but slightly higher than in County Galway, where 3% of the total population is in unskilled social classes (Table 6-7).

As outlined in Table 6-8, 22% of the population in the study area are in 'Skilled Trades Occupations', which is higher than in County Galway (18%) and at state level (14%).

Table 6-7 Percentage of Total Population in each Social Class for Study Area and Comparator Areas

Area	% of Total Population by Social Class						
	Professional	Managerial/ Technical	Non-Manual	Skilled	Semi-Skilled	Un-skilled	Other
Study area	7%	24%	19%	19%	12%	4%	14%
County Galway*	7%	29%	17%	15%	12%	3%	16%
Ireland	8%	28%	18%	14%	11%	4%	18%

Source: CSO, census 2016; Small Area Population Statistics 2016[2].

**Note: Excluding Galway city administrative area*
Note: Figures may not sum to those presented in preceding paragraph due to rounding.

Table 6-8 Percentage of Total Population in each Occupation Group for Study Area and Comparator Areas

Area	% of Total Population by Occupation									
	Managers, Directors and Senior Officials	Professional	Associate Professional and Technical Occupations	Administrative and Secretarial Occupations	Skilled Trades Occupations	Caring, Leisure and Other Service Occupations	Sales and Customer Service Occupations	Process, Plant and Machine Operatives	Elementary Occupations	Not stated
Study area	4%	13%	9	11%	22%	9%	5%	15%	6%	7%
County Galway*	7%	18%	10%	9%	18%	8%	5%	10%	7%	8%
Ireland	7%	17%	11%	10%	14%	7%	7%	7%	9%	10%

Source: CSO, census 2016; Small Area Population Statistics 2016[2].

**Note: Excluding Galway city administrative area*
Note: Figures may not sum to those presented in preceding paragraph due to rounding.

6.5.2.3 Income

Income levels in the study area are higher than across the national average. The household median gross income in the study area in 2016 lies between €46,689 (Abbey East) and €51,120 (Abbey West), comfortably higher than the median rate for Ireland (€45,256) and County Galway (€44,352).

Table 6-9 Household Income, 2016

Indicator	Study Area	Galway	Ireland
Household median gross income (€)	46,689-51,120	44,352	45,256

Source: CSO, Geographic Profiles of Income in Ireland (2016) (CSO, 2016).

6.5.3 Travel Patterns and the Existing Transport Network

The N63 is a regional connector route connecting Roscommon to the M17 which leads on to Galway. Table 6-10 shows the travel time to work, school, or college for residents of the study area and its comparator areas in 2016. The results show that residents in the study area travel shorter distances to work, school or college compared to the rest of County Galway or at State level. Approximately 49% of respondents from the study area reported spending 29 minutes or less travelling to these destinations, compared with 59% in County Galway and 61% in Ireland.

Table 6-10 Travel Time to Work, School or College

Area	% of Total Population by Travel Time to Work, School or College						
	Under 15 mins	15-29 mins	30-44 mins	45-60 mins	1-1.5 hours	>1.5 hours	Not Stated
Study area	22	27	27	9	6	2	6
County Galway	34	24	20	7	6	2	6
Ireland	32	29	17	6	6	2	7

Source: CSO, Census 2016; Small Area Population Statistics 2016[2]*.*

**Note: Excluding Galway city administrative area*

Note: Figures may not sum to those presented in preceding paragraph due to rounding.

Table 6-11 shows the modes of transport most commonly used to travel to work, school, and college for residents of the study area and its comparator areas in 2016. The results show that residents of the study area rely primarily on private vehicles. Approximately 79% of residents in the study area travel to their respective destinations by driving or as a passenger in a private vehicle. This is higher than the percentage of residents who travel by private vehicle in County Galway (76%) and Ireland (64%). Conversely, only 1% of residents travel by foot or cycle, which is lower than for County Galway (8%) and Ireland (17%). This is primarily because the study area is somewhat rural. There is a primary school in Abbeyknockmoy village, but residents are required to travel elsewhere for secondary school and college. Employment opportunities in the village are also limited.

Residents in the study area are very likely to be travelling south on the existing N63 to Abbeyknockmoy, or north to Roscommon and to the M17, which leads on to Galway. These areas all have large a number of educational facilities and large employment workforces.

Table 6-11 Travel Mode to Work, School, or College

Area	Foot	Bicycle	Bus or Coach	Train	Car/Van Driver	Car Passenger	Other	Not Stated
Study area	1	0	13	0	57	22	1	4
County Galway*	7	1	9	0	51	23	1	4
Ireland	14	3	10	3	43	19	0	4

Source: CSO, census 2016; Small Area Population Statistics 2016.

**Note: Excluding Galway city administrative area*
Note: Figures may not sum to those presented in preceding paragraph due to rounding.

Maintaining the connections between the study area and these areas is therefore important for the local community. The N63 currently experiences significant traffic congestion issues in the vicinity of the Liss Bridge. More information regarding congestion on the transport network is available in Chapter 05 Traffic Analysis.

6.5.4 Human Health

6.5.4.1 Overview

This section provides an overview of the general health profile of residents of the study area and its surrounding areas.

Table 6-12 Proportion of the Population by General Health for the Study Area and its Comparators

Area	Proportion of Population by General Health (%)					
	Very good	Good	Fair	Bad	Very Bad	Not Stated
Study area	60	29	9	1	0	2
County Galway*	59	89	8	1	0	2
Ireland	59	28	8	1	0	3

Source: CSO, Census 2016; Small Area Population Statistics 2016[2]*.*

**Note: Excluding Galway city administrative area*
Note: Figures may not sum to those presented in preceding paragraph due to rounding.

The Proposed Road Development and all receptors relevant to the population and human health assessment are located in County Galway, in the West Region of Ireland. Data used was from the CSO's 'Vital Statistics Annual Report 2017[3]' and 'Vital Statistics Yearly Summary 2019' and 2016 Census.

The key health indicators for County Galway (and the West Region where relevant) are as follows:

- Birth and infancy[4]:
  - The birth rate in 2019 in County Galway equates to 12.6 births per 1,000 residents, which is slightly above the national average (12.1).
  - The infant mortality rate in 2019 in County Galway equates to 3.4 per 1,000 residents, slightly above the national average (3.2).
  - The neonatal mortality rate in 2019 in County Galway equates to 2.1 per 1,000 residents, below the national average (2.4).
- Circulatory system health[4]: The standardised death rate from diseases of the circulatory system in 2017 in County Galway equates to 1.80 per 1,000 people, somewhat lower compared to the national average of 1.85 per 1,000 people. In 2019, 29% of all registered deaths in County Galway were related to diseases of the circulatory system.

[3] Vital Statistics Annual Report (2017) Accessed 01/12/2020
[4] Vital Statistics Summary (2019) Accessed 01/12/2020

- Respiratory system health: The standardised death rate from diseases of the respiratory system in 2017 in County Galway equates to 0.67 per 1,000 people, which is slightly higher than the national average (0.85 per 1,000 people). In 2019, 12% of all registered deaths in County Galway were related to diseases of the respiratory system.
- Neoplasms[5]: Standardised death rate from neoplasms in 2017 in County Galway equates to 1.62 per 1,000 people, which is lower to the national average (1.95). In 2019, 32% of all registered deaths in County Galway were related to malignant neoplasms.
- Disability: In 2016, 13% of the West Region over the age 15 were registered as disabled (CSO, 2016).

6.5.4.2 Life Expectancy

Life Expectancy Tables in Ireland are produced every 5 years. They take population figures from the most recent census, and number of deaths at each age from the most recent Vital Statistics annual reports. The last life expectancy tables were for the years 2015-2017.

In 2016, male residents in the West Region were expected to live to 79.7 years whilst female residents were expected to live to 84.5 years, compared to 78.7 years and 83.3 years respectively in 2011[6]. The life expectancies in 2016 are almost identical to the country's averages (79.6 years for males and 83.4 years for females).

6.5.4.3 Physical Activity

Most residents aged 15 and over in the West Region (70%) are not limited at all in their daily activities, with 25% limited slightly and only 4% considered to be severely limited. This profile broadly aligns with the national results, where 72% are not limited at all, 24% are limited slightly and 4% are severely limited (CSO, 2016).

Figure 6-3 displays the proportion of residents aged 15 and over undertaking physical activity in the West Region and Ireland. A greater proportion of residents in the West Region cycle to get to and from places. However, a greater proportion of residents nationally partake in sports, fitness or recreational physical activities and muscle strengthening activities compared to the West Region.

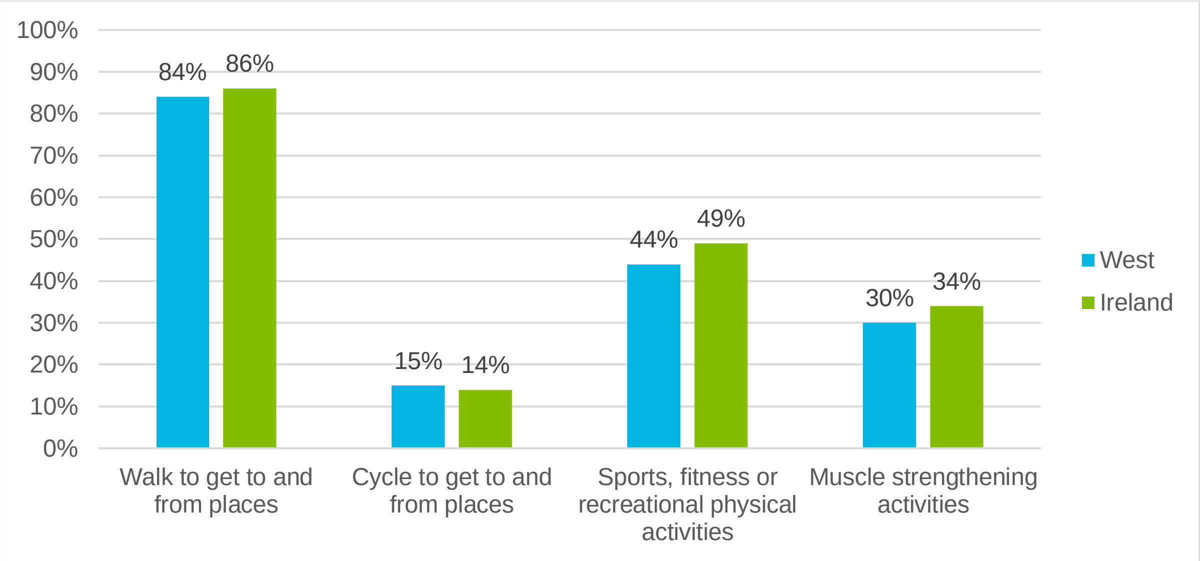

Figure 6-3 Physical Activity undertaken for All Persons Aged 15+ Years, 2016.

Source: CSO (Ireland) (2016).

[5] *An abnormal mass of tissue that forms when cells grow and divide more than they should or do not die when they should. Neoplasms may be benign (not cancer) or malignant (cancer). Benign neoplasms may grow large but do not spread into, or invade, nearby tissues or other parts of the body* (Cancer.gov).
[6] https://www.cso.ie/en/releasesandpublications/er/ilt/irishlifetablesno172015-2017/ Accessed 01/12/2020

6.5.4.4 Mental Health

The Irish Health Survey reports the mental health status of residents (aged 15 years and over). The most recent health survey undertaken in 2015, reported that 78% of residents stated they experience no or minimal depression in the West Region, which was higher than across Ireland (74%). The full mental health statistics for the West Region and Ireland are shown in Table 6-13, which indicates on the whole residents in the West Region experience similar levels of depression as residents across the nation.

Table 6-13 Mental Health Status for All Persons Aged 15+ Years

Mental Health Indicator	West Region	Ireland
None to minimal depression	78%	74%
Mild depression	17%	18%
Moderate depression	3%	5%
Moderately severe or severe depression	2%	3%

Source: CSO Irish Health Survey 2015 (CSO, 2015)

6.5.4.5 Deprivation

The Pobal Deprivation Index[7] ranks the relative affluence of electoral divisions in Ireland against one another. According to the index, both Abbey East and Abbey West have a score which is considered ‘marginally below average’.

6.6 Assessment of Impacts and Effects

6.6.1 Construction Phase

6.6.1.1 Land Use and Accessibility

6.6.1.1.1 Temporary Land Acquisition

During the construction phase, 740 m^2 of residential land will be acquired temporarily to facilitate the construction of the new boundary walls. During the works, there could be some access restrictions to the residential properties; however, it is anticipated that access will not be restricted for long periods of time for residents (<1 hr). Therefore, it is expected there will likely be a **temporary**, **negative,** and **low** effect on the existing residential land and its users (**medium** sensitivity); therefore, the significance of effect will likely be **not significant.**

6.6.1.1.2 Permanent Land Acquisition

The Proposed Road Development will require the permanent acquisition of 390 m^2 of residential land (i.e. existing boundary walls) to facilitate the proposed new footpaths. As outlined in Chapter 16 Material Assets Non-Agriculture, where the partial acquisition of residential land will be required, it is proposed to re-build the existing boundary wall in a different location (e.g. 2 m set back) and restore entrances and accesses to residential properties. With the implementation of these embedded mitigation measures, there will be no access restrictions to the residential properties. As this land is associated with a residential property, the sensitivity is assessed to be **medium.** The permanent acquisition of the land will likely result in a **permanent**, **negative,** and **negligible** effect on the existing land use and its users (**medium** sensitivity); therefore, the significance of effects will likely be **slight** as a result of the land take.

Additional information on temporary land acquisition can be found in Chapter 16 Material Assets - Non-Agriculture.

[7] Haase, T. and Pratschke, J. 2017. The 2016 Pobal HP Deprivation Index for Small Areas. Accessed 13/09/21.

6.6.1.2 Community Severance

The study area has only one primary school, it does not have a secondary school and it offers limited employment opportunities. Residents in the study area are very likely to be travelling south on the existing N63 to Abbeyknockmoy, or north to Roscommon and to the M17, which leads on to Galway to access their workplace, school, or college. These areas all have large a number of educational facilities and large employment workforces. Therefore, they rely heavily on the local road network, travelling northbound and southbound on the existing N63. No specific sensitivity values are assigned to receptors in the severance assessment.

To transport the quantity of material required to and from the Proposed Road Development site (95,000 m^3), it is estimated to require approximately 15,200 heavy Goods Vehicle (HGV) movements. Assuming then that the HGV movements are equally distributed over a 9-month period with a five-day work week, this results in 196 working days each with 78 HGV movements per day. The assessment of the Proposed Road Development's impact on traffic flow capacity as discussed in Chapter 05 Traffic Analysis indicates that, during the construction phase, the greatest percentage increase in traffic caused by the Proposed Road Development could result in 3.3% on the existing N63 (to the east of the Proposed Road Development[8]). The construction traffic assessment determined that this will likely result in a negligible effect on the surrounding road network. Therefore, it is not expected that the additional construction traffic will result in any congestion considerable enough to deter local residents from accessing the workplaces, educational facilities, or community facilities which they use.

Although the majority of the Proposed Road Development is offline, there could be temporary lane closures in place (i.e. by provision of signal control alternate shuttle working) on the existing N63 to facilitate the construction of the Proposed Road Development and at junction tie-in points with the existing N63; however, the Proposed Road Development will not result in the closure of the existing N63. Therefore, the temporary lane closures will have a **temporary**, **neutral,** and **negligible** effect local residents in the study area and the facilities which they use during the construction period. The significance of effect is assessed to be **imperceptible**.

Further assessment of the impact of the Proposed Development on the transport network is provided in Chapter 05 Traffic Analysis.

6.6.1.3 Employment

The impact on direct employment has been identified by the number of workers required on the Proposed Road Development site. The main construction works associated with the Proposed Road Development are scheduled to occur between 15-18 months.

During this period, the number of workers will vary considerably though the maximum required by the Proposed Road Development during working hours is expected to be approximately 70. As far as practicable, these workers will be sourced from the local area, to increase the Proposed Road Development's local impact.

It is expected that temporary indirect jobs will be created in the supply chain to provide material, specialist labour and services for the workforce. Based on the information available at present, it is not possible to quantify the extent of the indirect employment created.

In conclusion, given the size, nature, and duration of the Proposed Road Development, it has potential to create some temporary employment in Abbeyknockmoy and its surrounding area. Therefore, overall, the construction phase of the Proposed Road Development has the potential to have a **short-term**, **neutral** to **positive** effect on employment; therefore, the significant of effect is considered **not significant**.

6.6.1.4 Human Health

6.6.1.4.1 Access to Healthcare Services and Other Social Infrastructure

There is a school and crèche located in close proximity to the Proposed Road Development. Abbeyknockmoy Health Centre is located in Abbeyknockmoy village, to the west of the Proposed Road Development. Local residents of these facilities currently use the existing N63 to access these facilities. Changes in access to services, community facilities, and recreation facilities have the potential to affect health and wellbeing by impacting on community welfare, cohesion, mental health, and physical activity.

The Proposed Road Development will result in construction traffic on the road network in the vicinity of the Health Centre and other social infrastructure. As previously outlined, during the peak of construction activity, it is expected there will be up to 78 HGV movements per day. However, the Proposed Road Development has considered the capacity, location and accessibility of healthcare facilities and other social infrastructure in the study area and as a

[8] Based on the worst-case assessment where the entirety of construction traffic will travel from/to Proposed Road Development from east or from west, while a more realistic scenario will be a combination of the two.

result, proposed construction schedules have ensured access will be maintained for pedestrians and vehicles in the study area. For example, the Proposed Road Development will not result in closures of the existing N63. In addition, the additional traffic as a result of the construction works is not expected to lead to an increase in congestion which will affect users' ability to access these resources, as the impact of the construction traffic on the surrounding road network is considered to result in a negligible effect (as outlined in Chapter 05 Traffic Analysis).

There is currently one footpath along the south side of the existing N63 in front of St. Bernard's Church. There are currently no pedestrian facilities outside of the community facilities, including the Abbeyknockmoy Community Centre and Newtown National School. It is assumed that the footpath in front of the church is well used by locals and vulnerable groups for access to the church. During the construction phase, disruptions for local residents could occur due to the construction of a new 3.0 m wide footpath and upgrading existing footpath in front of church; however, pedestrian access to these facilities will not be impacted.

Therefore, the effect of the Proposed Road Development on access to healthcare services and other social infrastructure as a determinant of human health is assessed to be **neutral**.

6.6.1.4.2 Accessibility and Active Travel

There are no designated scenic driving routes, national walking routes, including looped walks, on road cycling and waymarked ways, located within the study area. As outlined above, there is currently one footpath along the south side of the existing N63 in front of St. Bernard's Church and pedestrian use of this footpath will not be impacted during the construction phase.

Therefore, the effect of the Proposed Road Development on accessibility and active travel as a determinant of human health is assessed to be **neutral**.

6.6.1.4.3 Air Quality, Noise and Neighbourhood Amenity

The construction phase is expected to last 15-18 months. During this time, excavations and earthworks, temporary stockpiling of potentially dusty materials, waste, cutting and grinding of materials and cement, use of unsurfaced haul roads and construction traffic haul roads could result in temporary and negative effects on air quality, noise and neighbourhood amenity as a determinant of human health.

A number of additional construction vehicles will be using the existing N63 to gain access to the construction site, which will be a nuisance to the local residents and existing road users. However, as outlined previously, it was determined that additional HGV's during the construction phase will not lead to journey increases and/or congestion issues as the impact of the construction traffic on the surrounding road network is considered to result in a **negligible effect** (as outlined in Chapter 05 Traffic Analysis).

During the construction phase oil excavation, earthworks and temporary stockpiling could contribute to negative effects on air quality. However, the air quality assessment concluded that the implementation of standard industry good practice mitigation measures will ensure that potential significant adverse effects from residual dust and vehicle emission impacts during the construction phase will not occur on residential properties adjacent to the existing N63 close to Abbeyknockmoy; therefore, the residual effect will be negligible.

It was determined in Chapter 12 Noise and Vibration that construction noise limits will be exceeded for a small number of properties along the eastern end of the Proposed Road Development[9]. Effects on these properties will be mitigated as set out in Chapter 12. Overall, the assessment determined that with the implementation of appropriate mitigation measures, the likely residual effects on the noise environment will be **negative, moderate, local, and short-term** for the majority of locations. However, where construction works are taking place within 25 m of a noise-sensitive location, there is potential for a significant effect assuming worst case noise levels.

The effect of the Proposed Road Development on air quality, noise, and neighbourhood amenity as a determinant of human health is assessed to be **negative** due to the potential negative moderate and significant noise effects on sensitive receptors in the study area.

[9] within 25 m of the proposed works which were identified as potentially being effect by construction noise.

6.6.1.4.4 Access to Work and Training

Residents in the study area are very likely to be travelling south on the existing N63 to Abbeyknockmoy, or north to Roscommon and to the M17, which leads on to Galway. These areas all have large a number of educational facilities and large employment workforces. The enforcement of a Construction Traffic Management Plan (CTMP) during the construction phase will mean that there will be no journey increases and/or congestion issues and the impact of the construction traffic is considered to result in a negligible effect on the surrounding road network (as outlined in Chapter 05 Traffic Analysis). Therefore, it is anticipated that the Proposed Road Development will **not impact** accessibility for residents in the study area travelling to work and training.

As outlined in Section 6.6.1.3, the Proposed Road Development will provide temporary additional employment opportunities in Abbeyknockmoy and the surrounding area during the construction phase. The Proposed Development will therefore lead to employment and training opportunities and the potential health effects during construction on access to employment and training opportunities is assessed to be **positive**.

6.6.1.4.5 Climate Change

An assessment of the likely climate change effects arising from the construction and operational phase as part of the Proposed Road Development is provided in Chapter 11 Climate.

The climate assessment determined that, with the mitigation measures defined in Chapter 11 in place, the Proposed Road Development will result in a **minor (low significance**) impact due to emissions being calculated to be less than 1% of permitted residual emissions .

Given the Proposed Road Development has the potential to create a negative effect on climate change, it is assessed that the effect on climate change as a determinant of human health will also be **negative**.

6.6.2 Operational Phase

6.6.2.1 Land Use and Accessibility

There will be no land use and accessibility impact during the operational phase.

6.6.2.2 Community Severance

Community severance impacts on the local community during operation can result in additional traffic on existing roads, leading to increased journey times. The N63 currently experiences significant traffic congestion issues in the vicinity of the Liss Bridge. This Proposed Road Development will assist in the alleviation of these issues at the local level, while improving safety for both motorised and non-motorised users. Any proposed upgrade to the current sub-standard N63 alignment will improve the route consistency of the national road network and increase the overtaking opportunities. This will help with connectivity between these areas and improve journey times and reliability.

The traffic data indicates that the Proposed Road Development will result in a re-distribution of traffic which currently uses the existing N63 onto the Proposed Road Development, with no notable additional traffic being drawn to the local area. The traffic assessment concluded that the Proposed Road Development will substantially decrease the volume of traffic on the existing N63 corridor, particularly in area near the National School and Community Centre, as a result of the re-distribution of the traffic. The traffic assessment identified that the Proposed Road Development will provide a reduction in total distance travelled (-4.4%), a reduction in travel time (-20.4%) and an increase in average speed (+20.1%) throughout the entire modelled road network. The Proposed Road Developing during its operation will therefore not lead to any severance or increases in journey times for residents attempting to access the resources they use.

In addition, the new bridge crossing over the Abbert River, with its improved horizontal and vertical alignments, coupled with the new pedestrian footpaths and cycle tracks along the mainline, has the potential to improve connectivity to the community facilities for local residents in Abbeyknockmoy and along the existing N63. It will also potentially provide a safer and more pleasant journey for motorised and non-motorised users along the existing route to serve the existing community centre, Knockmoy Abbey, community facilities and a number of local schools. Additionally, remediation measures for the Proposed Road Development will include a new viewing area looking towards Knockmoy Abbey. The viewing area will be elevated to maximise the views, it will include layby space for motorists to pull over and walk to the viewing point and it will have a footpath connecting the viewing area with Abbeyknockmoy village.

Overall, the operation of the Proposed Road Development will likely result in a **permanent**, **positive,** and **medium** effect on the local residents; therefore, the significance of the effect is considered **slight** during the operational phase.

6.6.2.3 Human Health

6.6.2.3.1 Access to Healthcare Services and Other Social Infrastructure

Dedicated pedestrian/cycle routes will allow for direct access for residents in Abbeyknockmoy village and along the existing N63 line to a number of community facilities along the existing N63, including the Newtown's National Primary School, Newtown's Creche and the GAA club. In addition, one new controlled pedestrian crossing of the existing N63 is proposed at Abbeyknockmoy Community Centre (Figure N63-ACM-PH03-0000-DR-HW-0015), to provide connection with the Newtown National School and Abbeyknockmoy Community Centre for residents along the existing N63 and in Abbeyknockmoy village. In turn, this will allow safe access for children but will also offer safe access for vulnerable road users and give people a new connection to the social infrastructure. The fact that the Proposed Road Development will remove entirely the regional (through) traffic from the existing N63 will also provide safe access for residents along the existing N63 to access the Abbeyknockmoy Healthcare Centre in Abbeyknockmoy village. The additional bridge crossing over the Abbert River has the potential to improve connectivity to the community facilities for residents along the L6234 and north of Liss bridge. As outlined in Chapter 05 Traffic Analysis and outlined in Section 6.6.2.2 above, the assessment determined that the Proposed Road Development will provide a reduction in total distance travelled, a reduction in travel time and an increase in average speed throughout the entire modelled road network.

The reduction in total distance travelled and travel time, and the increase in average speed coupled with the introduction of pedestrian/cycling facilities, will therefore improve accessibility to healthcare services, community facilities and heritage resources. The effect of the Proposed Road Development on access to healthcare services and other social infrastructure as a determinant of human health is therefore assessed to be **positive**.

6.6.2.3.2 Accessibility and Active Travel

There are no designated scenic driving routes, national walking routes, including looped walks, on road cycling and waymarked ways, located within the study area. However, during the operational phase, provisions have been included in the design to replace and enhance existing routes used by Non-Motorised Users (NMUs). The new pedestrian footpaths and cycle facilities have the potential to encourage greater pedestrian and cycle activity as a result of the increased opportunity for walking and cycling for residents on the existing N63; this in turn could have knock-on effects of the health profile of the local community. These dedicated pedestrian/cycle routes will also allow for direct access for residents in Abbeyknockmoy village to community facilities, including the GAA pitch.

As previously outlined, the additional bridge crossing, in addition to the new pedestrian footpath, over the Abbert River also has the potential to improve connectivity to the community facilities along the existing N63 and in Abbeyknockmoy village for residents along the L6234 and north of Liss bridge.

The effect of the Proposed Road Development on accessibility and active travel as a determinant of human health is therefore assessed to be **positive**.

6.6.2.3.3 Air Quality, Noise and Neighbourhood Amenity

During the operational phase, the Proposed Road Development is likely to decrease the congestion issues at Liss bridge on the existing N63. Therefore, the improved traffic flows are expected to improve air quality and reduce noise and neighbourhood amenity impacts in parts of the study area.

The air quality assessment concluded that locally there will be an overall reduction in exposure to NOx and PM_{10} as a result of the operation of the Proposed Road Development, as the majority of sensitive receptors are located on the existing N63 and approximately 60% of vehicles will use the Proposed Road Development instead, which is further away from these receptors. Regionally, increases in PM_{10}, will be expected with the Proposed Road Development due to the greater number of vehicle-kilometres travelled with the Proposed Road Development, while decreases in NO_2 and CO_2 will be expected with the Proposed Road Development due to the alleviation of congestion. Overall, the assessment concluded the effects from the Proposed Road Development will be considered not significant and neutral with respect to air quality.

The noise assessment concluded that once operational and with the inclusion of the recommended noise mitigation measures, traffic noise levels associated with the Proposed Road Development combined with traffic along the adjacent surrounding roads are sufficiently reduced. In total 27 of the 37 assessed locations in the vicinity of the Proposed Development will experience a positive noise impact as the Proposed Road Development is at a greater distance than the existing road. With just three locations requiring noise mitigation measures, the majority of locations assessed are predicted to have road traffic noise levels reduced; therefore, the assessment determined that the overall likely effects on the noise environment will be positive.

In addition, as outlined in Chapter 13 Landscape and Visual, the road design has incorporated a new viewing area for the Knockmoy Abbey for the benefit of users and in particular for the benefit of the local community. As a result of the Proposed Road Development, lighting effects will arise from both the lighting columns proposed to illuminate the roundabout and the glare of cars using the road at night and in low light conditions. However, the effect of the roundabout lighting will be seen as an extension of the town lighting and not entirely isolated. With enforcement of mitigation measures as described in the Outline Construction Environmental Management Plan (OCEMP), the successful implementation and maintenance of mitigation measures will result in a reduction of visual effects over time as the proposed screening vegetation matures.Therefore, overall, it was determined that the effects of the Proposed Road Development on air quality, noise, and neighbourhood amenity as a determinant of human health is assessed to be **positive**.

6.6.2.3.4 Access to Work and Training

It is anticipated that the Proposed Road Development will likely improve commuting times for residents along the existing N63 due the fact that the Proposed Road Development will remove entirely the regional (through) traffic from the existing N63. This coupled with the introduction of pedestrian/cycling facilities on the existing N63 will improve accessibility to employment sites in Abbeyknockmoy and the wider area. The impact of the Proposed Road Development on access to work and training as a determinant of human health is assessed to be **positive**.

6.6.2.3.5 Climate Change

An assessment of the likely climate change effects arising from the operational phase as part of the Proposed Road Development is provided in Chapter 11 Climate. It states that during the operational phase, in relation to Ireland’s national Greenhouse Gas (GHG) inventory, the impact of GHG emissions during the operation of the Proposed Road Development have been found to be minor (low significance).

In addition to this, an assessment of potential risk of a Major Accident and Disaster (MAD) as a result of climate change is provided in Chapter 15 Major Accidents and Disasters. The MADS assessment determined that measures implemented in design to ensure suitability for predicted atmospheric temperatures and other climatic conditions are suitable and sufficient.

Given the Proposed Road Development has the potential to create a negative effect on climate change, it is assessed that the effect on climate change as a determinant of human health will also be **negative**.

6.7 Mitigation and Monitoring Measures

6.7.1 Construction Phase

Potential impacts from the Proposed Road Development and their respective mitigation measures, which are of relevance to the population and human health impact assessment, are addressed in detail in Chapter 05 Traffic Analysis, Chapter 10 Air Quality, Chapter 11 Noise and Vibration, Chapter 12 Landscape and Visual, and Chapter 16 Materials -Non-Agriculture.

Additional mitigation measures during construction to reduce impacts on population and human health should be written into the construction Environmental Management Plan (CEMP) and CTMP and include:

- Clear signage of any temporarily diversions to existing motorised and non-motorised routes (including pedestrians and cyclists);
- Road surfaces in proximity to the construction site are to be kept clear of mud and debris as much as is possible; and
- All temporary lane closures, one-way systems, signage, and temporary safety measures will be carried out in accordance with Section 8 of the Traffic Signs Manual (2010). The traffic management plans and diversions will be implemented at the interface between the works and traffic will be the contractor’s responsibility. Issues relating to temporary diversions will be defined in traffic management plans produced by selected contractors.

No monitoring has been proposed for the construction phase of the development.

6.7.2 Operational Phase

It was identified that the Proposed Road Development will likely result in a net **positive** effect on land use and accessibility, employment, and human health; therefore, no mitigation or monitoring is required.

No monitoring has been proposed for the operational phase of the development.

6.8 Residual Impacts and Effects

Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines (EPA 2017), the effects from the impacts that remain after all assessment and mitigation are referred to as 'Residual Effects'.

Reference should be made to Table 6-14 for a summary of residual impacts and effects.

6.8.1 Construction Phase

6.8.1.1 Land Use and Accessibility

It is anticipated that the effects from the temporary acquisition of residential land will likely remain **temporary**, **negative, low,** and **not significant** as no additional mitigation has been proposed.

6.8.1.2 Community Severance

The effects on community severance will likely remain **temporary**, **neutral**, **negligible,** and **imperceptible** with the implementation of mitigation measures outlined in Section 6.7.1.

6.8.1.3 Employment

Construction of the Proposed Road Development will lead to a **positive** and **not significant** effect on the local employment workforce due to the number of construction workers required. No change in effects is anticipated as no mitigation measures have been proposed.

6.8.1.4 Human Health

No change in effects on human health is anticipated as no mitigation measures have been proposed. Effects will likely remain **neutral** on access to health services and other social infrastructure and climate change as determinants on human health. The effects on access to work and training as determinant of human health will remain **positive** due the increased accessibility to employment opportunities and training for the employment workforce in the local and wider community. The effects on air quality, noise and neighbourhood amenity will remain **negative** as no additional mitigation has been proposed.

6.8.2 Operational Phase

6.8.2.1 Land Use and Accessibility

No additional mitigation measures have been proposed during the operational phase. Effects on existing land use and accessibility as a result of the permanent acquisition of land are as per the construction phase.

6.8.2.2 Community Severance

No change in effects on community severance is anticipated as no mitigation measures will be required during the operational phase. Effects will likely remain **permanent**, **positive**, **medium,** and **slight** during the operational phase.

6.8.2.3 Human Health

No change in effects on climate change as a determinant on human health are anticipated and anticipated health impacts will remain **Negative**. No change in effects on the remaining determinants of human health (access to healthcare services and other social infrastructure, opportunities for active travel, changes in neighbourhood amenity to due air quality and noise impacts, and access to work and training) from the Proposed Development are anticipated as no mitigation measures have been proposed. The effects on human health will remain **positive** due the increased accessibility to employment opportunities and training for the employment workforce in the local and wider community; the separation of regional and local traffic, coupled with the introduction of pedestrian/cycling facilities, which will improve accessibility to healthcare services, community facilities and heritage resources. In addition to this, the potential reduction in traffic on existing roads and the provision of pedestrian footpaths and cycle tracks within the design of the Proposed Road Development will potentially encourage greater pedestrian and cyclist activity within the study area and surrounding environs.

6.9 Do-Nothing Scenario

The 'Do-Nothing' scenario assumes the Proposed Road Development is not built and no upgrades to the existing N63 will be undertaken. There is likely to lead to increased traffic congestion, especially at Liss bridge, and potential negative environmental effects to the local residents in the study area including:

- An increase in noise and emissions to air (determinants of human health); and
- Increase journey times.

The potential positive benefits on human health as a result of the proposed cycling and pedestrian facilities would also be lost.

6.10 Cumulative Impacts and Effects

In the population and human health assessment, the combined action of a number of different projects, cumulatively with the Proposed Road Development on a single resource/receptor is also assessed during both the construction and operational phase. This involved a search of planning applications made within 5 km of the Proposed Road Development. The relevant planning applications are listed in Volume 4; Appendix A1-1. The following subsections identify, for each type of impact whether there are likely to be cumulative impacts.

6.10.1 Land Use and Accessibility

None of the planning applications listed in Volume 4; Appendix A1-1 are expected to lead to significant effects on either the land use or accessibility to any residential properties and/or community resources in the study area as the majority of the planning applications refer to developments located approximately 1-4 km from the study area. The impact on land use and accessibility is therefore as is described in Section 6.6.1 and Section 6.6.2 and there are no cumulative impacts on land use.

6.10.2 Severance

The assessment of severance impacts is inherently cumulative. The traffic data used to inform the assessment includes traffic growth to account for cumulative developments that may affect traffic flows in the study area. The cumulative effects from traffic during both the construction and operational phase are therefore as reported in Section 6.6.1 and Section 6.6.2.

6.10.3 Employment

The assessment provided in Section 6.6.1.3 identified a slight, positive effect on the workforce in the study area and the surrounding area. The planning applications listed in Vol 4; Appendix A1-1 also require construction workforces. However, none of the planning applications that could potentially have a construction period likely to coincide with the Proposed Road Development will require a large construction workforce as the majority of the planning applications are small scale, one off dwellings. In addition to this, given the scale and duration of the works, the number of workers required during construction of the Proposed Road Development is predicted to be small. Therefore, the cumulative effect on employment is not expected to be significant.

6.10.4 Human Health

The cumulative assessment of ‘Access to Healthcare Services and other Social Infrastructure’ is as per the cumulative assessment of ‘Community Severance’ set out above in Section 6.10.2 and the cumulative assessment of ‘Access to Work and Training’ is as per the cumulative assessment of ‘Employment’ set out above in Section 6.10.3.

For the assessment of ‘Air Quality, Noise and Neighbourhood Amenity’, there are no anticipated cumulative noise effects. Chapter 10 Air Quality provides a cumulative assessment of the impact of the Proposed Road Development combined with a number of planning applications listed in Vol 4; Appendix A1-1. The air quality cumulative assessment indicated that in the event that there was a cumulative construction project, the implementation of industry standard mitigation measures will ensure that there will be a negligible cumulative dust effect. It also concluded that there will be no cumulative effects during the operational phase as no permitted developments are known that will affect the traffic flow on the Proposed Road Development. Therefore, the impacts on air quality, noise, and neighbourhood amenity as a determinant of human health in the study area are as reported in Section 6.6.1.4.3 and Section 6.6.2.3.3.

The assessment of ‘Climate Change’ is based on the GHG assessment provided in Chapter 11 Climate. The GHG assessment is by nature a cumulative assessment as it considers whether the Proposed Road Development will contribute significantly to emissions on a national level. By comparing the Proposed Road Development against the national inventory, as being representative of the global climate, the cumulative impact of the scheme is being considered on a national scale.

Table 6-14 Summary of Residual Impacts and Effects

Residual Impact	Description of Effect (Pre-Mitigation)	Mitigation Measures	Residual Effect (Post-Mitigation)
Construction Phase			
Temporary acquisition of land.	**Temporary, negative,** and **low** effect on existing land use and its users of **medium** sensitivity; therefore, the significance of the effect will be **not significant**.	N/A	**Temporary, negative,** and **low** effect on existing land use of **medium** sensitivity; therefore, the significance of the effect will be **not significant**.
Permanent acquisition of land.	**Permanent, negative,** and **negligible** effect on the existing land use and its users (**medium** sensitivity); therefore, the significance of the effects will likely be **slight.**	N/A	**Permanent, negative,** and **negligible** effect on the existing land use and its users (**medium** sensitivity); therefore, the significance of the effects will likely be **slight.**
Community severance	**Temporary, neutral,** and **negligible.** The significance of effect is assessed to be **imperceptible.**	• Clear signage of any temporarily diversions to existing motorised and non-motorised routes (including pedestrians and cyclists); and • All temporary lane closures, one-way systems, signage, and temporary safety measures will be carried out in accordance with Section 8 of the Traffic Signs Manual (2010). The traffic management plans and diversions will be implemented at the interface between the works and traffic will be the contractor's responsibility. Issues relating to temporary diversions will be defined in traffic management plans produced by selected contractors.	**Temporary, neutral,** and **negligible.** The significance of effect is assessed to be **imperceptible.**
Increased employment opportunities.	**Short-term, neutral** to **positive** effect on employment; therefore, the significant of the effect is considered **not significant.**	N/A	**Short-term, neutral** to **positive** effect on employment; therefore, the significant of the effect is considered **not significant.**
Access to healthcare services and other social infrastructure (determinant of human health)	**Neutral**	N/A	**Neutral**
Opportunities for active travel (determinant of human health)	**Neutral**	N/A	**Neutral**
Changes in neighbourhood amenity to due air quality and noise impacts (determinant of human health).	**Negative**	N/A	**Negative**
Access to work and training (determinant of human health).	**Positive**	N/A	**Positive**
Climate change (determinant of human health).	**Neutral**	N/A	**Negative**

Residual Impact	Description of Effect (Pre-Mitigation)	Mitigation Measures	Residual Effect (Post-Mitigation)
Operational Phase			
Community severance	**Permanent**, **positive,** and **medium** effect on the local residents; therefore, the significance of the effect is considered **slight**.	N/A	**Permanent**, **positive,** and **medium** effect on the local residents; therefore, the significance of the effect is considered **slight**.
Access to healthcare services and other social infrastructure (determinant of human health)	**Positive**	N/A	**Positive**
Opportunities for active travel (determinant of human health)	**Positive**	N/A	**Positive**
Changes in neighbourhood amenity to due air quality and noise impacts (determinant of human health).	**Positive**	N/A	**Positive**
Access to work and training (determinant of human health)	**Positive**	N/A	**Positive**
Climate change (determinant of human health).	**Negative**	N/A	**Negative**

6.11 Summary

In summary:

- There is the potential for some negative effects to be experienced during the construction phase of the Proposed Road Development; however, these will be localised and temporary in nature;
- It is anticipated that the effects from the temporary acquisition of residential land will remain temporary, negative, low, and not significant. The permanent acquisition of the land will likely result in a permanent, negative, and negligible effect on the existing land use and its users; therefore, the significance of the effects will likely be slight as a result of the land take;
- The Proposed Road Development will likely result in a slight, positive effect on employment due to the workforce required onsite during the construction phase and the associated indirect employment required in the supply chain;
- Additional employment created by the Proposed Road Development will have a positive effect on access to work and training as a determinant of human health during the construction phase;
- The Proposed Road Development will likely have a neutral effect on access to healthcare services and other social infrastructure; accessibility and active travel and climate change during the construction phase;
- The effect of the Proposed Road Development on air quality, noise, and neighbourhood amenity as a determinant of human health is assessed to be negative during construction, due to the potential negative, moderate, and significant noise effects on sensitive receptors in the study area.
- The Proposed Road Development will have a positive effect on access to healthcare services and other social infrastructure, as well as open space and nature and accessibility and active travel as a health determinant during operation;
- The Proposed Road Development will likely have a positive effect on noise, and neighbourhood amenity as a determinant of human health during operation due to the majority of homes experiencing a reduction in noise. There are no significant air quality effects; and
- An assessment was carried out identifying the potential for a cumulative impact between the Proposed Development and a number of potential future developments. No cumulative impacts were identified.

6.12 References

- CSO. (2015). Irish Health Survey 2015, Central Statistics Office.
- CSO. (2016). Census 2016, Central Statistics Office.
- EPA. (2017). *EPA Guidelines on the information to be contained in Environmental Assessment Reports*, Draft, August 2017, Environmental Protection Agency, Co. Wexford, Ireland.
- Healthy Urban Development Unit (HUDU) guidance Fourth Edition, October 2019 (National Health Service (NHS, 2019);
- Highways England. (2020). LA 112 Population and Human Health. Design Manual for Roads and Bridges.
- IPH. (2009). Health Impact Assessment Guidance, Institute of Public Health.
- WHO. (2006). Constitution of the World Health Organisation.

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 07: Biodiversity

Galway County Council

February 2022

Table of Contents

Figures

Tables

Volume 03 Figures

Volume 04 Appendices

7. Biodiversity

7.1 Introduction

This chapter assesses the ecology of the receiving environment for the Proposed Road Development. Reference should be made to Chapters 01 Introduction to 04 Description of the Proposed Road Development for further information on the Proposed Road Development, and requirements for the proposed works. This chapter quantifies and assesses the potential effects of the Proposed Road Development on biodiversity i.e. flora and fauna, collectively known as biodiversity. Particular attention has been paid to species and habitats of ecological importance. These include species and habitats with national and international protection under the Wildlife Acts 1976 to 2021; European Communities (Birds and Natural Habitats) Regulations 2011 (as amended); European Union (EU) Birds Directive 2009/147/EC and EU Habitats Directive 92/43/EEC, among other relevant legislation.

This chapter sets out to:

- Describe the baseline ecology of the receiving environment (i.e. desk studies and field surveys);
- Identify and describe potentially significant ecological impacts associated with the Proposed Road Development;
- Compliance of Proposed Road Development proposals with nature conservation legislation;
- Describe other existing and/or approved plans and projects, with which the Proposed Road Development may have significant 'cumulative effects';
- Detail the minimum mitigation measures required to avoid or reduce significant effects to acceptable levels;
- Provide appropriate enhancement measures to supplement mitigation as required;
- Provide an assessment of the significance of any residual effects; and
- Detail monitoring measures required to verify predictions regarding performance of mitigation measures, and to inform amended mitigation as required.

7.2 Legislation, Policy, and Guidelines

Legislation, policy, and guidelines relevant to the assessment of biodiversity are outlined in this section. Reference should be made to Chapter 01 Introduction for discussion on the EIA Directive 2014/52/EU (hereafter called the EIA Directive).

7.2.1.1 European Union Habitats Directive

The "Habitats Directive" (Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna) is the main legislative instrument for the protection and conservation of biodiversity within the European Union (EU). The Habitats Directive lists habitats and species that must be protected within Special Areas of Conservation (SAC) on Annexes I and II, respectively. Additionally, the Habitats Directive identifies plant and animal species on Annex IV which are subject to strict protection wherever they occur in Ireland. The Habitats Directive also sets out the protocol for the protection and management of SACs. Collectively Special Protection Areas (SPA) and SAC are referred to as 'European sites' and form part of the Natura 2000 site network.

7.2.1.2 European Union Birds Directive

The "Birds Directive" (Council Directive 2009/147/EC on the Conservation of Wild Birds) provides a network of sites in all member states to protect birds at their breeding, feeding and/or roosting areas. The Birds Directive identifies species that are rare, in danger of extinction or vulnerable to changes in habitat and which require special protection (so-called 'Annex I' species). SPAs are designated under the Birds Directive to protect a range of bird populations including Annex I species.

Together, SACs and SPAs form a pan-European network of so-called 'European sites' for nature conservation (also known as Natura 2000 sites). The European Communities (Birds and Natural Habitats) Regulations 2011 (transposes Directive 2009/147/EC (Birds Directive) and Directive 2009/147/EC, 92/43/EC (Habitats Directive) into Irish law.

7.2.1.3 European Union Water Framework Directive

The Water Framework Directive (WFD) (Council Directive 2000/60/EC) (European Parliament and Council, 2000) provides a framework for the protection and improvement of rivers, lakes, marine and ground waters in addition to water-dependent habitats. The aim of the WFD is to prevent any deterioration in the existing status of water quality, including the protection of good and high water quality status where it exists (Council of the European Communities, 2000).

The WFD requires Member States to manage their water resources on an integrated basis in order to achieve at least 'good' ecological status. In Ireland, this is achieved through the 'River Basin Management Plan for Ireland 2018-2021' (RBMP) (DoHGLP, 2018). The RBMP outlines all the actions required to improve the water quality, with county councils and Irish Water playing an important role in the implementation of the Plan. The WFD requires all Member States to protect and improve water quality in all waters so that 'good' ecological status is achieved.

In this Chapter, the surface water catchment is defined at the scale of 'Catchment Management Unit (CMU)'. CMU is the major river catchment unit adopted in the RBMP; there are 46 CMUs in total in the Republic of Ireland. The Proposed Road Development is located within the Corrib CMU[1]. Chapter 09 of this Environmental Impact Assessment Report (EIAR) specifically relates to assessment of the Water environment.

7.2.1.4 National Legislation

Relevant European legislation is transposed into national legislation through Acts and regulations such as the 'Roads Acts' (collectively Roads Act 1993 (Act 14 of 1993), Roads Act 2007 (34 of 2007) & Roads Act 2015 (14 of 2015), the 'Planning Acts' (The Planning & Development Act 2000 (30 of 2000) as amended by the Planning and Development (Amendment) Act 2010 (30 of 2010), the Planning & Development (Amendment) Act 2018 (16 of 2018), and the 'Planning Regulations' (Planning & Development Regulations 2001-2021 (comprising the Planning and Development Regulations 2001 (S.I. No. 600 of 2001), as amended)).

Key water policy regulations in Ireland are governed by European Communities (Water Policy) Regulations, 2003 (S.I. 722/2003), the European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. 272/2009), the European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010). Fish species are protected through the Fisheries Acts 1959-2017 (S.I. No. 16 of 2017). The Local Government (Water Pollution) Amendment Act, 1990 (S.I. No. 21 of 1990), provides the legal framework for the prevention and control of water pollution.

The primary domestic statutes in the Republic of Ireland providing for wildlife protection are the Wildlife Act 1976 number 39 of 1976 as amended and the Wildlife Act 2000 38 of 2000 as amended, and Wildlife (Amendment) Act (2021) (hereafter 'The Wildlife Acts'). The Wildlife (Amendment) Act 2000 makes legal provision for the designation and protection of a national network of Natural Heritage Areas (NHAs). Proposed NHA (pNHA) are considered important at the national scale, although they are not currently formally proposed for designation, and are generally afforded protection through statutory licensing restrictions and planning policies.

All bird species are protected under the Wildlife Act from offences including intentional killing or injury and disturbance during the breeding season. The protection extends to the eggs, young and nests of birds. The Wildlife Acts provide protection to species not listed under the EU Habitats Directive, including selected mammal species (e.g. Badger *Meles meles*), two amphibian species (Common Frog *Rana temporaria* and Smooth Newt *Lissotriton vulgaris*), one butterfly species (Small Blue *Cupido minimus*) and Common Lizard *Zootoca vivipara*. These species are all protected from intentional killing or injury and their breeding or resting sites are also protected (from wilful disturbance).

Where used in this chapter, the term 'scheduled invasive species' refers to those species scheduled to the European Communities (Bird and Natural Habitats) Regulations 2011 and 2015 (hereafter 'the Regulations'). Under Article 49 (1) of the Regulations a person is guilty of an offence if they breed, reproduce or release or allows or causes to disperse or escape from confinement any animal which is included in Part 2A or Part 2B of the Third Schedule.

[1] Available online at https://www.catchments.ie/maps/ Accessed January 2021

Under Article 49 (2) of the Regulations a person is guilty of an offence where they "*plant, disperse, allow or cause to disperse, spread or otherwise cause to grow*" any plant included in Part 1 of the Third Schedule. A number of vascular (i.e. flowering plants) and non-vascular plant species (i.e. non-flowering or 'lower plants') are listed under the Flora (Protection) Order, 2015 S.I 356/2015 (hereafter 'The Flora Protection Order'). It is an offence to cut, pick, collect, uproot, or otherwise take, injure, damage, or destroy any specimens of the species listed under the Flora Protection Order.

7.2.1.5 Plans and Policies

This section lists plans and policies at national level and below of relevance to biodiversity.

7.2.1.5.1 National Plans

- National Biodiversity Plan 2017-2021 (NPWS 2015);
- Project Ireland 2040 National Planning Framework (National Planning Framework, 2018); and
- All Ireland Pollinator Plan (NBDC, 2020).

7.2.1.5.2 Other Plans

- Regional Spatial & Economic Strategy (RSES) for the North and West region[2];
- Water Services Strategic Plan (WSSP). Irish Water, who has national statutory remit for wastewater and drinking water services, has committed to a 25-year programme of improvements to wastewater impacts on surface waters;
- Galway County Heritage and Biodiversity Plan 2017-2022[3]; and
- Galway County Development Plan (GCDP) 2015 – 2021[4,].

A Draft Galway County Development Plan (Draft CDP) 2022 – 2028 has been prepared by Galway County Council. The Draft CDP has not yet been adopted, however has been on public display and available for public consultation from the 20th May 2021 to the 30th July 2021. The adoption of the Draft CDP is required to be completed by May 2022. Reference should be made to Chapter 02 Need for the Scheme and Planning Policy Context for a summary of these plans.

7.2.1.6 Guidance

The methodology used to assess the potential impact of the Proposed Road Development on ecological features, and develop relevant mitigation measures had regard for key guidance including:

- Environmental Protection Agency (EPA) 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017);
- Relevant Irish governmental guidance such as that available from the National Parks & Wildlife Service on mitigation for bats (NPWS, 2006), and the extensive guidance available for other ecological topics from the NPWS online databases [5];
- Various National Roads Authority (NRA now Transport Infrastructure Ireland (TII)) guidance from the 'Environmental Planning and Construction Guidelines series' including the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (TII[6], 2009);
- The Irish semi-natural grasslands survey 2007-2012. Irish Wildlife Manuals, No. 78 (O'Neill *et al*., 2013);
- Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. (Kelleher & Marnell, 2006);
- Chartered Institute of Ecology and Environmental Management (CIEEM). *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, 2018, updated September 2019);

[2] Available online at https://www.nwra.ie/rses/ Accessed January 2021.
[3] Available online at http://www.galway.ie/en/media/Galway%20County%20Heritage%20and%20Biodiversity%20Plan%202017%20-2022.pdf Accessed January 2021.
[4] Available online at http://www.galway.ie/en/services/planning/planspolicy/gcdp2021/ Accessed January 2021.
[5] Available online at http://www.galway.ie/en/services/planning/planspolicy/gcdp2021/environ/ Accessed January 2021.
[6] Available at https://www.npws.ie/development%20consultations#6.%20Conservation%20objectives. Accessed January 2021
[7] The National Roads Authority has been subsumed into Transport Infrastructure Ireland since the publication of this guidance.

- Other guidance (i.e. plans and policies and methods to inform field surveys) referenced throughout this Chapter as relevant; and
- Directive (Directive 2011/92/EU as amended by 2014/52/EU): Environmental Impact Assessment of Projects: Guidance on the preparation of the Environmental Impacts Assessment Report". European Commission, 2017. European Commission, 2017.

7.2.2 Referencing and Naming Conventions

Throughout this chapter, references to web resources not associated with a published report (e.g. online databases) are referenced in the text. All published reports, to include the 'grey' literature (i.e. government and consultancy), and the peer-reviewed literature are cited within the text following the Harvard format and named in the References Section.

7.2.3 Statement of Authority

Flynn Furney Environmental Consultants have 20 plus years of experience in ecological surveying and management. We have detailed knowledge on the principles and implementation of both Irish and European environmental legislation. We have worked closely with statutory bodies including the National Parks and Wildlife Service and Waterways Ireland on habitat management and protection projects. Other expertise includes Ecological Impact Assessment, Habitat and Floral Surveys, Bird Surveying, Bat Surveying, Fish and Waterways Surveys.

Billy Flynn (BSc, MSc (Agr.), H.Dip, Dip Ind., MIBiol, MCIEEM, MIEnvSc. CEnv.) is an Ecologist and Chartered Environmental Scientist. A native of Co. Monaghan, he was educated in London, Madrid and Dublin. He has over 20 years of experience in environmental science and engineering. He has worked on the survey, ecological design and construction supervision of most of Ireland's motorway projects. He has worked on the planning and design of national roads, greenways and light rail as well as constructed wetlands and parkland biodiversity areas.

Usna Keating (B.Sc., M.Sc., M.Res.) is an experienced onsite ecologist who has worked on many large infrastructure projects in challenging environments. He has also worked with universities, state agencies and NGO's and has published a number of scientific research papers, which have primarily focused on bird conservation. He undertook a masters by research in University College Cork, which explored the relationship between afforestation and bird conservation in Ireland, and made recommendations to the Department of Agriculture, Food and The Marine, on Ireland's afforestation policy, to promote biodiversity retention. Usna also worked on an EU Life Project in Biebrzanski National Park, Poland.

Ian Douglas (MSc, BSc, H Cert.Ag) an Ecologist and Agri-environmental Consultant specialising in appropriate assessment, ecological impact assessment, habitats classification, soil science, GIS mapping and regenerative agriculture. Ian has worked on projects including large road developments, power infrastructure projects, planning and design of nature trails, constructed wetland creation and on farm habitat development.

7.3 Methodology

This section describes the methodologies employed during the preparation of this chapter. The methods section adheres to best practice guidelines to inform the baseline ecology of the receiving environment and assessment rationale for potential impacts associated with the Proposed Road Development.

7.3.1 Zone(s) of Influence and Study Areas

The zone of influence (ZoI) for a project (or "*spatial extent of the impac*t" as described in Annex III (3) of the EIA Directive 2014/52/EU) is the area over which ecological features may be subject to significant impacts as a result of the Proposed Road Development and associated activities. In the case of the project area for example, the Proposed Road Development crosses the Abbert River, which is part of the Lough Corrib SAC (Site Code: 000297).

The ZoI is likely to extend beyond the boundary of a Proposed Road Development; for example, where there are hydrological links extending beyond the site boundaries that create connectivity to other areas. Activities associated with the construction, operation, (and where applicable, decommissioning and restoration) phases should be separately identified where relevant.

The ZoI will vary for different ecological features depending on their sensitivity to environmental change. It is therefore appropriate to identify different ZoI for different features. The features affected could include habitats, species, and the processes on which they depend. ZoI are specified for different features, and types of potential impact.

It is also important to acknowledge, as per EPA draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (hereafter referred to as the 'EPA draft guidelines') (EPA, 2017) "*that the absence of a designation or documented feature does not mean that no such feature exists within the site*". As such, ZoI should be identified for all features potentially occurring within the Proposed Road Development, in addition to any features known to occur.

Desktop survey areas for the Proposed Road Development correspond, as a minimum, to the ZoI of potentially significant effects for each ecological feature. As recommended by CIEEM (2018; updated September 2019), professionally accredited or published studies are used to determine ZoI. Professional judgement is also used to assess ZoI in this assessment, in the absence of data, or presence of conflicting data. Having considered the Proposed Road Development, ZoI have been estimated for habitats and flora and fauna species and their associated habitats. In this Chapter, the study area for cumulative effects is considered to be within the ZoI of the Proposed Road Development. The ZoI for informing this assessment is given in Volume 04; Appendix A7-1. Site maps, surveys and findings can be found in Volume 03 figures A7-1 to A7-10.

7.3.2 Desk Study

A desktop study was carried out to inform the initial scope of the ecological surveys required to develop the assessment. The desk study includes records and literature of published information on flora and fauna occurring within the ZoI of the Proposed Road Development. Key resources assessed include:

- Data on designated sites and rare or protected invertebrate and vertebrate species held online by the National Parks and Wildlife Service (NPWS)[7] and the National Biodiversity Data Centre (NBDC)[8] which includes data from Bat Conservation Ireland
- Information on ranges of mobile Qualifying Interest (QI) populations in Volume 1 of NPWS' 'Status of EU Protected Habitats and Species in Ireland' (NPWS, 2019a);
- The AECOM - Ecological Impact Assessment Phase 2 - LDR4 (AECOM, 2019);
- The AECOM N63 Liss to Abbey Realignment Scheme. Appropriate Assessment Screening (AECOM, 2020);
- The AECOM N63 Liss to Abbey Realignment Scheme. Natura Impact Statement (AECOM, 2021);
- Information on threats to, conservation condition, and habitat characteristics of Annex 1 habitats in Volume 2 of NPWS' 'Status of EU Protected Habitats and Species in Ireland' (NPWS, 2019b);
- Data on Kingfisher *Alcedo atthis* ecology in the Corrib catchment, including territory sizes, from Cummins *et al*. (2010);
- Conservation status of species in the Irish context from relevant Irish 'Red Lists' (e.g. Marnell *et al*., 2009 for mammals, Regan *et al*., 2010 for butterflies, King *et al*., 2011 for fish and amphibians; Lockhart *et al*., 2012 for bryophytes; Curtis and McGough, 1988 and Wyse Jackson *et al*., 2016 for vascular plants);
- Data on water quality in the surface water catchment within which the Proposed Road Development is located (i.e. the Abbert River CMU identified in the RBMP for Ireland (DoHGLP, 2018))[9]; and
- Data on the extent and vulnerability of local groundwater and surface water bodies[10].

The following ecological records were excluded from the baseline of the EIAR:

- Records greater than 50 years old; and
- Any marine habitats and species thereof (i.e. habitat range outside the ZoI of the Proposed Road Development).

[7] www.npws.ie (last accessed March 2021)
[8] maps.biodiversityireland.ie (last accessed March 2021);
[9] https://www.catchments.ie/maps/ (Accessed February 2021)
[10] https://gis.epa.ie/EPAMaps/ (Accessed February 2021)

7.3.2.1 Designated Sites

Designated sites were identified using the current boundary shapefiles from the NPWS and online mapping tools; and the EPA online database[10]. All sites located within 15 km of the Proposed Road Development were investigated.

7.3.2.2 Habitats

Habitat research included a review of the National Survey of Native Woodland (NSNW) and Ancient Woodland. Inventory data, Grassland Monitoring Survey (GMS) of Annex I grassland types in Ireland. Information on the identification, and conservation condition of the EU Annex 1 listed habitat *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (EU code 6410) was reviewed (NPWS 2019b), as well as Information on the identification, and conservation condition of the EU Annex 1 listed habitat Petrifying Springs with tufa formation (Cratoneurion) (EU code 7220) (NPWS 2019b). The overall National Conservation Assessment (NCA) for 6410 was assessed (NPWS, 2013; Martin *et al*. 2018). The Irish Semi Natural Grassland Survey (ISGS) was also reviewed (Devaney *et al*. 2013). Detailed botanical and habitat studies were undertaken in the field and were compared with the aforementioned literature to accurately classify habitats (See Volume 04; Appendix A7-5 & A7-6).

7.3.2.3 Fauna

As noted above, various datasets available from the National Biodiversity Data Centre (NBDC) were examined for rare or protected organisms, to assess their presence within the Proposed Road Development site boundary and ZoI. All species records previously recorded within the study area or within a 2 km and a 10 km radius of the study area, available through NBDC were reviewed. A search of the NBDC online records portal for adjacent 10 km² squares returned bat species recorded in the area. A review of data gathered from the NBDC is presented in Volume 04; Appendix A7-2. More detailed research was undertaken for bird and fish species (see below). NPWS data on protected animal distribution including Freshwater Pearl Mussel (*Margaritifera margaritifera*), Salmonids and other protected species was also accessed and reviewed as part of this assessment.

7.3.2.4 Birds

A desktop review of habitat and bird data were undertaken to assess the impact of the Proposed Road Development on birds. According to the NBDC[11], Abbeyknockmoy and the surrounding area is used by a high diversity of bird species. All bird species within the site boundary and the immediate tetrad square in which the site is positioned are considered. This bird data was accessed via the NBDC database on Atlas data from 2007-2011[12] (BirdWatch Ireland, 2021). Two fieldwork methods were used for the acquisition of this data. As part of the Roving Records, bird records from every 10-km square were collected, which were used to describe the distribution range. The Timed Tetrad Visits (TTVs) method gathered records from tetrads (2 x 2-km squares) and were used to generate information on relative abundance of a species within a 10 km square. The data was used to produce the BTO/SOC/IWC Bird Atlas 2007-11 (Balmer *et al*. 2013).

The data covers four winters and four summers from November 2007 to July 2011. The quality of the data is considered high. All data underwent rigorous data verification and validation. The dataset status is deemed to be complete, except for records of some of Ireland's rarest birds, which are not mapped in order to safeguard these species from possible disturbance. The study site overlaps with the area where TTVs were undertaken and therefore Atlas data for the immediate Proposed Road Development area was obtained.

7.3.2.5 Fish

Available data on fish survey results from the Abbert River were reviewed. Detailed review findings are detailed in Section 7.5.11.

[11] https://maps.biodiversityireland.ie/Species (Accessed February 2021)
[12] https://maps.biodiversityireland.ie/Dataset/220 (Accessed February 2021).

7.3.3 Consultations

In order to assist in gathering baseline ecological records for the Proposed Road Development site and surrounding environs, several statutory and non-statutory consultees were contacted in relation to the Proposed Road Development.

Development Applications Unit care of Department of Tourism, Culture, Arts, Gaeltacht, Sports and Media and the Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media were contacted in relation to the overall project. This consultation included a high emphasis to ensure consideration for the biodiversity conservation within the area of the Proposed Road Development and surrounding areas, and the context of the Proposed Road Development relative to the surrounding landscape. Detailed information regarding the considerations for mitigation for selected species and habitats was also received (also see Section 1.4.1 of Chapter 01 Introduction).The response provided by the Department of Tourism, Culture, Arts, Gaeltacht, Sport and Media included information on where information and publications relevant to the Proposed Road Development could be found. This included:

- The National Parks and Wildlife Service (NPWS);
- Invasive Species Ireland;
- National Biodiversity Data Centre (Biodiversity Ireland);
- Inland Fisheries Ireland (IFI);
- Birdwatch Ireland;
- Bat Conservation Ireland; and
- Office of Public Works (OPW).

7.3.3.1 Bat Conservation Ireland

No response received at time of writing.

7.3.3.2 Galway County Council (Heritage Officer)

No response received at time of writing.

7.3.3.3 National Parks and Wildlife Service (Research Branch)

NPWS were contacted and forwarded on data highlighting rare and protected species within the M54 Hectad on 14/12/2020. Guidance on how to access information for Lough Corrib SAC 000297 was highlighted by NPWS.

Species records were provided as both Excel file and shapefile (in Irish Grid TM75). Records were represented as squares in the shapefile, with the side lengths of the squares corresponding to the resolution (1x1 m to 10x10 km) in which the observations were recorded.

It was noted that datasets received are not complete or perfect in terms of quality, and that the absence of information in the NPWS dataset for an area, does not necessarily imply a low biodiversity value for that area. It was reiterated that the NPWS species dataset is incomplete, particularly for fish, bats and birds and that locations for sensitive species should not be made publicly available.

The list of what qualifies as a rare or threatened species was sourced from the NPWS[13]. It covers species listed on one or more of the following documents: EU Directives (Birds & Habitats), Wildlife Act, 1976 & Wildlife (Amendment) Act, 2000, Flora (Protection) Order 1999 or Published National Red Lists. It was noted by NPWS that this list is regularly updated, as new legislation is added, or red lists are published.

It was noted that habitats and species data from the Article 17 (Habitats Directive) and Article 12 (Birds Directive) Assessments in 2019 and 2013 are available for download from the NPWS website[14].

[13] https://www.npws.ie/sites/default/files/general/Listed_species_checklist_Dec12.pdf.
[14] http://www.npws.ie/maps-and-data/habitat-and-species-data

NPWS noted that GIS datasets used in the production of Site-specific Conservation Objectives for designated sites can also be downloaded from NPWS maps[15].

The NPWS consultation response noted that 'The National Biodiversity Data Centre, Inland Fisheries Ireland, BirdWatch Ireland and Bat Conservation Ireland may have additional records of use.

7.3.3.4 Inland Fisheries Ireland (IFI)

No response received at time of writing.

7.3.3.5 BirdWatch Ireland and Barn Owl Project

Consultation efforts were undertaken with Birdwatch Ireland, and representatives of the Birdwatch Ireland Barn Owl Project. At the time of writing, no responses have been received from Birdwatch Ireland or representatives of the Birdwatch Ireland Barn Owl Project. In the absence of records, and information on the nesting locations of Barn Owl, and given the suitability of the habitat within the Proposed Road Development for Barn Owl, it was assumed Barn Owl were present and breeding within the wider area.

7.3.3.6 Galway Barn Owl Project

Consultation efforts were undertaken with The Barn Owl Project (a Galway NGO that is affiliated to Birdwatch Ireland but separate and distinct from the Birdwatch Ireland project of the same name). A consultation response was received from representatives of the Galway Barn Owl Project. With regard to landscape planting of the embankment of the Proposed Road Development, they referred the authors to the publication by The Barn Owl Trust UK (2003). This 15-year study found that the establishment of continuous woody vegetation was most effective in deterring low flight by Barn Owls over the carriageway. Since initial correspondence with The Barn Owl Project, TII guidance on Barn Owl was published (TII, 2021).

7.3.4 Field Study

All surveys were carried out having regard to published guidance including, but not limited to, the NRA's (now TII's) (2009b) 'Ecological surveying techniques for protected flora and fauna during the planning of national road schemes', which provides information on appropriate survey seasons and methodologies for many of Ireland's protected species. The methodologies for field surveys carried out at the Proposed Road Development site are described in the following sections. Table 7-1 summarises species-specific survey dates. Specific survey methodologies are provided in the text for species and species groups.

Table 7-1 Species-Specific Survey Dates and Methodologies

Date	Target/Survey Type	Survey Methodology
18 December 2019 7 January 2020 1 February 2021	Wintering Bird Surveys	Gilbert, G., Gibbons, D.W. and Evans, J., 1998. Bird Monitoring Methods: a manual of techniques for key UK species. RSPB.
21 May 2020 28 May 2020 6 August 2020	Breeding Bird Surveys	Gilbert, G., Gibbons, D.W. and Evans, J., 1998. Bird Monitoring Methods: a manual of techniques for key UK species. RSPB.
7 January 2020 12 – 28 May 2020 24- 25 August 2020	Habitat/Walkover Surveys/Floral	Fossitt, J. (2000). Guide to Habitats in Ireland. The Heritage Council Heritage Council's 'Best Practice Guidance for Habitat Survey and Mapping' (Smith *et al*. 2011). Martin, J.R., O'Neill, F.H. & Daly, O.H. (2018) The monitoring and assessment of three EU Habitats Directive Annex I grassland habitats. Irish Wildlife Manuals, No. 102. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht, Ireland
15 – 18 August 2020	Bat Surveys	Bat Conservation Trust's (BCT) 'Bat Surveys for Professional Ecologists: Good Practice Guidelines' (Collins, 2016).

[15] http://www.npws.ie/maps-and-data/habitat-and-species-data

Date	Target/Survey Type	Survey Methodology
24 June 2020 And Desktop	Fish Surveys	**Fisheries habitat survey through river habitats survey:** *River Habitat Study in Britain and Ireland: Field Survey Guidance Manual 2003*. Environment Agency, HMSO, London. **Review of existing data** O'Brien, R., Matson, R., Gordon, P., Lopez, S., Cierpal, D., Connor, L., Corcoran, W., Coyne, J., Gavin, A., McLoone, P., Twomey, C. and Kelly, F.L. (2019) Sampling Fish in Rivers 2019 – Clare River Catchment, Factsheet No. 2019/2. National Research Survey Programme. Inland Fisheries Ireland. IFI (2010) Water Framework Directive Fish Stock Survey of Rivers in the Western River Basin District, 2010. IFI (2013) Water Framework Directive Fish Stock Survey of Rivers in the Western River Basin District, 2013
7 – 15 January 2020 29-30 January 2020	Mammal Surveys (Otters, Badgers, Red Squirrel and Pine Marten)	Bailey, M. & Rochford, J. (2006). Otter Survey of Ireland 2004/2005. Irish Wildlife Manuals No. 23. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin, Ireland. Harris, S., Cresswell, P., and Jefferies, D. (1989). Surveying Badgers. The Mammal Society, London.
April – July 2020	Amphibian: Common Frog (*Rana temporaria*) & Smooth newt (*Lissotriton vulgaris*)	Direct observation during other summer surveys
16 October 2020	Freshwater Macroinvertebrates	Kick sampling and Laboratory Analysis by Whitehill Environmental Ltd as per Toner et al (2005)
24 June 2020	River Habitat Survey	*River Habitat Study in Britain and Ireland: Field Survey Guidance Manual 2003*. Environment Agency, HMSO, London.
12 May – 17 July 2020	Common Lizard (*Lacerta vivipara*) Surveys	Direct observation during other summer surveys
24 June 2020	Crayfish Surveys	NBDC database, Dedicated Search as per NRA/TII guidelines (2010) *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes* Direct observation during RHS
25 August 2020 11 September 2020	Marsh Fritillary (*Euphydryas aurinia*) (web surveys)	March Fritillary Larval Web survey As per NRA/TII (as above, 2010), NBDC database

7.3.4.1 Habitats and Flora Survey

7.3.4.1.1 Heritage Council Habitat Classification

Initial habitat assessment was undertaken as per the guidelines given by TII (2009b). Surveys were carried out between April 2020 and February 2021 within the field survey site (4.2 km^2). The habitats present within the survey corridor were classified and mapped using the Heritage Council's classification system, Fossitt (2000), to Level III of these guidelines (see Volume 03; Figure A7-11). The habitat types and their species assemblages could be adequately surveyed at the time of the surveys and were readily identifiable. Habitats were classified and dominant plant species noted according to the guidelines given by the JNCC (2010). Orthophotography was used to map the extent of habitat types occurring and following the Heritage Council's 'Best Practice Guidance for Habitat Survey and Mapping' (Smith *et al*. 2011). Semi-natural habitats of ecological interest were subject to more detailed survey. A comprehensive list of plant species was recorded for semi-natural habitats of ecological interest.

Habitat surveys were carried out to record dominant species, indicator species for different habitat types, rare or declining species identified on relevant Irish Red Lists (Lockhart *et al*., 2012; Wyse Jackson *et al*., 2016), or 'scheduled' or other invasive species. The information collated from the survey was used to ascribe a value to habitat features following the valuation examples in the TII (2009). The information also informed species-specific survey work to inform this chapter.

7.3.4.1.2 Annex 1 Habitat Classification

Species-rich wet grassland (GS4) encountered along the route, and within the ZoI, was assessed for its correspondence with the Annex I habitat *Molinia* meadows on calcareous, peaty or clayey-silt laden soils *(Molinion caeruleae*) (6410) with reference to the positive indicator species for the habitat listed in Martin *et al*. (2018) and information on vegetation communities from the latest NPWS Conservation Status Assessment (NPWS, 2019b).

The calcareous springs (FP1) were assessed, by an experienced botanist, for their correspondence to the Annex I habitat Petrifying Springs with Tufa Formation (Cratoneurion) (7220) with reference to Lyons & Kelly (2016). Lyons and Kelly (2016) describe eight plant communities of Irish petrifying springs based on relevé data. Further information on the vegetation communities associated with this habitat is presented in Lyons and Kelly (2016).

7.3.4.1.3 Invasive Species

In addition to other surveys, a targeted walkover survey for invasive species was carried out in July 2020 by direct search during daylight hours. Any non-native species classified as invasive by the NBDC and/or Invasive Species Ireland were recorded.

7.3.4.1.4 River Q-Value Assessment

Fieldwork was carried out on October 16th 2020. The three study sites (stations), were chosen in riffle areas along the Abbert River, that were representative of riffle conditions. At each station, the surrounding habitats were noted along with other parameters such as water flow, stream depth and the predominance of vegetation.

All samples were taken with a Freshwater Biological Association (FBA) approved handheld sweep net with a mesh diameter of 500 µm. At all stations, a two-minute kick sample (the travelling kick) method was taken, which ensures that all habitats within a riffle area are sampled. Samples were deposited in a tray on the bank of the river. Bigger stones were washed and any benthic macro-invertebrates clinging to the stones were removed and placed in the tray. Once the debris in the sample was removed, the sample containing the benthic macro-invertebrates and the finer substrates were placed into containers and preserved with isopropyl alcohol. All macro-invertebrates from each sample, were identified to the appropriate taxonomic level using FBA taxonomic guides. Invertebrates were classified into five different groups based on their sensitivity or tolerance to pollution. Based on the relative abundance of invertebrate indicator species, the Q-value was determined for the sites in accordance with the biological assessment procedure used by the EPA (Toner *et al*., 2005).

7.3.4.1.5 River Habitat Survey

A survey of the corridor of the Abbert River was carried out using the River Habitat Survey (RHS) methodology as devised by the Environment Agency (2003).

Survey data was collected and analysed and a summary of the key findings from the data was made. Additional information on aspects of the RHS methodology can be found in the River Habitat Survey Field Survey Guidance Manual (Environment Agency, 2003). The survey was carried out over 2 no. reaches of the Abbert River. The RHS methodology requires 500 m sections to be surveyed with transects taken for detailed survey at 50 m intervals. This present survey covered 2 no. 500 m reaches, one upstream and one downstream of the Proposed Road Development's alignment crossing point of the Abbert River.

Habitat Quality Assessment (HQA) is one of two key indices derived from RHS (Table 7-2). It is a broad measure of the diversity and "*naturalness of the physical (habitat) structure of the river channel and corridor"*. Its site value is determined by the presence and extent of features of known wildlife interest recorded by the standard survey procedure. A limitation of the system is the subjective nature of the scoring system, based, as it is, on a consensus of informed professional judgement.

As a rough guide, sections with an HQA of 40+% are good (average and above) for the river type considered during this survey. The scores were calculated by summing all component scores for each category (HQA = Flow types, Channel substrate, Channel features, Bank features, Bank vegetation structure, Channel vegetation, Land use within 50 m, Trees and associated features, and Special features).

Habitat Modification Score (HMS) is a measure of the extent that the natural characteristics of the survey section have been modified by Man. A HMS value of zero indicates no significant modification and represents natural (good) conditions. HMS score considers Modifications at spot-checks, Modifications present but not recorded in spot-checks, and Modified features within the whole site. HMS values increase with increasing levels of modification. Like the HQA, the HMS can be described as an objective application of a set of subjective rules that provide a consistent form of comparison between sites. Factors that contribute to high HMS values include resectioned, reinforced, poached, bermed and embanked banks and culverted, resectioned, reinforced, dammed, weired and forded channels. Arising from this, a Habitat Modification Index (HMI) may be assigned to sites that have been subject to RHS methodology (Table 7-3).

Table 7-2 Derivation of Habitat Quality Assessment

HQA Score Category	HQA Class	HQA Description
0 – 20%	5	Very Poor
20-40%	4	Poor
40-60%	3	Fair
60-80%	2	High
80-100%	1	Very High

Source: Environment Agency (2003)

Table 7-3 Derivation of Habitat Modification Index

HMS	Descriptive Category of Channel	HMI Class
0	Pristine	1
0-2	Semi-natural	1
3-8	Predominantly unmodified	2
9-20	Obviously modified	3
21-44	Significantly modified	4
45+	Severely modified	5

Source: Environment Agency (2003)

7.3.4.2 Bat Surveys

7.3.4.2.1 Activity Surveys

Bat activity surveys were based on survey methods in line with Bat Conservation Trust's (BCT) 'Bat Surveys for Professional Ecologists: Good Practice Guidelines' (Collins, 2016). Two dusk activity surveys on the 7th and 8th August 2020 both commenced thirty minutes before sunset and ended a minimum of two hours after sunset (see Volume 04; Appendix A7-10). A dawn activity survey on 08th August 2020 commenced 2 hours before sunrise and ended thirty minutes after sunrise, Table 7-4. The transects covered lands both directly under the Proposed Road Development's footprint and also adjacent landscape features such as hedgerows, treelines, and ditches. The surveyor stopped at any features, such as along hedgerows, for periods of 3 minutes to monitor for bat activity as species such as Brown Long-eared Bat *Plecotus auritus*, were considered more likely to be detected at these points, rather than in the more open agricultural fields, typical of the surrounding landscape. During the three surveys, the surveyor paused at the location of the proposed river crossing for at least twenty minutes as bat species using the river for commuting and foraging are potentially at greatest risk of significant impacts resulting from the construction and operation of this structure.

The surveyor listened for bats using an +EM3 detector with headphones and a Garmin etrex 10 GPS device was used to take grid references of points along each transect where bat activity was observed and/or heard. Upon hearing a bat, the surveyor attempted to identify the direction and height of bat flight, and any notable bat behaviour (e.g. foraging or commuting). Weather conditions during the three activity surveys were suitable. Bat data was converted using Kaleidoscope 5.4.1 and analysed using Analook W (0.4.1.20). When there was more than a one second interval between detections, and based on surveyor observation and judgement where appropriate, these were classified as separate bat passes.

Table 7-4 Bat Activity Surveys

Date	Transect Type	Sunset/Sunrise	Survey Start Time	Survey End Time	Weather Conditions
07/08/2020	Dusk	21.19	20.49	23.49	Clear, calm, temperatures +10°C to +14°C
08/08/2020	Dawn	06.05	04.05	06.35	Clear, calm, temperatures +7°C to +8°C
08/08/2020	Dusk	21.17	20.47	23.47	Clear, calm, temperatures +14°C to +16°C

7.3.4.2.2 Building Assessments

Five buildings (all unoccupied) were inspected for signs of bat presence. Evidence of bat presence includes droppings, grease staining (created when the bat's fur rubs against timber etc as it enters and exits its crevice space), urine marks, feeding signs (invertebrate remains such as moth and butterfly wings), dead bats and/or the presence of bat fly pupae, *Nycteribiidae*. The overall structural condition of each building was also evaluated with notes taken on the state of the roof, roofing materials, obvious gaps and crevices in stonework, windows, and doorways open or sealed etc.

Evidence of bat roosts was searched for and information on all potential roosts was recorded according to roost identification guidelines 'Bat Survey Guidelines: Traditional Farm Buildings Scheme', Aughney, T., Kelleher, C. & Mullen, D. (2008). The results were used to grade each building's potential to support bat roosts as 'Negligible', 'Low', 'Moderate', or 'High' suitability in accordance with the Bat Conservation Trust's (BCT) 'Bat Surveys for Professional Ecologists: Good Practice Guidelines*'* (Collins, 2016).

7.3.4.2.3 Tree Assessments

A preliminary ground level roost assessment was carried out during daylight hours along the Proposed Road Development, using close-focusing binoculars. These surveys aimed to identify Potential Roosting Features (PRF) for bats in any trees likely to be felled. Features such as split limbs and branches, knot holes, decay holes, lifting bark and dense ivy growth were surveyed for. Any tree potentially impacted by light spill from the Proposed Road Development were assessed. Guidelines followed the BCT's 'Bat Surveys for Professional Ecologists: Good Practice Guideline*s'* (Collins, 2016); and Bat Roosts in Trees (Andrews, 2018).

7.3.4.3 Ground Mammal Surveys

A targeted survey of mammals and any evidence of mammal activity was carried out between January and June 2020. An area of approximately 4.7 km^2 was surveyed in total. Surveys followed the methodologies given in the guidelines by TII (2006 & 2008a) and were carried out by direct search during daylight hours for any mammal activity.

7.3.4.3.1 Badger Survey

The Proposed Road Development and wider ZoI were searched for evidence of Badger *Meles meles*. The Badger survey methodology followed Harris *et al*. (1989) and guidance from the TII (2006b). The entire habitat survey area was also surveyed for Badger, encompassing 4.2 km^2 (Volume 03; Figure A7.5)). This area included all areas up to 150 m either side of the Proposed Road Development and abutments. These abutment areas were searched for Badger setts to account for the potential effect of piling at the location of the proposed bridge over the Abbert River. Any signs of Badger activity were noted if applicable, including the presence of setts (classified as potential main, annex, subsidiary or outlier setts if found), foraging evidence, hairs (snagged along runs), faeces, tracks, and prints.

7.3.4.3.2 Otter Survey

Watercourses, drainage ditches and wetland habitats within the Proposed Road Development and wider ZoI were assessed for Otter *Lutra lutra*. The survey methodology took cognisance of guidance which follows NRA (2006c) (now TII) and included searches for breeding or resting sites up to 150 m of the Proposed Road Development to account for the potential effect of piling. Other evidence of Otter, including spraints, footprints, 'slides' along riverbanks or feeding remains, etc. were also searched for.

7.3.4.3.3 Other Protected Mammal Surveys

'Other protected mammals' refer to mammal species that are protected under Irish or European legislation, but exclude species of Bat, Badger and Otter, which are referred to separately in this document. Emphasis was placed on identifying other protected species including Hedgehog *Erinaceus europaeus*, Pine Marten *Martes martes*, Irish Stoat *Mustela erminea hibernica*, Pygmy Shrew *Sorex minutus,* Red Squirrel *Sciurus vulgaris,* Irish Hare *Lepus timidus hibernicus.* Squirrel dreys and potential Pine Marten refuges were also targeted. Any signs of mammal activity such as droppings, scrapes, hair, tracks, prints and trails were recorded. Signs of American Mink *Mustela vison* (an invasive mammal species) were also sought during survey.

7.3.4.4 Bird Surveys

7.3.4.4.1 Breeding Birds

The bird surveys were completed on 21st May 28th May and 06th August 2020, having regard for the methodology of the Common Bird Census (Gilbert *et al*., 2012) and of TII (2017). Onsite surveys consisted of the surveyor walking routes which cover every point of suitable habitat onsite to within 100 m, with surveying undertaken to a 500 m radius of Proposed Road Development site peripheries (where accessible).

Surveys were conducted at various times throughout the year to record breeding species. Bird surveys were done to assess impacts on breeding species identified within the Proposed Road Development area. Therefore, these surveys assess the breeding species present along the Proposed Road Development and potential effects of the Proposed Road Development on those species. Particular emphasis was placed on those species protected by national and international legislation or considered to be of particular nature conservation importance (Colhoun and Cummins, 2013). All species seen or heard were recorded. The positions of all amber and red-listed bird species were mapped. Breeding evidence was recorded in line with the British Trust of Ornithology (BTO) breeding status codes. Surveys were undertaken and, following all surveys, the maps were analysed to determine the number and location of breeding territories (Volume 3, & Volume 4; Appendix A7-3).

The focus of the survey was to identify the presence of any bird species of Medium or High Conservation Concern as per the latest Birds of Conservation Concern in Ireland list (Colhoun and Cummins, 2013). As part of the field surveys, suitable habitat was also checked for evidence of Bird of Prey occupancy (including Barn Owl occupancy) (i.e. indicators of presence of birds) during bird surveying. This involved searching for birds, their nests, their droppings, pellets, and feeding remains. The number of field days in which species were recorded was noted.

Kingfisher is listed under Annex 1 of the Birds Directive and was recorded within the ZoI of the Proposed Road Development. Vantage point surveys and examination of river embankments were conducted for Kingfisher following the TII guidelines (TII, 2009). Evidence of nesting or breeding activity was looked for. The riverbank was walked and surveyed within the survey area.

7.3.4.4.2 Wintering and Wetland Birds

Surveys were conducted in winter to record wintering bird species. Surveys were conducted on 18/12/2019, and 7/01/2020 and 1/02/2021 as per the methodology above (for breeding birds), with emphasis placed on wintering and wetland birds. Abundance of these species was recorded. These surveys were done to assess impacts on wintering species identified within the Proposed Road Development area (Volume 03, & Volume 04; Appendix A7-3).

7.3.4.5 Fish

A desktop study was undertaken, to identify fish species within the Abbert River. Aspects of this review are discussed in detail in the Fisheries Review (Section 7.5.11). The aquatic environment was also assessed for fish potential. As there is a high level of fisheries data available for the Abbert River, in the interests of fish conservation within the Lough Corrib SAC, it was deemed appropriate that no invasive sampling of fish was unnecessarily undertaken. Therefore, fish surveys were not conducted, but a detailed fisheries review was undertaken.

7.3.4.6 Amphibians

A targeted search for the breeding places of Common Frog *Rana temporaria* and Smooth Newt *Triturus vulgaris* was carried out between January-February (for Frogs) and April-July (for Frogs and Newts) 2020. Surveys followed the guidelines given by TII (2008). Any amphibian species observed (*ad hoc*) during habitat surveys were recorded. Areas offering potential as breeding habitat for these species were also recorded.

7.3.4.7 Lepidoptera

Habitat suitability surveys for Marsh Fritillary *Euphydras aurinia* were carried out at as per guidelines given by TII (2008). These involved transect surveys for Devil's Bit Scabious *Succisa pratensis,* (the food plant of this species) in wet grassland areas on both the eastern and western extents of the Proposed Road Development .Web surveys for Marsh Fritillary occurred on the 25th August 2020 and the 11th September 2020. Areas within and outside of the route line boundary (RLB) were surveyed for Marsh Fritillary, as Marsh Fritillary habitat within the RLB may contribute to a metapopulation if present (Volume 04; Figure A7.9).

7.3.4.8 White-clawed Crayfish

Targeted survey for White-clawed Crayfish (*Austropotamobius pallipes*) was carried out in the Abbert River and Derreen Stream on the 24th June 2020. Survey methodology was by manual search of suitable habitat areas, as given in the guidelines by TII (2008).

7.3.4.9 Other Protected and Notable Species

Surveys also targeted the Common or Viviparous Lizard (*Zootoca vivipara* – formerly *Lacerta vivipara*). This was carried out by direct searches during suitable weather conditions of suitable habitat such as basking areas. Suitable habitat areas for this species were also recorded where found. Surveys occurred between May and July 2020.

7.3.5 Impact Assessment Methods

7.3.5.1 Baseline Conditions

The EPA draft guidance (EPA 2017) summarises the function of the baseline description as: "*to facilitate evaluation of the EIAR, [with] reference to recognised descriptive standards and classifications..., as well as supporting records, information and descriptions of methodologies employed.*" Key aspects of the baseline environment identified in EPA draft guidance include context, character, significance, and sensitivity.

7.3.5.2 Valuing Ecological Features

The methodology used to assess, and value ecological features is compliant with relevant principles underpinning impact assessment under the EIA Directive. However, the methodology also has regard for the geographic frames of reference in the TII's 'Guidelines for Assessment of Ecological Impacts of National Road Schemes*'* (TII, 2009).

In conjunction with relevant terminology from EPA draft guidance (EPA 2017), the geographic frames of reference employed by the TII (2009) are employed in this Chapter when defining ecological value of features, because they provide useful examples of features at each geographic scale, and because a quantitative element (i.e. use of '1% thresholds') provides useful scientific 'rules of thumb' in an attempt to standardise valuations. Professional judgement has been used in the assessment of impacts on more common habitat types, where data on habitat extent may otherwise be limited.

'Key Ecological Receptors' (KERs) also referred to as significant ecological features, are those valued at Local Importance (Higher Value) or above as per the examples in Volume 04; Appendix A7-4. Features below this value are not carried forward to impact assessment and are generally deemed to be of low ecological value or are common and widespread where they occur.

7.3.5.3 Potential Impacts

Potential impacts of the Proposed Road Development (both positive and negative) are predicted for all KERs. The impact assessment methodological approach takes cognisance of CIEEM (2018; updated September 2019) published guidelines and assesses potential impacts on ecological receptors in the absence of appropriate control measures and prescribed mitigation. In accordance with the EPA draft guidance (EPA, 2017), CIEEM (CIEEM, 2018), and TII guidelines (TII, 2009), potential impacts are characterised by considering the parameters shown in Table 7-5.

Table 7-5 Descriptions of Potential Impact Parameters (Adapted from CIEEM, NRA (now TII) and EPA Guidelines)

Potential Impact Parameter	Description
'Quality' of impact (i.e. positive vs negative)	Positive potential impact– a change resulting from an action that improves the quality of the environment or slows an existing decline in the quality of the environment. Negative potential impact– a change resulting from an action which reduces the quality of the environment e.g. destruction of habitat, removal of species foraging habitat.
Magnitude or extent	The size of the area, number of sites. Proportion of a population, or other measurable unit significantly affected by an impact.
Duration	Duration defined in relation to ecological characteristics (such as a species' lifecycle) as well as human timeframes. [Note: The EPA provides definitions for a wide range of effects for the following units of time in order of increasing duration: momentary, brief, temporary, short-term, medium-term, long-term, permanent. In this Chapter, discussion focuses only on effects which are likely to be significant; and as such momentary, brief, or temporary effects are typically not discussed further).
Frequency and timing	Frequency refers to how often the effect will occur (e.g. once, rarely, occasionally, frequently, hourly, daily, or constantly). Timing differs from frequency and is of particular relevance to biodiversity effects; the timing of an activity may result in a significant potential impact if it coincides with critical life-stages or seasons e.g. bird nesting season. Outside this period, similar actions may not cause significant impacts.
Probability	EPA draft Guidance (2017) categorises potential effects as either likely or not likely. Only likely (and significant) effects are assessed in this Chapter.
Significance	Significance of effects is usually understood to mean the outcome of the impact (the consequences of the change). Refer to Section 7.3.5.4 for further details.

Potential impacts (a change resulting from an action) and effects (the consequences of impacts, often expressed as the 'significance of effect') may occur during the construction phase (which is taken to also include enabling works such as demolition, vegetation clearance and earthworks) and the operational phase of a development. Direct potential effects are directly attributable to an action associated with a development. Indirect potential impacts are often produced away from a development, or as a result of other initial impacts.

7.3.5.3.1 Pollution Impacts and Effects

Pollution impacts from the construction and/or operation of the Proposed Road Development are considered as a reasonable worst-case, to potentially impact hydrologically connecting wetlands downstream of, and within the same CMU as the Proposed Road Development.

7.3.5.3.2 Cumulative Impacts and Effects

In accordance with the revised wording in the EIA Directive (Annex IV (4)), the EIAR must consider "*the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources*".

More than one potential impact acting on a feature simultaneously may have a cumulative potential impact that is greater than when the same potential impacts act in isolation. As already stated in Section 7.3.1, the study area for cumulative impacts includes at least the extent of the ZoI from the Proposed Road Development boundary.

Cumulative impacts as a result from individually insignificant, but collectively significant, actions taking place over time or concentrated in a location. Cumulative impacts are important in the context of biodiversity impacts, as many ecological features are already exposed to background levels of threat or pressure and could be close to critical thresholds where further impact could cause irreversible decline.

7.3.5.4 Determining Effect Significance

According to the EPA draft guidance (EPA 2017), significance of effects is usually understood to mean the importance of the outcome of the effects and is determined by a combination of objective (scientific) and subjective (social) concerns.

The EPA draft guidance (EPA 2017) further notes that: "*While guidelines and standards help ensure consistency, the professional judgement of competent experts plays a role in the determination of significance. These experts may place different emphases on the factors involved. As this can lead to differences of opinion, the EIAR sets out the basis of these judgements so that the varying degrees of significance attributed to different factors can be understood*".

With this in mind, the geographic frame of reference applied to determining impact significance by the TII (2009) in Ireland and CIEEM (2018; updated September 2019) in Ireland and the UK, has been adopted in this Chapter in tandem with the EPA's qualitative significance criteria. Table 7-6 compares the qualitative (EPA) versus geographic approaches (NRA (now TII) and CIEEM) to determining the significance of effects.

Table 7-6 Equating the Definitions of Significance of Effects Using a Geographic vs. Qualitative Scale of Reference

Geographic Scale of Significance (TII, 2009; similar to CIEEM, 2018; updated September 2019[16])	Qualitative Scale of Significance of Effects (EPA, 2017)
Negligible or Local Importance (Lower Value). *Potential impacts at this scale are not significant.*	Imperceptible. An effect capable of measurement but without significant consequences. Not significant. An effect which causes noticeable changes in the character of the environment but without significant consequences.
Local Importance (Higher Value), County, National, or International. *Potential impacts are significant.*	Slight/Moderate/Significant/Very Significant/Profound *Potential effects are significant*

The geographic frame of reference can be a good fit to assessments of impacts and associated effects on biodiversity because it allows clear judgements to be made about the scale of significance, with reference to published estimates for the population size of a given species at county, national and/or international scales or areas of habitats at such scales.

The proportion of a known feature impacted at County scale (i.e. 1% of the known or estimated population in a given county) is measurably different from that impacted at national scale (i.e. 1 % of the known or estimated national population).

A non-geographic qualitative approach can be a poor fit to assessments of biodiversity since the definitions provided for the different qualitative terms do not relate to measurable units of space such as a county or national boundary.

Having regard for the above, and in accordance with the TII (2009), significant effects in this chapter are associated with:

- Impacts affecting features/populations valued at Local Importance (Higher Value) and above;
- Impacts likely to be material in decision-making process; and,
- Impacts which affect the conservation status or integrity of the feature/population in question.

[16] In this Chapter, the categories for different scales of geographic impact significance follow those applied in the TII (2009) in preference to CIEEM (2018; updated September 2019), because the latter includes the weakly defined administrative unit "regional".

7.4 Limitations and Assumptions

Every effort was made to obtain relevant ecological data in the public domain to inform the baseline and impact assessment. It is possible that other information not in the public domain and known only to private individuals exists. All surveys were carried out by suitably qualified surveyors, during the appropriate season having regard for TII guidance (TII, 2009a, b).

Surveys were conducted in optimal conditions for identifying various species and species groups. All field areas and river bank areas within the survey perimeter were surveyed.

7.5 Baseline Environment

7.5.1 Sites Designated for Nature Conservation

A total of 22 areas designated as either SAC, SPA, NHA or pNHAs have been identified within 15 km of the Proposed Road Development (Table 7-7; Volume 03, Figure A7-1). Based on professional judgement, no likely or perceived significant impact of the Proposed Road Development on the qualifying interests or species of conservation interest of Natura 2000 sites beyond 15 km were deemed plausible given the design, footprint and location of the Proposed Road Development (AECOM, 2021). Within the Appropriate Assessment Screening (AECOM 2020) only the Lough Corrib SAC was noted as possibly at risk from the Proposed Road Development. Risks to the Qualifying Interests of any other site within or beyond 15km from the Proposed Road Development was considered unlikely due to the distance between the Proposed Road Development and the Natura 2000 sites and the nature of the site conservation objectives and qualifying interests. Due to being located directly within the study area and the above reasons, the qualifying interests of Lough Corrib SAC are outlined in

Table 7-8.

Table 7-7 Designated Sites within 15 km of the Proposed Road Development

Site Code	Site Name	Designation	Distance
1242	Carrownagappul Bog	SAC	14.7km
2197	Derrinlough (Cloonkeenleananode) Bog	SAC	11km
295	Levally Lough	SAC	9.1km
297	Lough Corrib	SAC	0km
2352	Monivea Bog	SAC	8.3km
326	Shankill West Bog	SAC	13km
1254	Derrinlough Bog	NHA	11km
1255	Derrynagran Bog and Esker	NHA	9.2km
1280	Killaclogher Bog	NHA	2.8km
307	Lough Tee Bog	NHA	9.35km
234	Belclare Turlough	pNHA	13.7km
1242	Carrownagappul Bog	pNHA	14.7km
263	Drumbulcaun Bog	pNHA	12.4km
282	Killower Turlough	pNHA	14.4
289	Knockavanny Turlough	pNHA	10.8km
1288	Knockmaa Hill	pNHA	14.8
295	Levally Lough	pNHA	9.1km
311	Monivea Bog	pNHA	8.3km

Site Code	Site Name	Designation	Distance
323	Richmond Esker Nature Reserve	pNHA	11.7km
326	Shankill West Bog	pNHA	13km
1319	Summerville Lough	pNHA	9.7km
1709	Tiaquin Bog	pNHA	7.9km

Table 7-8 Qualifying Interests of Lough Corrib SAC*

Qualifying Interests of Lough Corrib SAC
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 *Isoeto-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*
Species
1096 Brook Lamprey *(Lampetra planeri)*
1092 White-clawed Crayfish *(Austropotamobius pallipes)*
1095 Sea Lamprey *(Petromyzon marinus)*
1393 Slender Green Feather-moss *(Drepanocladus vernicosus)*
1106 Salmon *(Salmo salar)*
1303 Lesser Horseshoe Bat *(Rhinolophus hipposideros)*
1355 Otter *(Lutra lutra)*
1029 Freshwater Pearl Mussel *(Margaritifera margaritifera)*
1833 Slender Naiad *(Najas flexilis)*

*For Qualifying Interests or Special Conservation Interests of all SACs and SPAs within 15 km of the Proposed Road Development see Volume 03; Figure A7.1 and Volume 04; Appendix A7-5 for further information. Also see the AA Screening and NIS prepared for the Proposed Road Development.

7.5.2 Desktop Review Findings – Fauna and Flora

Protected and rare fauna and flora species identified in the desk study of NBDC and NPWS records (within a minimum 2 and up to 10 km radius from the Proposed Road Development) are detailed in Table 7-9.

Table 7-9 Protected and Rare Fauna Mammals Returned from NPWS and NBDC Search Within a 10 km Radius from the Proposed Road Development

Common Name	Scientific Name	Legally Protected Species (a Habitats Directive, b Wildlife Act)	Within 2 km (A), Within ~10 km (B)	Habitat Preferences
Badger	*Meles meles*	✓ b	A	Deciduous or mixed woodlands near farmland or open ground[17]
Brown Long-eared Bat	*Plecotus auritus*	✓ a, b	B	Open deciduous and coniferous woodland, parkland, gardens and orchards[10]
Common Frog	*Rana temporaria*	✓ a, b	B	Lakes and ponds, grassland, marsh, wet heath, peatlands, woodland and scrub, dune slacks, machair and riparian[18].
Common Pipistrelle	*Pipistrellus pipistrellus sensu lato*	✓ a, b	B	Along hedgerows and treelines, woodlands, parklands[19].
Daubenton's Bat	*Myotis daubentonii*	✓ a, b	B	Near calm, slow-moving water[12].
Hedgehog	*Erinaceus europaeus*	✓ b		All lowland habitats where grassland is found next to mixed woodland and scrub [10].
Irish Hare	*Lepus timidus* subsp. *Hibernicus*	✓ b	B	Various habitats including upland and lowland bogs, farmland, and ranging from coastal to mountainous habitats[20].
Leisler's Bat	*Nyctalus leisleri*	✓ a, b	B	Woodland, parkland, pasture, treelines, over lakes, beaches, dunes, riparian habitats, and in urban areas above streetlights [10,13].
Lesser Horseshoe Bat	*Rhinolophus hipposideros*	✓ a, b	B	Woodland, pasture, hedgerows, treelines, derelict buildings [10,13].
Natterer's Bat	*Myotis nattereri*	✓ a, b	B	Woodland, pasture, hedgerows, treelines, and over water such as white-water rapids [10,13]

[17] Available at: www.iucnredlist.org [Accessed in July 2021)
[18] Available at: www.biodiversityireland.ie [Accessed in July 2021)
[19] Available at: www.habitas.org.uk [Accessed in July 2021]
[20] Available at: www.mammals-in-ireland.ie / https://www.vincentwildlife.ie/ [Accessed in July 2021]

Common Name	Scientific Name	Legally Protected Species ([a] Habitats Directive, [b] Wildlife Act)	Within 2 km (A), Within ~10 km (B)	Habitat Preferences
Otter	*Lutra lutra*	✓ [a, b]	B	Lakes and ponds, watercourses, swamps, riparian woodland, estuaries, sea inlets and bays, saltmarshes [13].
Irish Stoat	*Mustela erminea subs hibernica*	✓ [b]	A	Pasture, hedgerows, scrub, and stone walls [10,13].
Pine Marten	*Martes martes*	✓ [a, b]	B	Landscapes with forest or scrub cover [10,12,13].
Pygmy Shrew	*Sorex minutus*	✓ [b]	A	Habitats with high ground cover, particularly woodlands, grasslands, hedgerows, and peatlands [10,13].
Red Squirrel	*Sciurus vulgaris*	✓ [b]	B	Woodland [10,13].
Soprano Pipistrelle	*Pipistrellus pygmaeus*	✓ [a, b]	A	Along hedgerows and treelines, woodlands, and riparian habitats [10,13]
Marsh fritillary Butterfly	*Euphydrias aurinia*	✓ [b]	A	Associated with wet and unmanaged grassland areas, with the presence of the plant species Devil's Bit Scabious *Succisa pratensis* [10, 13].

7.5.3 Habitats

Habitats of various ecological value recorded within the ZoI of the Proposed Road Development are presented, which include the relevant habitat codes from Fossitt (2000). A summary of each habitat classification, according to Fossitt (2000) is provided below. The areas of various habitats are listed in Table 7-10. Lists of plant species recorded for selected habitats are presented in Volume 04; Appendix A7-6. Maps of these habitat areas can be seen in Volume 03. These surveys did not identify any rare, threatened, or protected species of plants as per the Red Data Book (Curtis and McGough, 1988) or Red List (Wyse Jackson *et al*., 2016). Two Annex I habitats as per the Habitats Directive were found to occur within the immediate study area. This is discussed in detail below.

Table 7-10 Area and Relative Percentage of Various Habitat/Habitat Features Surveyed

Habitat Types	Habitat Codes	Total Habitat Areas in the Study Area (ha)	Total Habitat Areas within the CPO Line (ha)	Estimated Total Habitat Areas lost in Works Footprint (ha)	Percentage Area of Individual Habitats Estimated to be Lost within the Overall Works Footprint (%)
Amenity grassland	GA2	9.7	0.1	0.1	0.5
Amenity grassland/Stone walls and stonework	GA2/BL1	0.7	0.0	0.0	0.0
Buildings and artificial surfaces	BL3	27.0	2.5	2.3	22.5
Calcareous spring (Annex 1)	FP1	0.0	0.0	0.0	0.0
Conifer plantation	WD4	0.3	0.0	0.0	0.0
Drainage ditches	FW4	0.9	0.1	0.1	1.2
Dry calcareous and neutral grasslands	GS1	1.3	0.0	0.0	0.0
Dry calcareous and neutral grasslands/ Scrub	GS1/WS1	0.7	0.0	0.0	0.0
Earth Banks	BL2	0.5	0.0	0.0	0.0
Hedgerow	WL1	12.1	1.1	0.7	6.8
Hedgerow/Scrub	WL1/WS1	1.1	0.1	0.0	0.3
Scrub/Hedgerow	WS1/WL1	0.5	0.1	0.1	0.5
Hedgerow/Treeline	WL1/WL2	0.6	0.0	0.0	0.0
Immature woodland	WS2	0.2	0.0	0.0	0.0
Improved grasslands	GA1	246.2	6.2	3.9	38.3
Improved grasslands/Scrub	GA1/WS1	1.0	1.3	0.0	0.0
Improved grasslands/Wet grasslands	GA1/GS4	27.6	0.0	0.8	7.7
Mixed broadleaved woodland	WD1	23.1	0.2	0.1	0.7
Mixed broadleaved woodland/Immature woodland	WD1/WS1	0.7	0.0	0.0	0.0
Mixed broadleaved woodland/Improved grassland	WD1/GA1	1.0	0.0	0.0	0.0
Mixed broadleaved woodland/Treelines	WD2/WL2	2.9	0.0	0.0	0.0
Molinia Meadow (Annex I)	GS4	1.5	0.35	0.22	2.1
Non-calcareous spring	FP2	0.0	0.0	0.0	0.0
Ornamental/non-native Shrubs	BC4	0.1	0.0	0.0	0.0
Pond	FL8	0.0	0.0	0.0	0.0
Riparian woodland	WN5	0.3	0.2	0.0	0.1
Scrub	WS1	0.8	0.0	0.0	0.1

Habitat Types	Habitat Codes	Total Habitat Areas in the Study Area (ha)	Total Habitat Areas within the CPO Line (ha)	Estimated Total Habitat Areas lost in Works Footprint (ha)	Percentage Area of Individual Habitats Estimated to be Lost within the Overall Works Footprint (%)
Scrub/Cutover bog	WS1/PB4	0.1	0.0	0.0	0.0
Scrub/Mixed broadleaved woodland	WS1/WD1	0.1	0.0	0.0	0.2
Spoil and bare ground	ED2	0.6	0.0	0.0	0.0
Stone walls and stone work	BL1	0.5	0.0	0.0	0.0
Tilled Land	BC3	0.3	0.0	0.0	0.0
Treeline	WL2	2.6	0.1	0.1	0.9
Eroding/Upland River	FW1	2.5	0.0	0.0	0.0
Wet grassland	GS4	52.3	3.3	1.9	18.2
Lough Corrib SAC			0.0	0.0	0.0
Total:		419.8	15.7	10.3	100.01

7.5.3.1 Freshwater

7.5.3.1.1 FP1: Calcareous Springs

Springs were identified during the survey. The calcareous springs (FP1) were assessed for their correspondence to the Annex I habitat Petrifying Springs with Tufa Formation (Cratoneurion) (7220) with reference to Lyons & Kelly (2016). One spring was identified as a calcareous spring, the other as a petrifying spring. The species present in both springs were assessed and indicator species for Petrifying Springs with Tufa Formation (Cratoneurion) (7220) were confirmed (Volume 03; Figure A7-2; Volume 04; Appendix A7-6). This Petrifying Spring exists within Lough Corrib SAC, in a woodland between the Abbert River and the existing road. Petrifying springs rely on permanent irrigation, usually from upwelling groundwater sources or seepage sources (Lyons and Kelly, 2013). The location of this habitat is outside of the Proposed Road Development boundary (Volume 03; Figure A7-2). The groundwater source feeding this spring is likely to flow through the footprint of the Proposed Road Development, which is discussed in more detail in 7.6.3.

7.5.3.1.2 FW1 Eroding/upland Rivers

The study area is bisected by the Abbert River (within Lough Corrib SAC), which has been highly modified in places with evidence of channel deepening and realignment.

7.5.3.1.3 Drainage Ditches

The study area was bisected by numerous drains. Drains were typically running along field margins, interspersed with Hawthorn *Crataegus monogyna* and Blackthorn *Prunus spinosa* as well as Willow *Salix Spp* and Bramble *Rubus fruticosus agg*. One large drainage ditch was recorded toward the north-eastern extent of the study area. This ditch was approximately 100 m long and steep-sided. The western bank was overhung with mature Willow and Bramble. The ditch contained Fool's Water-cress *Apium nodiflorum* and Duckweeds *Lemna spp.* within standing water. Drains typically had low flows during surveying, with most showing signs of drying out locally, with some localised ponding, during dry weather conditions. Drains had a relatively low botanical diversity.

7.5.3.1.4 FS1 Reed Swamp

A patch of this habitat existed in an undrained area. The area comprised patches of vegetation, which were classified as Reed swamp, including a dominance of Rushes *Juncus Spp*. The reed swamp had low species-richness (Volume 04; Appendix A7-6).

7.5.3.2 Grassland

7.5.3.2.1 GS4 Wet Grassland

Areas of Wet Grassland were likely the precursor to improved grassland areas before drainage, fertilisation, and re-seeding. Wet areas were still present, but varied in terms of their level, of management and their species-richness. As a result, some areas had a higher botanical diversity, and species assemblages are noted accordingly. These wet areas were characterised by a dominance of Rushes and grasses including Yorkshire-fog *Holcus lanatus*, Creeping Bent *Agrostis* sp and Purple Moor-grass *Molinia caerulea*. Other species included Wild Angelica *sylvestris*, Flag Iris *pseudacorus* and scattered Bramble patches were observed (Volume 4; Appendix A7-6).

7.5.3.2.2 GS4 Wet Grassland – Molinia Meadows on Calcareous, Peaty or Clayey-Silt-Laden Soils

Annex I habitats are habitats of European importance which are listed under Annex I of the EU Habitats Directive (92/43/EEC). One field area along the study area (area approximately 2.5 ha) contains a species-rich wet grassland which botanical field surveys have assessed as having correspondence to the Annex I habitat *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (*Molinion caeruleae*) (6410). This area is not connected to or in close proximity to any other areas of *Molinia* Meadow within the Lough Corrib SAC and is therefore not important as a supporting habitat area to areas of *Molinia* Meadow within the SAC.

The Annex I habitat was located in the northern 2/3 of this field with approximate area of 1.5 ha (Volume 03; Figure A7-2; Volume 04; Appendix A7-7). The lower southern portion of the field may contain localised patches of Annex I habitat, but this appeared to be more rank with abundant rushes at the time of survey (Volume 04; Appendix A7-7). The location of this habitat patch is outside of any Natura 2000 site (Volume 04; Appendix A7-6, & Appendix A7-7). Given the limited size of the area of habitat (1.5 ha) surrounded by improved agricultural grassland, it is appropriate to evaluate this grassland area as of County value. The conservation value of the grassland was assessed according to the TII (2009) conservation evaluation scheme as of county value as a "*site containing area or areas of the habitat types listed in Annex I of the Habitats Directive that do not fulfil the criteria for valuation as of International or National importance*".

7.5.3.2.3 GS1 Dry Calcareous Grassland

GS1 Dry Calcareous Grassland was found in one location along an embankment ridge. This small area was characterised by a high plant species diversity (Volume 04; Appendix A7-6).

7.5.3.2.4 GA1 Improved Grassland

GA1 Improved Grassland is the dominant habitat within the landscape. These pastures are likely used for extensive or intensive grazing by cattle, sheep, and horses. Grasses recorded included Rye-grasses *Lolium spp*, Meadow-grasses (*Poa spp.,* Timothy *Phleum pratense*, Crested Dog's-tail *Cynosurus cristatus* and Yorkshire-fog. Species of agricultural herbs identified included Dandelion *Taraxacum spp.*, Creeping Buttercup *Ranunculus repens*, Plantains *Plantago spp.*, Nettle *Urtica dioica*, Thistles *Cirsium arvense, C. vulgare* and Docks *Rumex spp.* (Volume 04; Appendix A7-6).

7.5.3.2.5 GA2 Amenity Grassland

GA2 areas were not surveyed in detail as these areas were within the grounds of a primary school and private properties. These areas appeared to comprise species-poor swards of Rye grass.

7.5.3.3 Woodland and Scrub

7.5.3.3.1 WL1 Hedgerows

Hedgerows containing trees including Oak *Quercus Spp*, Sycamore *Acer pseudoplatanus* and Ash *Fraxinus excelsior* interspersed with Hawthorn and Blackthorn were observed. Trees were observed to be host to an abundance of Ivy *Hedera helix*. The understory of the hedgerows contained Bramble, Herb-Robert *Geranium robertianum* and Creeping Buttercup.

7.5.3.3.2 SW1 Scrub

Small areas of scrub were found throughout the broad study areas on field boundaries, around abandoned buildings and on the edges of wet grasslands. Vegetation structure was dominated by Willows, Bracken (*Pteridium aquilinum*) and Bramble.

7.5.3.3.3 WD1 Mixed Broadleaved Woodland

Mixed woodland was found to contain Oak, Sycamore, and Ash, Willow, and Beech *Fagus sylvatica*. Understory species contained Bracken, Bramble, Ground-elder *Aegopodium podagraria*, Nettle and Enchanter's-nightshade *Circaea lutetiana*.

7.5.3.3.4 WD2 Mixed Broadleaved and Conifer Woodland

Mixed broadleaved and conifer woodland was found in a linear strip between the N63 and the Abbert River at the western end of the study area. Species included Scots Pine *Pinus* sylvestris, Sitka Spruce *Picea sitchensis*, Beech, Ash and Hawthorn.

7.5.3.4 Invasive Flora

Two species were recorded within the survey area that are listed on the 3rd Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (SI 477/2011), non-native species subject to restrictions under Regulations 49 and 50 which sets out the legal implications associated with alien invasive species. Giant Rhubarb *Gunnera tinctoria* was recorded in a limited area immediately adjacent to the Abbert River to the north-west and outside the ZoI of the Proposed Road Development.

Three-cornered Leek *Allium triquetrum* was found at a single location immediately adjacent to the existing N63. This species is described by TII (2020) as being an Invasive Alien Plant Species of Potential Concern.

Snowberry *Symphoriocarpos albus*, a non-native invasive alien plant species not listed on the above schedule, was found in the hedgerow immediately adjacent the existing N63. This is listed as an 'Amber-List' species by Invasive Species Ireland. That is, it is a species that under the right ecological conditions, may have an impact on the conservation goals of a site or impact on a water body achieving good/high ecological status under the Water Framework Directive (WFD). The latter two species are within the ZoI of the Proposed Road Development.

7.5.4 River Habitat Survey

7.5.4.1 Bank Profiles

A summary of the bank profiles in the study area is outlined below:

- Re-sectioned banks dominate the reaches under survey with 100% of these showing evidence of bank modification and channel straightening;
- Bank reinforcement occurred in only one part of the section under survey. This was the eastern extent of the upstream reach. Boulders have been used to reinforce both banks close to the amenity area adjacent the national school;
- No other bank reinforcement was recorded;
- Bank re-sectioning has resulted in vertical/near-vertical banks over approximately 80% of the areas under survey; and
- Undercutting was more pronounced in the upstream reach.

7.5.4.2 Bank Material

A summary of the bank material in the study area is outlined below:

- The bank material in 95% of the reaches surveyed was earth;
- Man-made bank materials – boulders made up the remainder (approximately 5%); and
- No bedrock banks occurred.

7.5.4.3 Landuse (within 50 m)

A summary of the landuse (within 50 m) in the study area is outlined below:

- The catchment is dominated by agricultural landuse;
- Improved grassland and rough pasture were the most commonly landuse;
- Rough pasture was most common to the north of the Abbert River; and
- Areas of scrub/shrub occurred only to the south of the Abbert River.

7.5.4.4 Flow Features

A summary of the flow features in the study area is outlined below:

- Flow type was relatively uniform across both reaches;
- 60% of both reaches was rippled flow and 40% was smooth flow;
- 5 no. areas of the upstream reach had riffles compared with 3 no. areas of the downstream reach; and
- Natural riffle-pool-glide configuration was noted in the downstream section.

7.5.4.5 Bank Features

A summary of the bank features in the study area is outlined below:

- Eroding cliff was noted as occurring at just under 50% of the survey transect points (19/40). It should be noted that this does not necessarily indicate erosion problems;
- Bank features were not visible at 7 of the transect points;
- No bank features occurred at another 7 points; and
- Vegetated side bars occurred at 3 points.

7.5.4.6 Channel Features

A summary of the channel features in the study area is outlined below:

- There were no channel features recorded in the upstream reach;
- Channel features were not visible or absent in the downstream reach; and
- There are no islands or mid-channel bars within these reaches.

7.5.4.7 Channel Substrate

A summary of the channel substrate in the study area is outlined below:

- Boulders were noted at 2 of the transects in the upstream reach. Higher than usual water levels meant that the substrate was not visible for much of this reach. However, boulders and cobbles would be predominant here; and
- Channel substrate was not visible for the greater majority of the downstream reach. However, sand was visible at one transect.

7.5.4.8 Trees and Associated Features

A summary of the trees and associated features in the study area is outlined below:

- Trees were recorded as being absent, isolated, or scattered for almost all the area under survey;
- In the upstream reach, there were no trees on the left (southern) bank. Trees were isolated or scattered on the right (northern) bank;
- Trees were isolated or scattered in the downstream reach;

- Channel shading and overhanging boughs were only present in a very limited area in the upstream reach; and
- There were no channel shading or overhanging boughs in the downstream reach.

7.5.4.9 Bank Vegetation

A summary of the bank vegetation in the study area is outlined below:

- Banktop vegetation structure (within 1 m of the bank edge) was simple for the entire extent of the left banktop;
- Banktop vegetation structure was complex at only 2 no. transects on the right banktop; and
- Bank-face vegetation structure was simple for the entire extent of bank-face on both banks. This is due in part to the vertical/near-vertical banks here.

7.5.4.10 Habitat Assessment Results

Survey findings from the River Habitat Assessment is given below.

Habitat Modification Index

Both reaches under survey may be described as *obviously modified* as re-sectioning was noted throughout the length of these. For much of the sections under survey, previously excavated materials have been deposited on the southern bank. At the eastern extent of the upstream reach, there is boulder bank reinforcement. Land use is not intensive and there is not thought to be significant pressure on the river habitats. Grazing animals are generally prevented from accessing the riverbank areas. However, there is little natural banktop vegetation and the bank-face vegetation has been much reduced due to bank sectioning here. The results are summarised in the Table 7-11.

Habitat Quality Assessment

Habitat quality may be described as being '*fair*' for both reaches. This is partly due to the paucity of natural or semi-natural habitat types along these sections. While some reed fringe does occur on the right bank, this was not captured during the RHS survey (not falling at a transect point). It is also based on the relative homogeneity of the in-stream habitat types. Woody vegetation is very scarce within the area under survey and large trees are all but absent from the riverbanks within the kilometre under survey. Also scrub/shrubs were recorded on the southern bank, these were confined to the berms constructed here of excavated materials from the river. `The results are summarised in the Table 7-11.

Table 7-11 Summary of Habitat Assessment of River Survey Sites

Site No. and Name	HQA	Habitat Quality Description	HMI	Modification Category
Reach 1 - Upstream	3	Fair	4	Obviously Modified
Reach 2 – Downstream	3	Fair	4	Obviously Modified

7.5.5 River Q-Value Assessment

Based on the relative abundance invertebrate fauna indicator species, the river had a Q-value of 3-4 (Volume 4; Appendix A7-8). This indicates a moderate WFD status, slight pollution, and an unsatisfactory condition. Overall, based on the results as part of this survey, it can be concluded that the ecological status of this water body at all stations is 'moderate', as all stations achieved a Q3-4. These values are lower than the EPA estimates, which note that the Abbert River has a Q-value of 4. The reason for these differences could be due to changes in river chemistry and land management practices and/or environmental conditions since the last round of ecological surveying.

7.5.6 Bats

7.5.6.1 Desktop Survey

The NBDC database search returned the following bat records for hectad M54 (BCI, 2021), (Table 7-12).

Table 7-12 Bat Records for Hectad M54

Grid Reference	Date	Survey Dataset	Surveyor	Species
M502442	22/04/2007	National Bat Database of Ireland	C. Shiel	Soprano pipistrelle *Pipistrellus pygmaeus*
M517436*	25/04/2005	National Bat Database of Ireland	N. Roche	Soprano pipistrelle *Pipistrellus pygmaeus*

**Record occurs within 250 metres of the footprint of the Proposed Road Development*

A search of the NBDC online records portal for adjacent 10 km² squares returned a total of seven species of bat occurring, including three records for the EU Habitats Directive Annex II Lesser Horseshoe bat *Rhinolophus hipposideros* from hectads M44 and M45. These three records are all at least 5 km from the Proposed Road Development (NPWS, 2021). In addition, Bat Conservation Ireland (BCI's) habitat suitability index (Lundy et al. 2011), available to view on the NBDC online mapping portal, classifies the landscape, within which the site is located, as having a relatively low value habitat suitability for bats, with a score of 21.11 for all bat species. The bats most likely to be associated with the habitats within hectad M54, as per this habitat suitability index are listed in Table 7-13.

Table 7-13 Bats and their Likely Association with Habitats Occurring in Hectad M54 (Lundy et al. 2011)

Species	Habitat Suitability Index Score
Common pipistrelle	33
Soprano pipistrelle	32
Natterer's bat	31
Leisler's bat	28
Brown long-eared bat	25
Daubenton's bat	19
Whiskered bat	17
Nathusius' pipistrelle	3
Lesser horseshoe bat	2

7.5.6.2 Activity Surveys

Activity surveys were undertaken on 07 August 2020 and 08 August 2020. Results of these dusk and dawn surveys are provided in Table 7-14 - Table 7-16. A total of four species of bat were detected during the three surveys; Common pipistrelle, Soprano pipistrelle, Leisler's bat and Daubenton's bat. The majority of the study area contains agricultural fields separated by wire fencing and stone ditches, resulting in bat activity being principally concentrated along the river and riparian habitats and the treelines and hedgerows at the eastern end of the study area. During the activity surveys, a focus was placed on the location of the proposed river crossing with the surveyor pausing at this point for between twenty and thirty minutes in order to establish the level of usage by species more associated with watercourses, such as Daubenton's bat and Natterer's bat.

Overall, the levels of bat activity detected during the three surveys was considered to be within the normal parameters as what would be expected in such an open landscape type. The Abbert River is important for Daubenton's bats and also other species that use the riparian corridor for commuting and foraging.

Table 7-14 Dusk Survey 07 August 2020

Time	Grid Reference (ITM)	Species	Comments/Observations
21:28	550642 743625	Soprano pipistrelle	Two individuals observed flying within the ruins of the Abbey
21:47	550654 743518	Soprano pipistrelle	Along Abbert riverbank
22:03	550845 743557	Leisler's bat	Faint call detected over open fields
22:17	550835 743658	Common pipistrelle Soprano pipistrelle	Both detected along a hedgerow
22:31	551010 743512	Daubenton's bat	Six passes over Abbert River at proposed bridge crossing point
22:54	551388 743808	Leisler's bat	Detected in open fields
22:59	551602 743843	Common pipistrelle	Detected along roadway
23:14	551616 743656	Daubenton's bat	Detected at existing N63 bridge
23:28	551718 743891	Soprano pipistrelle	Detected along hedgerow by N63
23:42	551968 743981	Soprano pipistrelle	Detected along hedgerow by N63

Table 7-15 Dawn Survey 08 August 2020

Time	Grid Reference (ITM)	Species	Comments/Observations
04:10	551223 743484	Soprano pipistrelle	Along hedgerow between N63 and Abbert River
04:19	551201 743548	Daubenton's bat	Two passes over Abbert River at proposed bridge crossing point
04:53	550921 743467	Leisler's bat	Along Abbert River
05:03	550779 743485	Daubenton's bat	Abbert River
05:32	550547 743346	Soprano pipistrelle	Along hedgerow
05:56	550450 743227	Leisler's bat	Close to Abbeyknockmoy village
06:19	550220 743506	Leisler's bat	Old Road, Abbeyknockmoy

Table 7-16 Dusk Survey 08 August 2020

Time	Grid Reference (ITM)	Species	Comments/Observations
21:11	551795 743927	Leisler's bat	Detected along hedgerow by N63
21:33	551668 743876	Soprano pipistrelle	Detected along hedgerow by N63
21:57	551199 743730	Leisler's bat	Flying over fields
22:11	551211 743562	Daubenton's bat	At proposed bridge crossing point
22:23	551093 743550	Daubenton's bat	At proposed bridge crossing point
22:27	551012 743511	Daubenton's bat	At proposed bridge crossing point
23:01	550477 743666	Soprano pipistrelle	Flying along ditch
23:11	550420 743628	Daubenton's bat	Two passes detected over Abbert River
23:26	550257 743623	Soprano pipistrelle	Detected close to bridge on Old Road

7.5.6.3 Building Surveys

No evidence of current or past bat usage was found in any of the five buildings surveyed, (Table 7-17). Due to the dangerous structural condition of two of these buildings, access to all sections was not possible on health & safety grounds. The interior and exterior of built structures were studied and assessed for the presence of features including access points, in/on windowsills and panes, walls, hanging tiles, eaves/soffits/fascias, and gaps in brick/block work. Three of the assessed buildings, BLD02, BLD04 & BLD05 were classified as having a 'Low' bat roost potential. According to BCT guidelines (Collins, 2016), a feature with 'Low' suitability to host roosting bats has "*one or more potential roost sites that could be used by individual bats (but not) on a regular basis or by larger numbers of bats (i.e. unlikely to be suitable for maternity or hibernation)*".

Buildings BLD01 & BLD03 were classified as having 'Moderate' suitability to host roosting bats due to their structural conditions. According to BCT guidelines (Collins, 2016), a feature with 'Moderate' suitability to host roosting bats has *"one or more potential roost sites that could be used by bats due to their size, shelter, protection, conditions and surrounding habitat but unlikely to support a roost of high conservation status".* Volume 04; Appendix A7-9 provides photographs for each of the assessed buildings. Based on the buildings not being proposed to be demolished and based on the building assessments for bat roost potential, which highlighted low suitability for bat roosts, no activity surveys were undertaken on the individual buildings.

Table 7-17 Buildings Assessed for Bat Roost Potential

Building Reference	Grid Reference (ITM)	Building Type	Search Type	Evidence of Bat Roosts	Bat Roost Potential
BLD01	551294 743427	Derelict cottage – renovation works planned	Internal	None.	Moderate
BLD02	551234 743416	Two storey residential/former commercial premises	External – access not available	None.	Low
BLD03	552470 744253	Derelict cottage	Internal	None	Moderate
BLD04	552407 744202	Derelict farm shed	Internal – limited on health and safety grounds due to poor structural condition of the building	None	Low
BLD05	552386 744187	Derelict two storey residence	Internal - limited on health and safety grounds due to poor structural condition of the building	None	Low

7.5.6.4 Tree Surveys

All trees assessed along the study area were classified as having 'negligible' to 'low' bat roost potential. The route of the Proposed Road Development traverses principally open agricultural fields, minimising the numbers of trees to be felled.

7.5.7 Badger

The desktop study indicated that Badger were observed within 1 km of the Proposed Road Development site in 2011. However, no Badger setts were recorded during surveying. Signs of Badger activity were rare within the study area. These were limited to a single Badger latrine which was noted in the north-eastern extent of the study area.

The variety of wet and dry grassland, scrub, and wooded habitats within and adjacent to the study area offer a wide range of potential feeding habitat to Badger which are generalist feeders (Cleary *et al*., 2009). There were no feeding signs of Badger recorded during the survey period in 2020 and 2021. This would indicate that there is not an active Badger territory within the ZoI of the Proposed Road Development.

7.5.8 Otter

Otter is a QI of Lough Corrib SAC, and their breeding and resting places are protected under the Wildlife Acts. Otter are also listed on Annex II and Annex IV of the EU Habitats Directive. Much evidence of Otter was found within the wider ZoI of the Proposed Road Development and along the Abbert River. Potential Otter couches and spraints were found in a number of locations along the course of the Abbert River. Evidence of Otter trails were found during the field surveys and a dead adult Otter was noted upstream of the study area in May 2020. A dedicated search for holts of the riverbanks and adjacent areas of both the Abbert and Derreen Stream was carried out. No Otter holts were noted within or near the Proposed Road Development. The survey area comprised the area surveyed for habitats.

7.5.9 Other Protected Mammals

There is abundant scrub and woodland habitat considered optimal for Irish stoat (Hayden and Harrington, 2001), on the margins of Proposed Road Development. Radio-tracking of stoat in Ireland (Sleeman, 1987) showed that this species regularly occupies holes dug by brown rat *Rattus norvegicus* and rabbit *Oryctolagus cuniculus* (i.e. their prey items), and often occupies numerous different holes within a territory. On the basis of this evidence, it is considered that detection of stoat breeding or resting sites during site survey is unlikely without use of radio-tracking. In the absence of credible evidence to the contrary, at least one stoat breeding or resting site(s) is presumed present in rat or rabbit holes within the ZoI of the Proposed Road Development. There are no known national or county population estimates for the species in Ireland. It is believed common and widespread and of Least Concern (Marnell *et al*., 2009). Stoat have been recorded with 5 km of the Proposed Road Development in 2014 (NBDC, 2021 (Atlas of Mammals in Ireland 2010-2015)).

Pygmy shrew were not identified. This species nests in long grasses in dense vegetation (including damp conditions) or under rocks or logs, occurring wherever adequate insect food supplies exist. This species breeds from April to October. Given the minimum territory size of 200 m^2 (Hayden and Harrington, 2001) and the abundance of rank grassland and damp woodlands available, there are predicted to be several territories within the study area. There are no known national or county population estimates for the species in Ireland. It is believed common and widespread and of Least Concern (Marnell *et al*., 2009).

There were no visual sightings or field signs of hedgehog observed during field surveys, however they are nocturnal, and field signs are less frequently observed than for other mammals. They are presumed to occur within grassland and scrub/woodland within the ZoI of the Proposed Road Development. Breeding is from May to October (Hayden and Harrington, 2001). There are predicted to be several territories within the Proposed Road Development, with nests potentially occurring in hedgerows and other wooded habitats. Scrub is likely to be favoured for hibernacula (Reeve, 1981 cited in Haigh 2011; plus, original data in Haigh, 2011). Badgers are a significant predator of hedgehog. The lack of Badger setts within the ZoI (and general absence of feeding or other evidence for Badger) is likely to favour local hedgehog populations. There are no known national or county population estimates for the species in Ireland where they are common and they are assigned a conservation status of Least Concern according to the Irish Red List (Marnell *et al*., 2009).

There is suitable habitat (e.g. meadow habitat) for Irish hare within the ZoI, and the species was recorded twice during surveys. Desktop surveys showed two records for this species approximately 5 km to the south of the Proposed Road Development in 1990 and 10 km to the north in 2016.

There is potentially suitable habitat for Red Squirrel in broad-leaved woodland within the ZoI of the Proposed Road Development. There are no records of the species within the ZoI (approximately 2 km from the Proposed Road Development) from the NBDC dating to 2015. No red squirrel sightings were recorded. No squirrel dreys or feeding signs of any squirrel species were recorded (note: grey squirrel *Sciurus carolinensis*, and red squirrel dreys and feeding signs cannot be told apart). Red Squirrel is elusive and the potential for the species to forage within the ZoI of the Proposed Road Development cannot be excluded.

7.5.10 Birds

7.5.10.1 Bird Species Diversity

All bird species scientific names are referred to in Volume 4; Appendix A7-3. Appendix A7-3 summarises desktop study findings and compares them with the field survey findings. The habitat associations of species are listed in Appendix A7-3, along with the species recorded during field surveys.

The Proposed Road Development site is within 10 km of Monivea Bog SAC, Killaclogher Bog NHA, Lough Tee Bog NHA and Tiaquin Bog pNHA, which are habitat types that typically support numerous open habitat bird species (Keating et al., 2016). This habitat type in these bog sites typically supports species associated with raised bog habitat including Meadow Pipit and Skylark, as well as Stonechat, and warbler species in scrub areas and peripheries where scrub growth is occurring (Lewis *et al*., 2019, Keating *et al*., 2016). Other designated sites and areas of high conservation in the surrounding land include, turloughs and loughs which are likely to provide habitat for a variety of birds including wetland birds and waterfowl in the adjacent land. The primary land-use in the area surrounding the Proposed Road Development site is agriculture, encompassing hedgerows and areas of woodland. Improved grassland, which is the dominant habitat type, is of generally low ecological value (Keating *et al*., 2016). Bird habitat types present within the ZoI are generally common within the Irish countryside (Keating *et al*., 2016) and are deemed to be of moderate ecological value for birds.

7.5.10.2 Annex I Bird Species

The area is used by some Annex I bird species (EU Birds Directive [Council Directive 79/409/EEC]) (Kingston, 2012) and encompass Kingfisher, and Little Egret *Egretta garzetta* in the riverine area (recorded breeding and foraging respectively, during 2020 field surveys). Species identified that use the tetrad (10 x 10 km spatial unit used to coordinate survey effort of Atlas bird data) in which the Proposed Road Development is planned to take place include Golden Plover *Pluvialis apricaria,* Merlin *Falco columbarius* and Whooper Swan *Cygnus cygnus*, which were recorded (Volume 04; Appendix A7-3), in winter, during the Atlas surveys between 2007 and 2011 (Balmer *et al*. 2007-2011). No summer evidence or breeding evidence of these species was noted.

Peregrine Falcon have been reported to nest in the adjacent land and are present in tetrads between 5 and 10 km from Abbeyknockmoy and Derreen. A field habitat survey and desktop study in the vicinity of the Proposed Road Development did not indicate that suitable habitat was present to support breeding of Golden Plover, Merlin, Whooper Swan, Peregrine Falcon or Little Egret. Breeding evidence of Kingfisher is noted from the 2020 bird survey and a nest was identified (Volume 03 & Volume 04; Appendix A7-3).

7.5.10.3 Non-Annex Birds of Prey

Sparrowhawk *Accipiter nisus*, Kestrel *Falco tinnunculus*, Buzzard *Buteo buteo* were the only bird of prey species recorded during field bird surveys. These species are specially protected under the Wildlife Acts. A single territory of each species is presumed to overlap the survey area. No breeding of any of these bird of prey species was identified to occur in the immediate footprint of the Proposed Road Development. Foraging of some species was evident within the ZoI of the site, and potential for breeding of these species was not observed in the survey area.

In terms of breeding Owls, no suitable breeding areas for Barn Owl were identified during bird surveys within the survey area. A desktop review of Bird Atlas data from 2007-2011 indicated that no Barn Owl were recorded in the tetrad (10 x 10 km^2) containing the immediate footprint of the Proposed Road Development (M55) (Volume04; Appendix A7-3), but that Barn Owl sightings were recorded in the adjacent environment and within 5 km of the Proposed Road Development. Barn Owl were present in tetrads M43, M44, M45, M63, M64 and M65. Two of these tetrads, M43 and M44, are within 5 km of the Proposed Road Development. Breeding evidence was confirmed during these previous surveys in tetrad M43 and M44, within 5 km (approximately 4 km) of the Proposed Road Development and therefore, an active territory may be within the ZoI.

7.5.10.4 Red-listed Breeding Species (Excluding Birds of Prey)

Two species, Meadow Pipit *Anthus pratensis* and Grey Wagtail *Motacilla cinerea*, were recorded during the summer 2020 surveys, and are on the previous Red List of the Birds of Conservation Concern in Ireland (BoCCI) (Colhoun and Cummins, 2013). It is noteworthy that both of these species were red-listed following short-term declines of more than 50% in their breeding populations. These declines coincided with prolonged cold weather in Ireland during the winters of 2009/2010 and 2010/2011. Both species were green-listed prior to being red-listed. Both of these species have both shown signs of population increase and recovery since 2011 (Colhoun and Cummins, 2013). Note that the updated BoCCI list (Gilbert *et al*. 2021) upgrades Kestrel, and Swift *Apus apus* (both identified during surveying) to the breeding bird Red-list for 2020-2026. It is considered likely that areas adjacent to the Proposed Road Development, can sustain displaced, Red-listed breeding species and that Red-listed species will be affected at a Local level.

7.5.10.5 Amber-listed Breeding Species

A total of 16 species recorded on the Summer 2020 surveys, are on the Amber List of the previous Birds of Conservation Concern in Ireland (Colhoun and Cummins, 2013). They are Common Sandpiper *Actitus hypoleucos*, Goldcrest *Regulus regulus*, Greenfinch *Carduelis chloris*, House Martin *Delichon urbicum*, House Sparrow *Passer domesticus*, Kestrel, Kingfisher, Linnet *Carduelis cannabina*, Mistle Thrush *Turdus viscivorus*, Robin *Erithacus rubecula*, Sand Martin *Riparia*, Sparrowhawk, Starling *Sturnus vulgaris*, Stonechat *Saxicola torquata*, Swallow *Hirundo rustica* and Swift *Apus apus* (Volume 04; Appendix A7-3). Note, Mistle Thrush, Stonechat, Sparrowhawk and Robin have since been Green-listed (Gilbert *et al*. 2021). No Sand Martin breeding activity was noted in the riverbank area. It is considered likely that adjacent areas can sustain displaced, Amber-listed breeding species.

7.5.10.6 Green-listed Breeding Species

Numerous common generalist species are likely to breed in the mosaic of habitats across the ZoI of the Proposed Road Development. These species include, among others, Dunnock *Prunella modularis*, Goldfinch *Carduelis carduelis*, Blackbird *Turdus merula*, Song thrush *Turdus philomelos*, Wren *Troglodytes troglodytes*, Blue Tit *Cyanistes caeruleus*, Long-tailed Tit *Aegithalos caudatus* and Chaffinch *Fringilla coelebs*. It is considered likely that areas adjacent to the Proposed Road Development, can sustain displaced, Green-listed breeding species.

7.5.10.7 Wintering and Wetland Birds

Snipe *Gallinago gallinago (which is now Red-listed)*, Jack Snipe *Lymnocryptes minimum* and Lapwing *Vanellus vanellus* (Red-listed species) were recorded in winter bird surveys (Volume 04; Appendix A7-3). Fieldfare *Turdus pilaris* were also recorded. There is some potential foraging habitat for wintering birds within the works footprint.

7.5.11 Fisheries Review

7.5.11.1 Abbert River Background

The Abbert River is 41 km long from its source east of Monivea village to its confluence with the Clare River at Anbally (Figure 7-1). It is a major tributary of the Clare River and is a typically sluggish, meandering stream flowing over boggy, flat limestone lowlands (Drew, 2010). Throughout its course, the Abbert River has been previously modified by various Office of Public Works (OPW) drainage schemes. This has been ongoing since the 1950's and includes channel realignment, widening and lowering of the riverbed to reduce floodplain connectivity. As the main land use along the Abbert is agricultural, the main objective of these schemes is to maximise the agricultural potential of adjacent lands. Negative effects of drainage on rivers is highly significant and far reaching. These effects include simplifying the physical form of channels which promotes homogeneity of river character and reduces ecological diversity (Figure 7-1). For Salmonids in particular, spawning potential is severely hampered and the carrying capacity for juvenile and adult fish is significantly reduced. This is recognised as a primary pressure on the receiving waters of the Abbert River. Rehabilitation works have been conducted since this drainage scheme was first carried out and it has successfully restored key habitat features in some sections which has improved the river for Salmonids (O'Reilly, 2002).

Figure 7-1: Comparison of the Abbert River Between the Present Day and an Historic 6-inch Map from 1837-1842[21].

The entire main channel of the Abbert River is located within the Lough Corrib SAC (site code: 000297) (Figure 7-3). Sea Lamprey (*Petromyzon marinus*), Brook Lamprey (*Lampetra planeri*) and Atlantic Salmon (*Salmo salar*) are all Annex II species listed as Qualifying Interests within this SAC. As such, the Abbert River is part of the fish sampling programme conducted by IFI for the WFD. The Abbert River was surveyed in 2010 and 2013 (IFI 2010; IFI 2013). Under national and E.U. law, Annex V of the WFD requires categorised rivers to be monitored for fish species composition, abundance and age structure (Directive 2000/60/EC).

[21] *Note the historic in-stream channel diversity and complexity compared to what the Abbert River looks like today (www.osie.ie accessed January 2021).*

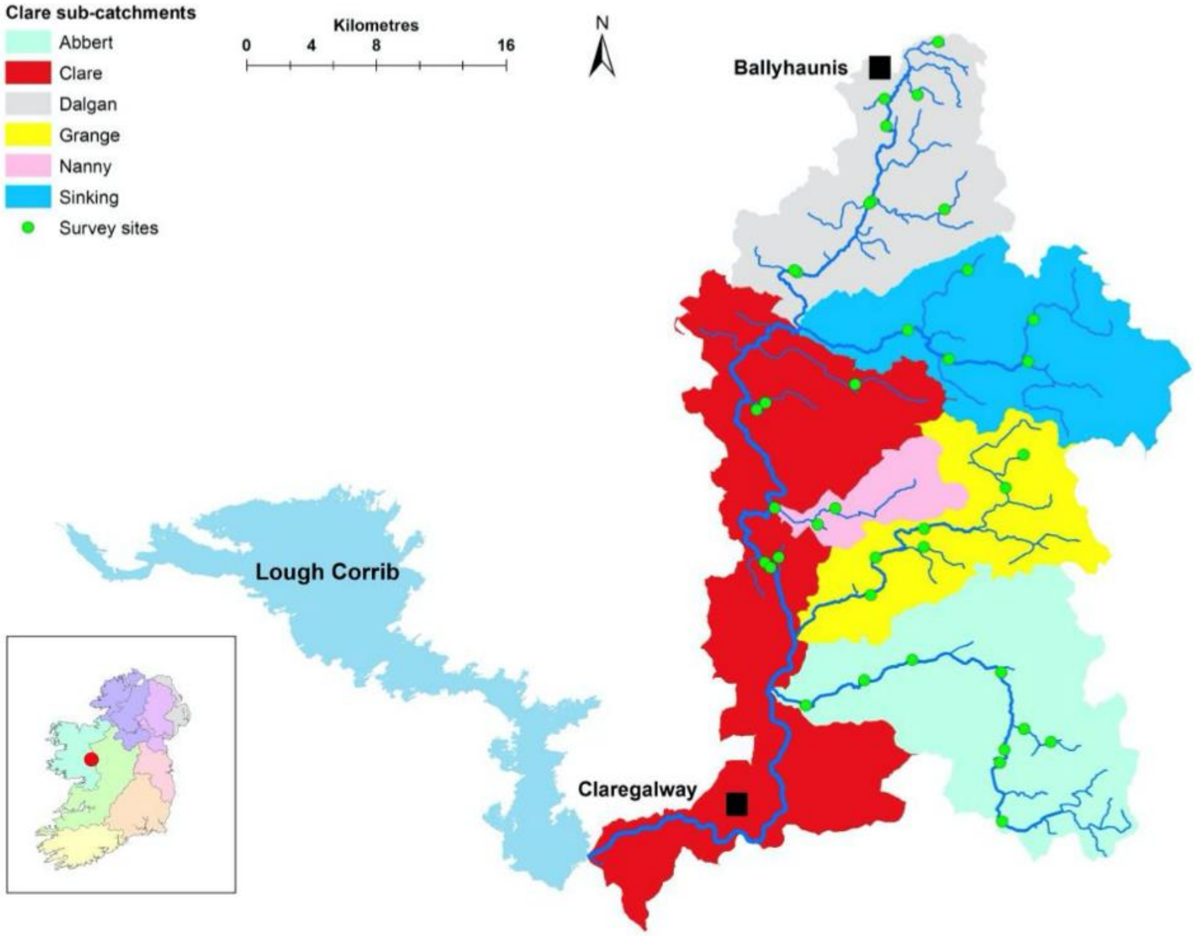

Figure 7-2 River Clare and Sub-catchment 2019 Survey Sites in Sampling Programme for the Water Framework Directive (O'Brien et al. 2019).

In the initial 2010 electro fishing surveys as part of the WFD programme, conducted at Bullaun Bridge 2.5 km upstream of its confluence with the River Clare, four fish species were recorded. Three native fish species included Salmon, Brown trout (*Salmo trutta*) and Three-spined Stickleback (*Gasterosteus aculeatus*) whilst one non-native species included Stone loach (*Barbatula barbatula*).

Salmon were the most abundant species captured at this specific site. When the entire survey area of the Western River Basin District is considered, which encompassed survey efforts across 10 different rivers, the Abbert River recorded the greatest densities of brown trout fry (0+) and Salmon (0+, 1+ and older) respectively[22]. Lengths for brown trout were recorded in this survey which indicated that growth rates were 'very slow' according to the classification of brown trout growth as shown by Kennedy and Fitzmaurice (1971).

According to the 2019 electro fishing survey results, the same four fish species were recorded. Out of 38 sites surveyed within the River Clare and its sub-catchments (Figure 7-3), Salmon were the most abundant fish species captured, followed by brown trout. Most notably, the highest densities of juvenile Salmon were recorded on the Abbert River at site 36, which is within the study area. Site numbers for the Abbert River are 35 to 38. Site number for the Killaclogher River and Killaclogher River tributary are 32 to 34 and 30 to 31 respectively.

[22] www.wfdfish.ie

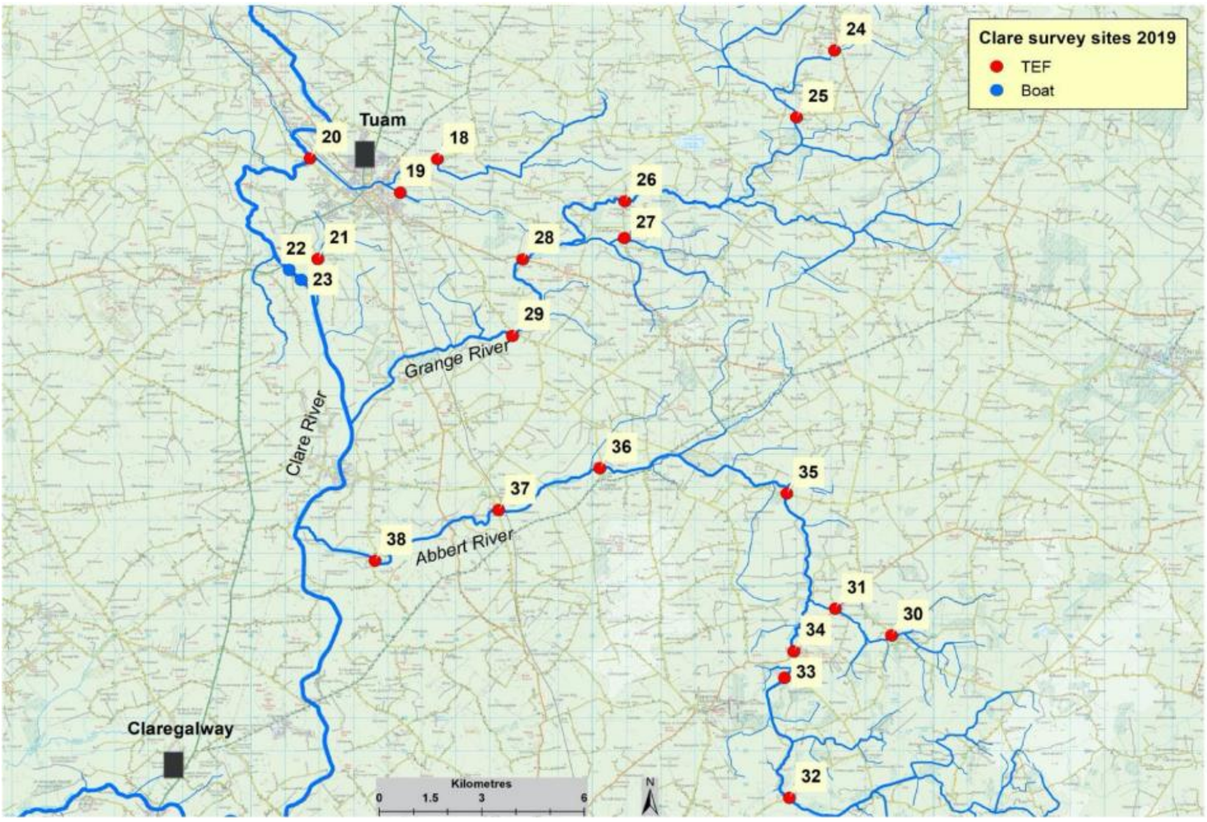

Figure 7-3 Catchment of the Lower Clare River (O'Brien et al. 2019).

Although not recorded in WFD fish population survey results, the NPWS commissioned a lamprey survey which discovered Brook Lamprey were present in 3 out of 5 sites investigated (O'Connor, 2007).

7.5.11.2 Ecological Status

An essential step in the WFD process is the allocation of fish ecological status classifications. This approach has led to the development of the Fisheries Classification Scheme 2 Ireland (FCS2 Ireland). The tool compares various fish community metric values with a specific site to those predicted for a site under un-impacted conditions. There are five ecological status classes including High, Good, Moderate, Poor and Bad. Although all sites have recorded 'good' fish ecological status, localised pressures including but not limited to nutrient enrichment were observed in 2019. Table 7-18 gives the fish ecological status result for the Abbert River from 2010-2019.

Table 7-18 Fish Ecological Status of the Abbert River since 2010 (sources: IFI 2010, 2013, O'Brien et al. 2019)

Site No.	2010	2013	2019
35	-	-	Good
36	-	-	Good
37	-	-	Good
38	Good	Good	Good

Overall, the Abbert River possesses highly significant fisheries potential, particularly for Salmon and brown trout. It is a significant Salmonid producing watercourse within the Lough Corrib SAC. In a national context, the Corrib system is recognised as being one of the highest Salmon producing catchments. The River Clare, which is the receiving water of the Abbert River, is recognised as the most important spawning tributary in the Corrib catchment. Indeed, IFI note that the Abbert River contributes 23% to the overall trout population in Lough Corrib, which is world famous for its Brown Trout fishing[23].

Any proposed development along the Abbert River should be cognisant of the importance of the river from a fisheries and ecological perspective.

7.5.12 Amphibians

Sites suitable for amphibian spawning habitat were found at a number of locations. These included more substantial drainage ditches and some limited pond habitat. Tadpoles of the Common Frog were found at only one location. This was in a substantial wet ditch approximately 300 m to the north of the proposed alignment's tie-in with the existing N63. No spawn/tadpoles of any amphibian species were found outside of this area. There are no records for common frog or Common Lizard for the ZoI on the NBDC database.

7.5.13 Lepidoptera

Several non-protected butterfly species were noted incidentally during multi-disciplinary walkover surveys, by the biodiversity team however, none were listed as 'Red List' species (Regan *et al*., 2010). A survey of transects across wet grassland was carried out on 31 August and 4 September 2020. Devil's Bit Scabious plants were found in 3 of the 5 transects. All of these were found to the north of the Abbert River. No larval webs were recorded. *Succisa pratenis* stands were found across the grassland areas of the site however were less frequent to absent in areas dominated by *Juncus* species and areas of grassland that have been improved. Table 7-19 provides the locations and descriptions of each stand of *Succisa* recorded during the transect walkovers.

Table 7-19 Locations and Descriptions of each Stand of *Succisa* Recorded During Transect Walkovers

Transect	Succisa Encountered	Location (ITM)		Description of Succisa Stand
A	NO	550953 550993	743477 743414	--
B	NO	551012 551070	743425 743496	--
C	NO	550970 551046	743526 743533	--
D	NO	551196 551156	743747 743672	--
E	YES	551273 551220	743761 743644	Stand approximately 2 m x 3 m. In a slight depression. Abundance – Occasional Stand approximately 1 m x 1.5 m. Abundance – Rare
F	YES	551324 551290	743776 743694	Stand approximately 2 m x 2 m. Stand approximately 2 m x 3 m. Abundance – Rare
G	YES	551842 551771	744094 743986	Stand approximately 1 m x 2 m. Abundance - Occasional Stand approximately 2 m x 2 m. Abundance – Rare
H	NO	551944 551802	743977 743931	--

[23] http://www.fishinginireland.info (Accessed November 2020)

7.5.14 White-clawed Crayfish

Surveys were carried out on 24 June 2020. Water levels and prevailing conditions were suitable for survey. There was bright sunshine and good visibility throughout. No White-Clawed Crayfish were found within the reaches surveyed. There are 3 no. records for this species on the NBDC database within the assessed area. The last record for this species dates from 1989. NPWS forwarded on a record of this species from 2005, from Central Fisheries Board surveys, for the M54 tetrad, as part of consultations with them. It was noted that suitable habitat for this species was found in both the Abbert River and Derreen Stream. It should be noted that no Crayfish remains were found in any of the Otter scats that were found during surveying.

7.5.15 Other Protected and Notable Species

No Common or Viviparous Lizards were recorded during surveys. It was noted that suitable habitat (e.g. wet grassland, marginal grassland) for this species occurs within the wider survey area. It is likely, therefore, that this species occurs within the ZoI of the Proposed Road Development.

Field surveys for Freshwater Pearl Mussel were not carried out. There are no records of this species within the area under survey.

No known populations of Freshwater pearl mussel occur in the Abbert River. It is noteworthy that the Owenriff drains into the Corrib catchment. This river contains freshwater pearl mussel. Though unlikely, impacts to Salmonids, in Lough Corrib, could affect pearl mussels in the Owenriff system. This is because the parasitic life stage of pearl mussel requires a salmonid host. No direct impacts of pollution, on Freshwater pearl mussel are envisaged, as, the Owenriff is in a different sub-catchment, and indirect impacts to Freshwater pearl mussel are deemed to be unlikely. Protection of fish species is dealt with separately in this EIAR (Section 7.7) and will ensure protection of salmonids and therefore prevent any indirect effects on Freshwater pearl mussel. As such, freshwater pearl mussel is not considered further in this assessment.

7.5.16 Summary Valuation of Significant Ecological Features

Table 7-20 Key Ecological Receptors (KER's) identified within the ZoI of potentially significant effects. Significant features (KERs) scoped into the EIAR are highlighted in grey (Also see Tables 7.10, 7.21 and 7.22 for further details). (Note: all works are limited to areas outside of Lough Corrib SAC).

Table 7-20 Summary Valuation of Significant Ecological Features (KERs) and Identification of Impacts and Vulnerability of Features Scoped out from the Biodiversity Assessment

Features		Highest Ecological Valuation (See Tables 7.21 and 7.22 for more information on potential impacts within the ZOI)	At Risk of Significant Impact	Considered Further in Assessment
Designated sites	European sites (Lough Corrib SAC) – including Abbert River	International	Yes	Yes (potentially at risk of significant impacts) (Habitat deterioration). The potential for adverse impact are considered further within the NIS and Section 7.6 of the EIAR.
	Other European sites	International	No	No (no risk of significant impact, no predicted pathways)
	National sites downstream of and within same CMU as Proposed Road Development (pNHAs)	National	No	No (no risk of significant impact, no predicted pathways)
	Other National sites (NHA/pNHA)	National	No	No (no risk of significant impact, no predicted pathways)

Features		Highest Ecological Valuation (See Tables 7.21 and 7.22 for more information on potential impacts within the ZOI)	At Risk of Significant Impact	Considered Further in Assessment
Habitats and flora	FW1 Eroding/upland rivers (Coincident with area of Lough Corrib SAC)	International (Within Lough Corrib SAC)	Yes	Yes (potentially at risk of significant effects) (habitat deterioration)
	FP1 Petrifying Springs with Tufa Formation (Cratoneurion) (7220) (Within Lough Corrib SAC)	International	Yes	Yes (potentially at risk of significant impact and effects) (habitat loss, deterioration) (Note that this habitat is within Lough Corrib SAC, but is outside of the Proposed Road Development footprint)
	GS4 - Molinia meadows on calcareous, peaty, or clayey-silt-laden soils (*Molinion caeruleae*) (6410) (Outside of Lough Corrib SAC)	County-National	Yes	Yes (potentially at risk of significant impact) (habitat loss, deterioration)
	FW4 Drainage ditches	Local (Higher value)	Yes	Yes (potentially at risk of significant impact) (habitat loss)
	FS1 Reed swamp	Local (Higher value)	No	No (no risk of significant impact)
	GS1 Dry Calcareous Grassland	Local (Higher value).	No	No (no risk of significant impact)
	GS4 Wet grassland	Local (Higher value)	Yes	Yes (potentially at risk of significant impact) (habitat loss).
	GA1 Improved agricultural grassland	Local (lower value)	No (permanent loss of locally abundant habitat)	No (no risk of significant impact)
	GA2 Amenity grassland	Local (lower value)	No (permanent loss of locally abundant habitat)	No (no risk of significant impact)
	WD1 Broadleaved woodland	Local (Higher value)	Yes	Yes (potentially at risk of significant impact) (habitat loss)
	WD2 Mixed woodland	Local (Higher value)	Yes	Yes (no risk of significant impact) (habitat loss)
	WL1 Hedgerows	Local (Higher value)	Yes	Yes (potentially at risk of significant impact) (habitat loss)
	WL2 Treelines	Local (Higher value)	Yes	Yes (potentially at risk of significant impact) (habitat loss). Landscape plan will aid in recovery of this habitat type.
	SW1 Scrub	Local (Higher value)	Yes	Yes (potentially at risk of significant impact) (habitat loss). Landscape plan will aid in recovery of this habitat type.
	FP1 Calcareous Springs (see Volume 03; Figure A 7-2 for location)	Local (Higher value)	Yes	Yes (potentially at risk of significant impact) (habitat loss)

Features		Highest Ecological Valuation (See Tables 7.21 and 7.22 for more information on potential impacts within the ZOI)	At Risk of Significant Impact	Considered Further in Assessment
Fauna	Fish (Atlantic Salmon, and Brook Lamprey) in the Abbert, River	National - International (QIs of Lough Corrib SAC)	Yes	Yes (potentially at risk of significant effects)
	White-clawed Crayfish (Presumed present; not identified during surveying)	National - International (QI of Lough Corrib SAC)	Yes	Yes (potentially at risk of significant effects)
	Otter (present within Abbert River)*	National - International (QI of Lough Corrib SAC)	Yes	Yes (potentially at risk of significant effects)
	Lesser Horseshoe Bat (not identified during surveying)	National - International (QI of Lough Corrib SAC)	Yes	Yes (potentially at risk of significant effects). Impacts are considered in combination with other bat species.
	Brown Trout, Three-spined Stickleback, Stoneloach in the Abbert River and Lough Corrib	County-National	Yes	Yes (potentially at risk of significant effects)
	Wintering birds	Local (Higher value)	Yes	Yes (potentially at risk of significant effects)
	Lepidoptera (Marsh Fritillary not identified in surveys)	Local (Higher value)	Yes	Yes (potentially at risk of significant effects)
	Bats (foraging populations of at least seven bat species)	Local-County	Yes	Yes (potentially at risk of significant effects)
	Structures/trees with low suitability for roosting bats	Local (Higher value)	Yes	Yes (potentially at risk of significant effects)
	Breeding birds including red and amber-listed species	Local (Higher value)	Yes	Yes (potentially at risk of significant effects)
	Common Frog, Smooth Newt	Local (Higher value)	Yes	Yes (potentially at risk of significant effects)
	Common Lizard, Pygmy Shrew, Hedgehog, Pine Marten, and Irish Stoat (all presumed present)*	Local (Higher value)	Yes	Yes (potentially at risk of significant effects)
	Badger	Local (Higher value)	Yes	Yes (potentially at risk of significant effects)
	Other species (Rabbit, Red Fox *Vulpes* and other unprotected species)	Local (Lower value)	Yes	Yes (potentially at risk of significant effects)

Drawings related to surveys and findings can be found in Volume 03 Figures A7-1 to A7-10 of this EIAR.

7.6 Assessment of Impacts

The impact assessment was carried out after considering embedded control which is inherent in the design only. Mitigation measures may need to be applied on consideration of the results of the impact assessment. Embedded control measures are detailed herein and in Chapter 04 Description of the Proposed Road Development.

7.6.1 Embedded Control Measures

Embedded control measures within the design of the project, are set out in Chapter 04 Description of the Proposed Road Development. The following measures have been incorporated into the project design and include:

- Adoption of a clear span bridge structure that eliminates the requirement for instream works and direct impacts on the Abbert River;
- Appropriate setback distances >/= 5 m from the Abbert River corridor will be maintained to avoid any restrictions on the movement of Otter from utilising riparian zones along the river margins and maintaining a natural corridor on either side of the river bank;
- No lighting is provided at the bridge location and the approached to that. This will prevent lighting of the Abbert River and riparian area. No lighting is provided at the bridge location and approach in order to avoid light spill into Lough Corrib SAC;
- Installation of a Sustainable Urban Drainage System (SUDS), including treatment and attenuation of all surface water to appropriate standards prior to discharge to the Abbert River and local drains (further details on drainage are provided in Section 4.5.2 of Chapter 04 Description of the Proposed Road Development);
- Provision of a sealed surface water drainage and attenuation system fitted with control valves and interceptors;
- Provision of a sub-surface drainage system of the road pavement to control groundwater levels in the vicinity of the Proposed Road Development and to drain the road foundation;
- Planting of attenuation ponds to aid pollution control;
- Provision of cut-off drains to intercept overland flow;
- Provision of flood connectivity culverts;
- Design of watercourse diversions to minimise impacts to existing flows;
- Adequate bridge free-board above the Abbert River (>3 m) allowing for safe passage and movement of bat species, Otter (QI of the Lough Corrib SAC), Kingfisher (Annex I species) and various bird species that use the Abbert River;
- Interceptor ditches will be provided to collect overland flow where the adjoining land slopes towards the road cutting or embankment. These interceptor ditches will discharge to existing watercourses where the topography permits and to the road drainage system in areas with no suitable outfall location;
- Planting of native, species-rich woodland and grassland areas within the Proposed Road Development as specified in Chapter 13 Landscape; and
- Flood Relief Culverts (≥ 600 mm) sized to accommodate adequate flows, which will also function for mammal access have been designed into the Proposed Road Development alignment.

7.6.2 Introduction to Types of Impacts

The Proposed Road Development could have a range of potential impacts (direct and/or indirect) upon significant ecological features (i.e. KERs) during the construction and/or operational phases. Direct impacts occur where the changes to an ecological feature are directly attributable to an action associated with a given development, such as habitat loss. Indirect impacts include aspects such as disturbance to bat activity as a result of habitat loss. The consequences of such impacts (i.e. the effect) on a receptor will include reduced abundance or density in a specific area as a result of changed behaviour or loss of roosting areas, due to habitat loss, habitat deterioration or disturbance during construction or operation.

7.6.3 Construction-Phase

A Natura Impact Statement (NIS) has been prepared to provide the competent authority with the information necessary to complete an Appropriate Assessment (AA) for the Proposed Road Development in compliance with Article 6(3) of the Habitats Directive. This section should be read in conjunction with Table 7-21 and Table 7-22.

In the absence of mitigation, the Proposed Road Development could have a range of potential effects on the QIs and other KERs within the ZoI during the construction phase. Potential impacts from road construction include habitat loss, changes to hydrology, spread of invasive species, disturbance (i.e. visual, light, vibration and noise, temporary barriers to connectivity, etc. (See Volume 03; Figure A4-33 regarding public lighting)) and the potential for the release of pollutants and contaminants (i.e. suspended solids, oils, fuels, paints, concrete, lime, etc.) to receiving watercourses.

A range of factors influence the magnitude of impact on receptors including vulnerability of individual receptors (e.g. condition of vegetation, or fitness of faunal populations), time of year and lifecycle stage of a species effected, and the potential for unforeseen events such as extreme weather (including flooding of working areas), or introduction of invasive species. In the absence of mitigation measures, construction phase impacts have the potential to disturb or degrade a range of habitats and protected species throughout the duration of construction.

7.6.3.1 European Sites (Lough Corrib SAC)

The only site considered to have the potential for impacts was Lough Corrib SAC, due to the proximity of the SAC (which encompasses the Abbert River). The Proposed Road Development route will pass close to and crosses the boundary of the SAC at one location (see Volume 03; Figures A4-2 to A4-6 and A4-26). A bridge over the Abbert River will also be required as part of this Proposed Road Development. No direct risks to the conservation objectives of any other Natura 2000 sites, NHAs or pNHAs are considered likely due to the following:

- Lack of connectivity between the Proposed Road Development and the designated area;
- Significant buffer between the Proposed Road Development and the designated area;
- No impact or change to the management of the designated area; or
- No anticipated change to chemical or physiological condition of the designated site as a result of the Proposed Road Development.

An AA Screening, and a NIS have been produced separately to this chapter, to assess the potential for adverse effects on the integrity of European sites from the construction and operation of the Proposed Road Development, both alone and in-combination with other plans and projects.

7.6.3.1.1 Surface Water Pollution

Potential pollution effect pathways (arising during construction works) have been identified between the Proposed Road Development and Lough Corrib SAC. In the absence of appropriate mitigation, any construction activities carried out close to surface waters involve a risk of pollution due to accidental spillage and leaks from liquids such as fuels, oils, lubricants, paints, bituminous coatings, preservatives and weed killers. Other risks associated with the Proposed Road Development could include the use of lime and concrete and the release of sediments and suspended solids to surface waters during construction works (i.e. runoff associated with material stockpiles, excavations, site stripping and earthworks, etc.). There is a risk of pollutants entering the Abbert River from land drains within the works footprint and being carried further downstream within Lough Corrib SAC. Pollution as a result of accidental spillage and sediment release could potentially affect the QI species of Lough Corrib SAC, other protected species and could have a negative effect on prey availability such as invertebrate communities. A reduction in water quality due to sedimentation could affect hydrochemistry, impair plant growth and impact on fish spawning habitat downstream. Pollutants have the potential to enter the Abbert River and spread to surrounding land (including QI habitats within) during the construction phase. Significant pollution events could occur during a flood event. Subject to the types and volumes of contaminants concerned, potential effects to the Lough Corrib SAC, from the pollution pathways via affected land drains could be significant in the medium-term.

7.6.3.1.2 Groundwater Pollution and Changes

In the absence of appropriate mitigation, potential pollution effects to groundwater and soils are plausible. Specifically, potential risks were identified in the event of an accidental spillage associated with fuels, chemicals, lime, and concrete (i.e. concreting during road and bridge construction and concreting for culverts). This could result in short-medium term impacts on soils and groundwater underlying the Proposed Road Development if inappropriately handled or stored during the construction phase. Potential contaminants could migrate through the subsoils and impact underlying groundwater. Applying the Precautionary Principle, such pollution could occur during construction, resulting in soil and/or groundwater contamination migrating into nearby receiving waters within the Lough Corrib SAC. This could result in significant adverse effects on QIs in the short-medium term, through direct mortality from a significant pollution event. In the absence of mitigation, changes in groundwater flow, water chemistry and pollution could adversely affect habitats dependent on groundwater such as Annex I Petrifying springs within Lough Corrib SAC.

7.6.3.1.3 Air and Dust Pollution

Potential short-term, moderate habitat degradation as a result of air quality impacts is plausible in the absence of mitigation. Deposition of dust from construction-related activities could cause local effects on the diversity or range of plant species and on habitat structure within Lough Corrib SAC and other habitats within the ZoI of the Proposed Road Development works. Construction activities could also impact on fauna of the SAC (Abbert River) through dust deposition to the river. Dust emissions associated with construction works could, in the absence of mitigation, affect adjoining habitats, potentially damaging sensitive habitats or plant species.

A review was undertaken and no critical load for dust deposition on habitats was identified. It is noteworthy that impacts on habitats can vary depending on species types within habitats, dust particle concentration, and distance from dust source (Holman *et al*. 2014). The impact declines with distance from the site. High sensitivity receptors (e.g. locations with an international or national designation and the designated features may be affected by dust soiling) are deemed to have high sensitivity to ecological impacts within 20 m, and medium ecological sensitivity to 50 m from source. Medium sensitivity receptors (e.g. locations with a national designation where the features may be affected by dust deposition or locations where there is a particularly important plant species, where its dust sensitivity is uncertain or unknown) are deemed to have medium sensitivity to ecological impacts within 20 m from source and low impact sensitivity within 50 m from source. Low sensitivity receptors (e.g. locations with a local designation where the features may be affected by dust deposition) are deemed to have low ecological sensitivity to dust within the 0-20 m from source range (Holman *et al*. 2014).

7.6.3.1.4 Habitat Damage or Deterioration

No land-take within Lough Corrib SAC is required for bridge development (Volume 03; Figure A4-26 and Figure A4-3). Loss of habitat, through disturbance and pollution is plausible. In the absence of mitigation, there is potential for excessive and unnecessary habitat loss, degradation of habitats from water pollution and the introduction and dispersal of scheduled invasive species to surrounding habitats (e.g. via vehicle tyre treads, machinery, construction personnel, and surface waters etc.). Effects of these impacts could result in excess habitat loss, reduced species abundances locally, reduced suitability of the ZoI for various species, erosion of bankside habitats and out-competing of native vegetation. Potential also exists for habitat deterioration in the form of littering/dumping of waste generated onsite and site access. In the absence of mitigation, potential impacts could result in significant effects at the County-National scale, in the long-term.

7.6.3.1.5 FP1 Calcareous Springs - Annex I Petrifying Springs with Tufa Formation

A FP1 Calcareous Spring - Annex I Petrifying Spring with Tufa Formation is within Lough Corrib SAC and is a qualifying interest of Lough Corrib SAC and is therefore of International importance. The Proposed Road Development is located near the petrifying spring but outside the SAC boundary. It is plausible that in the absence of mitigation, construction works may cause hydrogeological changes and alter hydrogeological regimes, flows and water chemistry of this Petrifying Spring . This could result in the deterioration of this Annex I - Petrifying Springs with Tufa formation. Potential damage to this habitat (via reduced groundwater flow) would be regarded as a significant, moderate, permanent negative effect at a County-National level.

Reductions in traffic volumes along the old N63 may be beneficial for the Petrifying spring habitat recorded adjacent to the boundary of the works area. Reduced; traffic volumes, debris, rubbish and runoff, due to reduced road usage and sealed drainage may have a positive impact on water quality in the pool formed by this spring.

7.6.3.2 Nationally Designated Sites (Excluding Lough Corrib SAC)

No impacts to other nationally designated sites (SPA's, SAC's, NHA's, pNHA,s), associated with the construction phase, are envisaged.

7.6.3.3 Habitat (Excluding Lough Corrib SAC)

7.6.3.3.1 Habitat Land-take

Land-take outside of the Lough Corrib SAC boundaries during the construction phase will be restricted to the works footprint and habitats of varying ecological importance (i.e. Improved grasslands (GA1), Wet grassland (GS4), Scrub (SW1), Broadleaved Woodland (WD1), Hedgerows (WL1)). Most of the habitats onsite are common and widespread, however; one Annex I habitat is present within the works area: Annex I *Molinia* Meadows on Calcareous, Peaty or Clayey-silt-laden soils). A summary of potential impacts and effects on designated sites, habitats and flora is given in Table 7-21.

7.6.3.3.2 Habitat Damage or Deterioration

In the absence of mitigation, there is potential for excessive and unnecessary habitat loss, pollution, and the introduction and dispersal of scheduled invasive species to various habitats. Potential also exists for habitat deterioration in the form of littering/dumping of waste generated onsite and site access. In the absence of mitigation, potential effects could be significant at the Local-County scale in the long-term.

7.6.3.3.3 Invasive Flora

The stand of Giant Rhubarb, being outside the ZoI of the Proposed Road Development will not be affected by the Proposed Road Development and is not considered further in terms of impact assessment.

Three-cornered leek could, in the absence of any intervention, spread further alongside the existing N63. This species spreads through seed dispersal (including spread of seed heads in cuttings). Bulbs could also be dispersed by soil translocation (containing seeds and bulbs) (from excavations and vehicle tracking). Over time, it could spread and exclude native species along the road.

In the absence of mitigation, Snowberry could continue to out-compete native hedgerow species in the affected area (Booy *et al*., 2015). This will result in fewer native flowering and fruiting species and fewer forging opportunities for native bird and mammal species. As this plant spreads by suckering, it is unlikely, given its location, to impact on the Abbert River within the short to medium-term. Construction works will not lead to the spread of Snowberry. On the contrary, works will involve the removal of the section of hedgerow/field boundary that is affected by this species. This will result in a long-term positive effect on a Local level.

7.6.3.3.4 Impacts on Drains

In the absence of mitigation, watercourses could become polluted. This could result in impacts on amphibians and on non-legally protected invertebrate species. Pollution could flow into the Abbert River and cause significant, temporary ecological damage at a Local level.

7.6.3.3.5 GS4 Wet Grassland – Annex I Molinia Meadows on Calcareous, Peaty or Clayey-silt-laden soils

This habitat is outside of Lough Corrib SAC (see Volume 03; Figure A7-2). In the absence of mitigation, there could be an overall loss of this Annex I habitat (approximately 0.35 ha) within the CPO (Table 7.10). No significant negative impacts to Annex I habitats within the boundary of the SAC would occur as a result of this loss.

The loss could be higher in the absence of mitigation, whereby if construction operations or an accidental pollution event caused additional deterioration and destruction. The hydrology of the area could be affected by construction activities, resulting in the possible loss of a substantial proportion of the remaining area of this habitat. In the absence of mitigation, invasive species may become established, and the area may become dominated by scrub vegetation in the short-medium-term and be replaced by a different habitat type. This would represent an overall loss of habitat and loss of biodiversity. The loss of this habitat would be regarded as a significant, permanent negative effect at a County level. Mitigation measures are noted in Section 7.7.

7.6.3.3.6 FS1 Reed Swamp

No impact is predicted as this area is deemed to be outside of the site footprint, though accidental removal may occur in the absence of mitigation (Table 7.10).

7.6.3.3.7 GS4 Wet Grassland (Excluding Molinia meadows)

Areas of Wet Grassland are declining in Ireland due to drainage and agricultural intensification. Wet grassland areas are being farmed more intensively, with an associated reduction in species richness (Fossitt, 2000). In the absence of mitigation, the wet grassland areas encountered in the CPO of the Proposed Road Development (approximately 3.3 ha) could be replaced, resulting in reduced abundance of plant species locally, and the fauna they support (Table 7.10). The impact of this loss would be deemed to be significant, and of permanent duration at a Local level.

7.6.3.3.8 GS1 Dry Calcareous Grassland

No impact is predicted as this area is deemed to be outside of the site footprint, though accidental removal may occur in the absence of mitigation (Table 7.10).

7.6.3.3.9 GA1 Improved Grassland

This is the dominant habitat within the landscape. This is typically a species-poor habitat and therefore Proposed Road Development could result in approximately 6.2 ha of improved grasslands being lost (Table 7.10). This loss would represent a negligible adverse effect from a biodiversity perspective.

7.6.3.3.10 GA2 Amenity Grassland

Given the low species richness of this habitat, no significant adverse ecological effects from the loss of this habitat will occur (approximately 0.1 ha of amenity grassland could be lost within the CPO) (Table 7.10).

7.6.3.3.11 WL1 Hedgerows

In the absence of mitigation, hedgerows and hedge associated species will be removed, with negative Local effects, due to a loss of local biodiversity and habitat. These impacts will affect habitat connectivity, foraging and breeding success for numerous species. These impacts could result in significant, permanent effects at a Local level (approximately 1.1 ha of hedgerow could be lost within the CPO in the absence of mitigation) (Table 7.10).

7.6.3.3.12 SW1 Scrub

In the absence of mitigation, scrub associated species will be removed, with negative local, small-scale effects. These impacts will affect habitat connectivity for and foraging and breeding success for numerous species. These impacts could result in significant, permanent effects at a Local level (approximately 0.2 ha of scrub could be lost within the CPO in the absence of mitigation) (Table 7.10).

7.6.3.3.13 WD1 Mixed Broadleaved Woodland

The core area of this habitat is deemed to be outside of the site footprint and ZoI. However, some treelines will be felled resulting in a Local, negative effect (approximately 0.2-0.4 ha of mixed broadleaved woodland could be lost within the CPO in the absence of mitigation). These impacts would affect habitat connectivity for and foraging and breeding success for numerous species. These impacts could result in significant, permanent effects at a Local level.

7.6.3.3.14 WD2 Mixed Broadleaved and Conifer Woodland

In the absence of mitigation, no significant adverse effects are predicted as this area is deemed to be outside of the site works footprint and ZoI (Table 7.10). Potential for tree root disturbance and destabilising trees is plausible in the absence of mitigation, such as clearly demarking works areas, and unnecessary excavations at tree bases. Though not envisaged, these impacts could result in significant, Local, adverse, permanent effects to biodiversity through loss of refugia.

7.6.3.4 Impacts and Effects on Mammals

A summary of potential impacts and effects on mammals is given in Table 7-22.

7.6.3.4.1 Impacts and Effects on Bats

Temporary Lighting

In the absence of appropriate control measures, construction activities will temporarily light the crossing point for the proposed bridge over the Abbert River, potentially disrupting light sensitive species such as Daubenton's bat. The removal of hedgerows and treelines in the eastern end of the Proposed Road Development will cause severance, disrupting commuting and foraging bats. The geographic scale of effect significance to bat foraging habitats and the Abbert River is assessed at a Local level for the duration of construction (i.e. short-term). As no Lesser Horseshoe Bats were identified in the area, no impact of the Proposed Road Development is envisaged on Lesser Horseshoe Bat (QI species). In the event that a population uses the area of the Proposed Road Development, potential impacts on Lesser Horseshoe bats would be as described for other bat species.

Tree Felling

The removal of sections of hedgerow and treelines will be required. Tree felling may result in the loss of low value roost features that may be used or potentially be used by bats. The loss of trees is assessed as low impact at the Local geographic scale.

7.6.3.4.2 Impacts and Effects on Badger

No indirect impacts to setts are predicted. Badgers could move into the ZoI of the Proposed Road Development and set up a territory or territories within or immediately adjacent the Proposed Road Development. However, much of the lands within the ZoI is unsuitable for the establishment of setts, being low-lying and possibly at risk of flooding. However, it is feasible that Badgers could create new setts within more suitable areas such as some of the woodland areas to the south-west of the Proposed Road Development or in higher ground to the north of the Proposed Road Development. In this instance, in the absence of mitigation, the Proposed Road Development could have both direct and indirect impacts upon these populations. These are described below:

Although no setts were found within the ZoI of the Proposed Road Development or the wider area under study, it is not possible to predicted whether setts may be established within the ZoI before works commence. As this is a possibility, this scenario has been included in the mitigation strategy.

- **Loss of Setts:** The field surveys showed that there are no setts within the survey area. As there are no breeding or resting places within the boundary of the Proposed Road Development site, there will not be a loss of any such habitat as a result of construction works based upon existing survey data. However, Badger setts subsequently established within the footprint of Proposed Road Development will require exclusion and removal as per guidelines by TII (2006) under licence from NPWS. There is also potential, without mitigation applied, that Badgers could be killed during site clearance. This will be a potential significant negative effect at a Local geographical level.
- **Loss of Foraging Habitat:** The construction of the Proposed Road Development will not result in the loss of any significant amount of foraging habitat. This is based on the scale of the Proposed Road Development and the relative abundance of alternative foraging habitat locally.
- **Habitat Severance/Range Restriction**: Should any Badger groups establish territories within the area under survey, it may be considered near-certain that the physical disturbance to the existing landscape during site-clearance and construction will result in some initial temporary severance of Badger territory. However, as construction works will typically be undertaken during normal daylight working hours and Badgers are nocturnal in habit, any affected Badger groups will be expected to habituate to the altered landscape. The severance of territory and 'barrier' effect will be temporary in nature and unlikely to have any significant effects on populations over any geographical level.
- **Disturbance and 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 Badgers from both breeding/resting places and from foraging habitat. As construction works will typically be undertaken during normal daylight working hours and Badgers are nocturnal in habit, displacement of Badgers from foraging areas (outside of areas where foraging habitat will be lost as a result of the Proposed Road Development) is extremely unlikely to affect the local Badger population and will not result in a likely significant negative effect, at any geographic scale.

7.6.3.4.3 Impacts and Effects on Otter

Otter is a QI of Lough Corrib SAC. Although no holt sites were found within the ZoI of the Proposed Road Development or the wider area under study, it is not possible to predicted whether holts may be established within the ZoI before works commence. As this is a possibility, this scenario has been included in the mitigation strategy.

- **Loss of Breeding/Resting Places:** The field surveys showed that there are no holts or couches within the survey area. As there are no breeding or resting places within the boundary of the Proposed Road Development there will not be a loss of any such habitat as a result of construction works.
- **Habitat Loss:** Otter activity was found within close proximity to the proposed river crossing. In the context of River Systems, the Threat Response Plan for Otter (DOEHG, 2011) defines terrestrial Otter habitat as "*a 10 m zone of riparian habitat along the riverbank.*" The construction methodology for the single crossing of the Abbert River will be a clear-span bridge which will partially impact on the 10 m riparian zone (a minimum of 5 m of riverbank will be retained). No in-stream habitat will be lost. A shading effect from the bridge will occur. However, shading, and partial loss of the riparian zone at the location of the bridge will not result in a significant effect on Otter or Otter habitat quality. The area or riparian habitat to be lost is dominated by grassland, with low foraging value for Otter. The set-back of the bridge structure of $\geq$ 5m will ensure a riparian corridor exists that allows for terrestrial connectivity between both sides of the bridge structure, at both sides of the Abbert River. Therefore, a negligible loss of foraging habitat will occur, but connectivity along the riparian corridor will be retained.
- **Habitat Severance/Range Restriction**: No 'barrier' effect of any significance is predicted on Otters, given that the bridge structure will not impede or encroach onto the riparian zone.
- **Disturbance and Displacement**: As no Otter breeding or resting places were found to occur within the ZoI of the development it is not considered that there will be any significant disturbance or displacement impacts on such sites associated with the construction works. However, noise and vibration have the potential to temporarily displace commuting Otters within the river channel. While signs of Otter activity were found within close proximity of the proposed river crossing point, Otters are generally nocturnal in habit and works will typically be carried out during normal daylight hours. It has been noted in numerous studies (e.g. Bailey & Rochford, 2006; Irish Wildlife Trust, 2012) that Otters can demonstrate tolerance to human disturbance and are even active within city centres including Dublin (Ní Lamhna, 2008). It is considered therefore that disturbance during construction is not likely to have a significant effect on the conservation status of Otter populations at a Local or wider scale.
- **Habitat Degradation through Water Quality Impacts:** In the absence of mitigation and applying the precautionary principle, there is potential for the project to have impacts on water quality. This might impact on species such as brown trout and crayfish. Both of these are key prey items for Otters. Thus, habitat degradation through surface water quality impacts could have a significant effect on the conservation status of Otter populations at a Local scale.
- **Physical Damage**: Otter could establish below-ground holts between the completion of mammal surveys informing the EIAR, and the start date of construction. If new holts became established within the ZoI of drilling prior to construction, piling could result in injury of Otter and/or young, potentially resulting in population-level significant effects at Local scale.

7.6.3.4.4 Impacts and Effects on Other Protected Mammal Species

In the absence of reliable techniques to determine their use of dense vegetation while breeding or during hibernation, pygmy shrew, stoat, and hedgehog are all presumed present (as breeding and/or hibernating populations) within scrub, grassland, treeline, and woodland habitats within the Proposed Road Development and wider ZoI. Site clearance at any time of year could result in injury or mortality to these species and destroy breeding or resting sites. Population effects will be greatest when juveniles remain present in nests (i.e. generally from April-October in the case of all three species).

These impacts could include permanent habitat loss within the boundary of the Proposed Road Development. However, given the relatively small scale of the Proposed Road Development and relative abundance of the habitat types to be affected, habitat loss is extremely unlikely to affect any of these species' conservation status at any geographical scale.

Site clearance works will pose a potential mortality risk to these mammal species. The greatest risk in these terms is if clearance is carried out during breeding seasons (as described above). Habitat severance, range restriction and barrier effects may be expected as described for Badger (above). Mitigation measures have been drawn up to address these impacts.

Disturbance and displacement effects could be expected during the construction phase, but these will be intermittent and temporary. Some disturbance and displacement could be expected in the long-term as a result of the operational phase of the Proposed Road Development. However, given the relatively small scale of the Proposed Road Development and the relative abundance of the habitat types in the wider area, disturbance or displacement effects are unlikely to affect any species' conservation status on any geographic scale. Taken together, site potential impacts will result in significant effects at local geographic scale, for the duration of construction and a period of time thereafter (i.e. < 7 years and therefore short-term).

7.6.3.5 Impacts and Effects on Birds

7.6.3.5.1 Breeding Birds

Potential impacts and effects on birds are summarised in Table 7-22. The pre-construction (site clearance) and construction phases pose various threats to birds. The primary impact will be unavoidable habitat loss. Sheetpiling and excavation can cause noise and vibration disturbance. The presence of anthropogenic activity (construction), artificial lighting and the presence of vehicles associated with the Proposed Road Development (road construction and bridge development) also pose a potential risk of disturbance to birds. A pollution risk is also presented, whereby birds species could be impacted by pollutants (e.g. oil spills in a wetland feeding area), with direct and indirect impacts including possible bird mortality. In the absence of mitigation and appropriate control measures, potential impacts could result in significant short-medium term effects on birds in the adjacent environment.

Construction works could disturb several territories of High Conservation Concern; Meadow Pipit, at least one territory of High Conservation Concern; Grey Wagtail, at least one territory of Medium Conservation Concern; Greenfinch, one territory for breeding Kingfisher, one territory of Stonechat and possibly several territories each of a number of Low Conservation Concern passerines. Potential effects include injury to eggs, young and nests, failed nesting attempts and permanent loss of potential nesting sites and foraging habitat. No buildings are posed for demolition, and therefore, breeding areas for species such as Swift*,* Swallow and House Martin are not envisaged to be impacted by the proposed works.

It is noteworthy that Kingfisher nest outside of the ZoI. If nesting of Kingfisher was to occur within the ZoI prior to development, negative impacts on Kingfisher could occur. Reduced nesting success for this species may constitute a short-term significant impact at a local-county scale. Potential effects for other breeding birds will not be significant above Local-County geographic scale. The duration of these potential effects is estimated will be limited to short term.

7.6.3.5.2 Wintering and Wetland Birds

In the absence of mitigation, adverse impacts on wintering and wetland birds could be plausible, with risk of direct mortality and local disturbance/displacement from some foraging areas. Wetland birds could be adversely impacted locally by pollution of surface waters (e.g. hydrocarbon contamination of waters, which may result in ingestion of contaminants and poisoning. Additionally, feather contact with hydrocarbons can cause reduced insulation capacity, leading to hypothermia and mortality). Potential effects for wintering birds will not be significant above Local geographic scale. The duration of these potential effects is estimated will be limited to be short term.

7.6.3.6 Impacts and Effects on Fish

In the absence of mitigation, the Proposed Road Development could have a range of potential adverse effects on fish species, including QI of European sites within the ZoI, during the construction phase. Potential impacts and effects during construction could include:

- Potential for the release of pollutants and contaminants (i.e. suspended solids, oils, fuels, paints, concrete, lime, etc.) to receiving watercourses;
- Habitat loss;
- Disturbance (i.e. visual, vibration and noise, temporary barriers to connectivity, etc.);
- Disconnection of habitat (Drain removal);

- Desiccation of wet area (a selected drain) with associated fish mortality; and
- Damage to fish from pumping operations.

A range of factors influence the potential impacts and effects including:

- Vulnerability of individual receptors (sensitivity of fish populations);
- Time of year and lifecycle stage of a species effected; and
- Potential for unforeseen events such as extreme weather (including flooding of working areas).

Impacts on fish are most likely to arise from the following (which are discussed below):

- Surface water Pollution;
- Groundwater pollution;
- Habitat Loss/Deterioration;
- Disturbance; and
- Physical damage (Fish mortality)

7.6.3.6.1 Surface Water Pollution

Construction activities taking place close to watercourses, or in watercourses (drains) pose the following threats to watercourses:

- Release of suspended solids;
- Release of hydrocarbons; and
- Release of water contaminated with concrete and lime.

Each of these three elements have the potential to negatively affect fish species (including QI species) in the Abbert River, and other watercourses/drains where works are undertaken. The release of suspended solids, hydrocarbons and water contaminated with concrete and lime can influence hydrochemistry, macroinvertebrate communities, aquatic plant assemblages and fragile spawning areas of Salmonids and lamprey downstream, for which the Abbert River is noted. This could have significant effects on fish species of short-term duration, through mortality due to chemical poisoning, asphyxia or increased alkalinity, and changes to oxygen levels in the water.

7.6.3.6.2 Groundwater Pollution

In the absence of appropriate mitigation, there is the potential pollution impacts to groundwater and soils by way of accidental spillages of hydrocarbons, concrete, and lime. This could result in effects on soils and groundwater underlying the Proposed Road Development if hydrocarbons, concrete, and lime were inappropriately handled or stored during the construction phase. Potential contaminants could migrate through the subsoils and impact underlying groundwater, eventually migrating to the Abbert River. This could have temporary detrimental effects on fish species in the short term, through mortality, due to chemical poisoning, asphyxia or increased alkalinity, and changes to oxygen levels in the water.

7.6.3.6.3 Habitat Loss/Deterioration

Land-take on both the northern and southern banks of the Abbert River is required to facilitate construction of the new route and associated infrastructure. Loss of bankside vegetation can promote river erosion, a reduced buffer zone which acts as a form of protection against other land-based activities, reduced leaf litter input to the Abbert River, which is a food source for macroinvertebrates, reduced terrestrial invertebrates which provide a food source to fish and reduced shading which can lead to increased water temperatures. Potential also exists for habitat deterioration in the form of release of general waste and construction debris. This constitutes a temporary effect on riparian habitat.

7.6.3.6.4 Disturbance

Sound from piling of abutments located on the river banks will be emitted both through the water column as a sound pressure wave and through the ground as vibration. Piling will take place within 2.5 m of the top of the riverbank. Atlantic Salmon are particularly sound insensitive, lacking specialist hearing mechanisms (Hawkins & Johnstone, 1978). This reduces the fish's sensitivity and bandwidth to detect a noise stimulus, resulting in a poorer ability to distinguish specific acoustic cues from background noise (Radford *et al.*, 2012). Brown trout exposed to a real piling event (average noise level 134 re 1 µPa, peak) did not exhibit any behavioural changes (Nedwell *et al*., 2003; 2006). Whilst they may hear sheet piling, this will occur over a short space of time and disturbance will be minimal. A dearth of information exists with regards to hearing in lamprey. It is highly unlikely that they will detect sound close to 10 kHz (Popper, 2005).

The results of three empirical studies examining the tolerances of Salmonid embryos to mechanical shock exposure suggest that 5.8 in/s (147 mm/s) is the minimum particle velocity that causes negative effects (Kolden *et al*., 2013). Fish embryos exposed to physical disturbance during epiboly can sustain tears in the perivitelline membrane, causing yolk to leak within the embryo (Smirnov, 1954). The potential for significant injury and/or disturbance effects to QI Atlantic Salmon and Brook Lamprey eggs from piling is assumed to be significant within the locality of proposed drilling activities, during drilling. This will be a localised temporary impact with potentially significant effects in the short-term (1-7 years).

7.6.3.6.5 Physical Damage (Fish Mortality)

In one drain, a diversion of the drain is required. Pumping operations, backfilling of drain habitat, desiccation of the drain if bunded off from the main channel could result in the mortality of fish within this drain. In the absence of mitigation and appropriate control measures during drain works, potential impacts could result in significant short-term effects.

7.6.3.7 Amphibians

Suitable spawning sites for Common Frog were found in several locations and these included substantial drainage ditches, pools, and wet grassland areas. One spawning site was confirmed but this was found outside of the ZoI of the Proposed Road Development. If clearance works take place within the period when spawn, tadpoles or froglets are likely to be present at a suitable site (February to July, inclusive), works could result in mortality. There will also be a permanent loss of spawning habitat. This could be significant negative effect on a Local scale. The duration of such an effect is difficult to predict. It is reasonable to assume that this could be limited to the short-term.

7.6.3.8 Lepidoptera

Site clearance will likely result in the direct mortality of adult butterflies and/or caterpillars/eggs of several common species of Least Conservation Concern. This will likely result in short term significant effects at Local geographical level. No impacts on Marsh Fritillary are predicted.

7.6.3.9 White-clawed Crayfish

No impacts on this species were predicted as likely, as the species was not identified during survey and no in-stream works will take place. There are previous records for this species in the Abbert River and this species is a QI for the Lough Corrib SAC. In the absence of mitigation and applying the precautionary principle, potential effects from degradation in water quality could be predicted as being of Local significance in the short-term.

7.6.3.10 Other Protected and Notable Species

Potential disturbance/displacement impacts to common lizard populations presumed to be present in the grassland habitats here could result in significant effects at Local scale in the short-term (the duration of construction).

7.6.4 Operational Phase

This section presents potential operation phase impacts and effects for the Proposed Road Development in isolation. This section should be read in conjunction with Table 7-21 and Table 7-22.

In the absence of mitigation and appropriate control measures, the Proposed Road Development could have a range of potential impacts on the QIs of European sites, and other KERs within the ZoI during the operational phase. Potential impacts during the operational phase include pollution, collision risk, artificial lighting, habitat loss, hydrological change, presence of barriers to migration and movement and increased disturbance. These have the potential of causing harmful effects to species and habitats, including habitat degradation, reduced range, reduced fitness, changed behaviour, mortalities due to collisions (road casualties), and interference with movement and behaviour due to barriers (e.g. culverts, fence lines, lighting). These factors may manifest themselves, individually, or in combination, with adverse effects on habitats and species populations within the ZoI. Spread of invasive species may additionally result in reduced availability of suitable habitat for species.

7.6.4.1 Surface Water

The Proposed Road Development will incorporate an embedded drainage system design that will allow storm-water management (see Section.6.1 and Section 4.5.2 of Chapter 04 Description of the Proposed Road Development). This will include petrol interceptors when outfalling to the Abbert River and attenuation ponds (See Chapter 09 Water). It is not envisaged that the normal operating water quality of the drainage outfalls discharging to surface water or drainage system will have any significant long-term adverse effect on water quality in the Abbert River, even in the event of a pollution incident. Habitat degradation as a consequence of operational effects on surface water is not predicted to affect the conservation status of any aquatic or wetland habitats and will therefore, not result in a likely significant effect, at any geographic scale.

7.6.4.2 Ground Water

There will be no active de-watering, of the bedrock aquifer, required during the operation phase but passive de-watering, 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. This impact on the hydrogeological regime has the potential to affect the conservation status of groundwater-dependant aquatic or wetland habitats and species and therefore, has the potential to result in a significant negative impact on Groundwater Dependent Terrestrial Ecosystems, wetland habitats and species. 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 (See Chapter 09 Water).

7.6.4.3 Air Quality

The ZoI of air quality effects is generally local to the edge of the Proposed Road Development and affected road network and not greater than a distance of 200 m (TII 2011).

Road traffic gives rise to emissions from exhausts as well as the deposition of particulates from the operation of engines and the wearing of brakes, clutches, and tyres. Increased deposition of oxides of Nitrogen, Ammonia, volatile organic compounds, heavy metals, and particulate matter within the immediate environment of the road may also be predicted. Effects on receiving habitats, especially vegetation communities can include influences on plant growth rates, species composition, species abundance and diversity.

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' (TII, 2011). These are also described in 'The Ecological Effects of Air Pollution from Road Transport: An Updated Review' (Natural England, 2016) and 'The Ecological Effects of Diffuse Air Pollution from Road Transport' (Bignal *et al.*, 2004).

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 (Bignal *et al.*, 2004; Natural England, 2016) and are therefore not considered further in this chapter.

NOx, NOs and NH_3

Air quality modelling of NOx concentrations and deposition rates have been calculated at distances up to 200 m from the Proposed Road Development (refer to Section 10.7.2.3 of Chapter 10 Air Quality for details). The Air Quality Standards Regulations (AQS) 2011 (S.I. No. 180 of 2011) have a limit value of 30 µg/m^3 for the protection of vegetation.

In all areas, the worst-case predicted annual average NOx concentrations at various distances from the Proposed Road Development are significantly (65%) below the limit value of 30 µg/m^3 for the Do-Something scenario including background concentrations. This includes the areas adjacent to the boundary of Lough Corrib SAC. Predicted concentrations are in compliance with the Air Quality Standard for the protection of vegetation (limit value of 30 µg/m^3). Therefore, even at <10 m from the edge of the Proposed Road Development, harmful effects on vegetation from NOx are not likely.

The contribution of the Proposed Road Development to the NO_2 dry deposition rate was assessed along a 200 m transect from the road edge in four locations. The modelled deposition was significantly below the critical load for the lower boundary limit for grassland habitat ("E1") occurring here or other grassland types. EPA modelling ('Research 323: Critical Loads and Soil-Vegetation Modelling' (EPA, 2020)) has recorded a background deposition of 12 kg(N)/ha/year on the woodland adjacent the scheme's eastern extent ("E4"). This exceeds the lower boundary limit for this habitat. The modelled NO_2 deposition predicts an increase of 0.3% of critical load on this woodland which may be regarded as being not significant.

An Air Quality Model was developed by AECOM (see Air Quality Chapter 10) for the Proposed Road Development. At the proposed crossing, data from EPA ('Research 323: Critical Loads and Soil-Vegetation Modelling*'* (EPA, 2020) shows that the background NO_2 levels already exceed the critical load for the lower boundary limit for freshwater habitat (5 – 10 kg(N)/ha/year). Modelling has predicted an increase in the deposition load of 0.2 kg(N)/ha/year at the proposed bridge crossing (+4.5% of the critical load). However, at the existing bridge crossing, a decrease of 0.3 kg(N)/ha/year is predicted (-5.3% of the critical load). There will therefore be an overall decrease in deposition load to the Abbert River and adjacent habitats during the operational phase of the Proposed Road Development. Therefore, harmful effects on vegetation or fauna within Lough Corrib SAC from NO_2 are not predicted.

The contribution of the Proposed Road Development to the NO_2 dry deposition rate along a 200 m transect from the edge of the Proposed Road Development is well below the critical load for the lower boundary limit for *Molinia caerula* habitats of 5-10 Kg(N)/ha/year (TII, 2011) and therefore, harmful effects on vegetation within this Annex I habitat from NO_2 are not likely.

Ammonia (NH_3) is emitted in small amounts by vehicles, but atmospheric concentrations are well below critical levels for this pollutant (Natural England, 2016; Bignal *et al*., 2004) and therefore, effects on vegetation within Lough Corrib SAC from ammonia are not likely, and therefore no significant effect is predicted.

Particulate Matter and Heavy Metals

Heavy metals from car emissions are associated with emissions of Particulate Matter, PM_{10} (particulate matter less than 10 µm) and $PM_{2.5}$ (particulate matter less than 2.5 µm). 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 40 µg/m^3 and 25 µg/m^3 respectively for the protection of human health and the environment as a whole. The maximum predicted concentrations along the route of the Proposed Road Development for the Do-Something scenario, including background concentrations, were well below these standards (refer to Chapter 10 Air Quality for details).

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 20-30 m. Given the 20-30 m zone within which the majority of PM/HM will be deposited, the low concentrations predicted, and dispersion due to wind, impacts on vegetation within the SAC from PM or HM are not likely and therefore no significant effect is predicted.

Conclusion

During operation, air quality impacts from the Proposed Road Development on vegetation within Lough Corrib SAC and other habitats within the ZoI of the Proposed Road Development works and are not likely to occur and will not result in a likely significant negative effect, at any geographic scale.

7.6.4.4 European Sites (Lough Corrib SAC Only)

In the absence of mitigation and appropriate control measures, the Proposed Road Development could have a range of potential impacts on the QI of Lough Corrib SAC within the ZoI during the operational phase. Road surface run-off containing contaminants could enter Lough Corrib SAC, with potential short-term effects. Potential impacts during the operational phase include pollution, habitat loss, hydrogeological change, habitat deterioration, barriers to connectivity, disturbance, mortalities due to collisions (road casualties) and artificial lighting. These factors have been dealt with in the mitigation measures outlined in this Chapter. A NIS has also been prepared to additionally provide the competent authorities with the information necessary to complete an Appropriate Assessment for the Proposed Road Development in compliance with Article 6(3) of the Habitats Directive.

7.6.4.4.1 FP1 Calcareous Springs - Annex I Petrifying Springs with Tufa Formation

In the absence of appropriate monitoring and implementation of mitigation post construction, drainage changes may result in long-term habitat deterioration and loss of Annex I -Petrifying Springs with Tufa formation through changes in groundwater flows and changes in water chemistry. Note that this habitat is within Lough Corrib SAC, but outside of the immediate footprint of the Proposed Road Development. Mitigation measures to protect this habitat are noted in Section 7.7.

7.6.4.5 Other Nationally Designated Sites

No impacts to other nationally designated sites, associated with the operation phase, are envisaged.

7.6.4.6 Local Habitat Loss

7.6.4.6.1 GS4 Wet Grassland – Annex I Molinia Meadows on Calcareous, Peaty or Clayey-silt-laden soils

In the absence of appropriate mitigation during construction, and absence of appropriate monitoring and implementation of mitigation post construction, drainage changes may result in long-term habitat deterioration and loss. Legacy issues from drainage during construction could result in habitat change during the operational phase. In the absence of adequate grazing, effects may also include habitat degradation and loss. This will represent an overall loss of habitat and loss of biodiversity. The loss of this habitat will result in significant effects at a County level. During operation, air quality effects on *Molinia* meadow habitat in the vicinity of the Proposed Road Development are not likely to affect plant species composition, diversity, or abundance. Mitigation measures are provided in Section 7.7.

7.6.4.6.2 Non-Annex Habitats

No terrestrial habitat loss associated within the operation phase is envisaged. Positive impacts locally are envisaged though development of the area following the landscaping plan, which includes planting of native species, and development of wetland areas.

7.6.4.7 Bats

7.6.4.7.1 Bats (Severance of Riparian Corridor)

Given the available data on use of culverts by the species of bats present (Bach *et al* 2004; Boonman, 2011; Abbott *et al*., 2012), the freeboard (approximately 2.5 m) above the 1% AEP flood level (1:100 year) is, when combined with the clear span bridge design predicted to provide sufficient height above water, and sufficient cross-sectional area to avoid any significant obstacle to bats commuting and feeding in the Abbert River corridor. The majority of the Proposed Road Development will pass through agricultural fields with hedgerow and treeline severance primarily limited to a small area at the eastern end.

7.6.4.7.2 Bats (Lighting)

A UK research report into the impact of lighting on bats (Stone, 2013) has categorised bats (including all Irish species), with reference to their potential relative sensitivity to lighting impacts. Leisler's bat, common pipistrelle, and soprano pipistrelle are, relative to other Irish bats, considered to be of Low to Medium sensitivity to lighting. Light spill onto the Abbert River and hedgerows and treelines could potentially disturb or displace up to seven species, especially Daubenton's bat, (of a total of nine in Ireland) during the operational phase of the Proposed Road Development. Potential effects to bats could be significant at Local to County geographic scales for the duration of operation (i.e. in the long-term). As a lighting design has been developed with ecological input, potential light spill onto sensitive habitats has been reduced, and therefore adverse impacts on bats have been minimised (see Section 4.5.8, Chapter 04 Description of the Proposed Road Development and Volume 03; Figure A4-33).

7.6.4.8 Mammals

7.6.4.8.1 Impacts on Badger

Although no setts were found within the ZoI of the Proposed Road Development or the wider area under study, it may not be predicted whether setts may be established within the ZoI before the operational phase of the Proposed Road Development commences. As this is a possibility, this scenario has been included in the mitigation strategy.

- **Habitat Severance/Range Restriction**: The construction of a new road where it severs existing Badger territories has the potential to act as a permanent barrier to Badger movement – either as a physical barrier or through road traffic being a deterrent to movement. The Proposed Road Development will not affect extensive areas of the suitable foraging habitat in terms of habitat severance or 'barrier effect.' Only five fields will be affected (e.g. transected) by the Proposed Road Development to the north of the Abbert River and seven smaller fields to the south. However, it should be noted that the clear-span bridge, even in absence of other mitigation) will allow movement of terrestrial mammals along the riparian zone.

- Nonetheless, the Proposed Road Development will have potential to act as a barrier to Badger movements. This will have potential for long-term effects on local Badger population dynamics. It could also affect both local foraging behaviour and competition for resources as well as dispersal of populations and genetic exchange between these. Potential long-term significant negative effects on Badger populations at a Local geographic scale cannot be ruled out. In order to address any severance, range restriction or barrier impacts, mitigation measures have been embedded in the design.
- **Mortality Risk:** The construction of a new road development in a rural landscape will permanently increase the risk of road traffic collisions with Badger. Although it is not possible to quantify the magnitude of the effect, the increased collision risk has the potential to result in long-term, moderate effects on Badger populations on a Local geographical scale (see Table 7-22). Mitigation measures including mammal fencing and large diameter ≥ 600 mm culverts that will function as underpasses have been included in Volume 3, Figure 7-11.

7.6.4.8.2 Impacts on Otter

- **Habitat Severance/Range Restriction**: The proposed bridge crossing will be via a clear-span structure. This will not represent a barrier to Otter movement along the Abbert River nor will it effect the existing hydrological regime or functioning of the river. Therefore, Otter populations here will not be affected in this regard.
- **Disturbance and Displacement:** As described above, Otters have been recorded as being relatively tolerant of human and traffic disturbance. Any increased level of disturbance associated with the Proposed Road Development is therefore extremely unlikely to have any perceptible disturbance or displacement of Otter from their habitat. Lighting of the bridge structure could have negative impacts on nocturnal species, including Otter (Rich & Longcore, 2005). However, the control of light-spill from the water and riparian zone will greatly reduce the significance of this effect. It is considered therefore that disturbance and displacement impacts during the operational phase of the Proposed Road Development are not likely to result in significant effects on the conservation status of Otter populations at a Local or wider scale.
- **Habitat Degradation through Water Quality Impacts:** The Proposed Road Development will incorporate a drainage system that will allow storm-water management. This will include attenuation ponds. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to surface water or drainage system will have any perceptible impact on water quality in the Abbert River, even in the event of a pollution incident. The road drainage network is described in more detail in Chapter 09 Water of this EIAR. Thus, habitat degradation through surface water quality impacts is not likely to have a significant effect on the conservation status of Otter populations at a Local or wider scale.
- **Mortality Risk:** The construction of the Proposed Road Development in a rural location, including a new watercourse crossing will permanently increase the risk of road traffic collisions with Otter, especially in areas proximate to the Abbert River. Although it is not possible to quantify the magnitude of the effect, the increased collision risk has the potential to result in long-term effects on Otter populations on a Local geographical scale(Table 7-22). Mitigation measures have been drawn-up to avoid this potential impact (see Section 7.7).

7.6.4.8.3 Impacts on other Protected Mammal Species

Some disturbance and displacement may be expected in the long-term as a result of the operational phase of the Proposed Road Development. However, given the relatively small scale of the Proposed Road Development and the relative abundance of the habitat types in the wider area, disturbance or displacement impacts are unlikely to affect any species' conservation status significantly on any geographic scale greater than a Local level. Therefore, the effect of the Proposed Road Development on this group is not deemed to be significant, while it is considered to be a long-term impact at a Local level arising from habitat loss (Table 7-22).

7.6.4.9 Birds

7.6.4.9.1 Bird Disturbance

The operational phases pose various threats to birds. The presence of anthropogenic activity (walking, cycling), artificial lighting and the presence of cars pose a potential risk of Local disturbance to birds. The effects of disturbance and displacement are expected to decrease over time as birds habituate to the new habitat configuration. The design of the Proposed Road Development avoids any long-term adverse impacts from disturbance to birds (Table 7-22).

7.6.4.9.2 Kingfisher

Kingfisher foraging behaviour (involving visual identification of fish prey in water) requires them to fly in low light conditions which enhance the risk of bridge strike. Collision with man-made objects including bridges has not been identified as a known threat to Irish Kingfisher populations (Cummins *et al*., 2010; NPWS, undated). The BTO's Ringing Scheme for historical ringing recoveries of dead or injured birds (containing over 3,000 records) does not contain any records for Kingfisher assigned 'circumstance codes' relating to strikes with man-made objects. The evidence base indicates there is unlikely to be significant risk of collision impacts to Kingfisher from the proposed bridge crossing. The design of the Proposed Road Development avoids any long-term adverse impacts to Kingfisher (Table 7-22).

7.6.4.9.3 Barn Owl

Barn Owl *Tyto alba* is red-listed in Ireland. Several studies to assess avian road mortalities have recorded Barn Owls to be the most frequently affected bird species (Baudvin 1997, Boves and Belthoff, 2012), or raptor (Massemin and Zorn 1998). Due to their rarity, cryptic nature, habitat associations, or foraging behaviour, Barn Owl are difficult to survey. Barn Owl have nocturnal foraging tendencies and therefore the survey methodology is unsuitable for this species. No barns or outhouses were noted for Barn Owl nesting potential within the survey area, and no signs of Barn Owl were detected during surveying. Barn Owls can be adversely affected by road developments (Lusby, 2019, TII, 2021). A significant long-term negative effect on Barn Owl could occur in the absence of mitigation. Effects could include mortality from road collisions. Mitigation for Barn Owl is described in Section 7.7. The design of the Proposed Road Development avoids any long-term adverse impacts to Barn Owl (Table 7-22).

7.6.4.9.4 Wintering and Wetland Birds

There will be a local loss of habitat for some wintering and wetland bird species. Some wetland species may benefit from the retention of settlement ponds (e.g. Mallard *Anas platyrhynchos*). In the absence of mitigation, road run-off could pose a pollution risk to wetland birds. The embedded design of the Proposed Road Development avoids any long-term adverse impacts from pollution to these wetland birds (Table 7-22).

7.6.4.10 Fish

In the absence of mitigation and appropriate control measures, the Proposed Road Development could have a range of potentially significant, Local impacts on the QI fish species within the ZoI during the operation phase.

7.6.4.10.1 Water Quality

There is potential for impacts on surface and ground water quality during the operational phase associated with the proposed drainage system and attenuation pond, and from infiltration of contaminated groundwater into the surface water network. Routine road runoff from the operation of the Proposed Road Development has the potential to impact on water quality in the receiving Abbert River that could potentially impact on QI Brook Lamprey and Atlantic Salmon, as well as all other fish species, exposed to a range of contaminants. These typically include hydrocarbons, suspended solids, and de-icing agents. In the absence of mitigation, there is the potential for short-term significant effects associated with accidental spills and leaks to occur from vehicles using the Proposed Road Development during its operation.

7.6.4.10.2 Habitat Loss/Deterioration

The proposed bridge is a clear span structure and will cast a permanent shadow on the underlying riverbed. Excessive shading of the riverbed will potentially effect the aquatic flora community present in the riverbed at a Local level (O'Grady, 2006). Bridges, bankside vegetation and trees provide shade along watercourses which promotes thermal regulation that will become increasingly important to Salmonids and other fish species as climate change alters water temperatures in riverine environments. Shading associated with the proposed bridge crossing at the Abbert River is unlikely to result in habitat loss or displacement of QI Atlantic Salmon and Brook Lamprey during the operation phase. In the absence of mitigation and appropriate control measures as noted in Section 7.7, removal of bankside vegetation and bank material could result in significant temporary effects at a Local level.

7.6.4.10.3 Disturbance from Human Presence and Lighting

The presence of cyclists and pedestrians (irregular and unpredictable), artificial lighting and to a lesser extent the presence of cars (regular and predictable) associated with the proposed bridge crossing poses a potential risk of disturbance to migrating Salmon under certain daytime, low flow conditions. The effects on downstream migrating Salmon smolts has been assessed and can induce short delays (Bloch *et al*., 2009). These delays can lead to increased predation. Artificial light can increase luminance levels in natural areas which could affect ecological functions. The location of inappropriate lighting could result in Salmon smolt migration disturbance and alteration in fry dispersal leading to reduced fitness (Riley *et al*., 2013). In the absence of mitigation and appropriate control measures as noted in Section 7.7, disturbance could result in significant long-term effects at a Local level.

7.6.4.10.4 Barrier to Connectivity

The proposed bridge abutments are located at a setback distance of >/= 5 m on both sides of the Abbert River. The bridge is an open span structure meaning no instream structures are required which could otherwise impede the upstream and downstream migration of fish species.

There is no potential for artificial light to spill onto the Abbert River as there will be no lighting on the bridge structure. Therefore, there are no significant effects predicted on habitat usage by fish species Table 7-22.

7.6.4.11 Amphibians

Operational impacts on amphibians will be limited to range restriction/barrier effects. This could be predicted as being a permanent significant effect at a Local scale. Pond and wet grassland creation (breeding and non-breeding habitat) will increase available habitat for these species with positive effects anticipated (Table 7-22).

7.6.4.12 Lepidoptera

No adverse operation phase effects of any significance are predicted. Potential positive operational effects at a Local level may be envisaged (Table 7-22).

7.6.4.13 White-clawed Crayfish

Habitat Degradation through Water Quality Impacts

The Proposed Road Development will incorporate a drainage system that will allow storm-water management. This will include attenuation ponds. It is extremely unlikely that the normal operating water quality of the drainage outfalls discharging to surface water or drainage system will have any perceptible impact on water quality in the Abbert River, even in the event of a pollution incident. The road drainage network is described in more detail in Section 4.5.2 of Chapter 04 Description of the Proposed Road Development of this EIAR. Thus, habitat degradation through surface water quality impacts is not likely to have a significant effect on the conservation status of Crayfish populations at a Local or wider scale (Table 7-22).

7.6.4.14 Other Protected and Notable Species

Operational phase effects on reptiles will be limited to range restriction/barrier and direct mortality through road-kill effects. In the absence of mitigation these could be predicted as being permanent significant effects at a Local scale (see Table 7-22).

7.7 Mitigation and Monitoring Measures

7.7.1 Mitigation Measures

7.7.1.1 Construction-Phase

7.7.1.1.1 General Mitigation Measures

Section 7.6 of this chapter identified impacts and effects likely to arise from the Proposed Road Development in the absence of mitigation. This section prescribes the mitigation measures and appropriate control measures to block pathways with the potential to result in adverse effects thereby protecting the integrity of European sites during the construction and operational phases of the Proposed Road Development.

The project adopts a number of pre-construction, construction and operation-phase measures that will avoid the potential for adverse impacts to habitats and species. Mitigation measures include those to be employed by the appointed Contractor during construction and Galway County Council (GCC) during the operational phase. These measures include the following key themes:

- Ecological surveying will be undertaken during the pre-construction and construction phases, to assess impacts on ecological receptors including selected habitats and species and assess site works to ensure adequate mitigation outlined in this EIAR has been installed;
- Appropriate timing of works by location within the Proposed Road Development footprint to minimise disturbance of nesting birds (being cognisant of bird nesting season) and other fauna (e.g. period for frogspawn, piling works);
- Use of monitoring by a suitably experienced Ecological Clerk of Works (ECoW) to determine the effectiveness of mitigation and liaison between contractor, client and client's Ecological Specialist, NPWS and IFI on mitigation implementation; and
- Precedence of mitigation protecting European sites over mitigation protecting other features if any unforeseen conflict arises.

7.7.1.1.2 Role of the Ecological Specialist and Ecological Clerk of Works

Prior to commencement of construction, a suitably experienced Ecologist will be engaged as part of the Employer's Representative (ER) Team. The Ecologist (referred to throughout this document as 'Ecological Specialist') will be a full member of a relevant professional institute such as the Chartered Institute of Ecology and Environmental Management (CIEEM), have relevant experience in the management of ecological constraints during construction, and hold or have held a protected species licence(s) in the Republic of Ireland. The Ecological Specialist shall be appointed sufficiently in advance of the Proposed Road Development to arrange for any mitigation requirements to be incorporated into the Contractor's site-specific programme. The Ecological Specialist will:

- Oversee carrying out of pre-construction surveys to the appropriate TII specifications (TII, 2005-2011);
- Supervise and direct construction of the Proposed Road Development as part of the Employer's Site Representative (ESR) Team;
- The role of the Ecological Specialist will include communicating and reporting pre-construction survey findings, and associated actions and plans arising to GCC, the Contractor, the NPWS and/or the IFI as appropriate;

The Ecological Specialist will agree on a water monitoring programme with NPWS and IFI, which will include turbidity, conductivity and pH;

- The Ecological Specialist will ensure mitigation addresses any changes in site conditions since completion of surveys that inform this EIAR in 2020 and 2021;
- The client/client representative team will ensure the Ecological Specialist has the necessary support in their role to carry out the duties required;
- The Ecological Specialist will review Contractor's method statements to ensure compliance with mitigation measures in this EIAR and the NIS; and

- The Ecological Specialist will liaise with the Contractor in regard to ecological requirements and mitigation for works and aspects of non-compliance with ecological requirements, if applicable.

At least six months (and no later than 12 months) in advance of commencing any construction works (including enabling or advance works), the Ecological Specialist will oversee the design and implementation of pre-construction surveys having regard for best available scientific knowledge including the specifications in the TII Environmental and Construction Guidelines (2005-2011).

The objective of these surveys will be to determine if any new breeding or resting sites of protected species, or new invasive species populations have become established since surveys were completed in 2019, 2020 and 2021.

The Client/Client Representative, with guidance from a suitably qualified Ecological Specialist will ensure suitably experienced ecologists complete the pre-construction surveys (as determined by the appointed Ecological Specialist).

The Ecological Specialist will coordinate and manage the following surveys:

- Otter breeding or resting sites (within 150 m of proposed piling works and 50 m of all other works);

Inspection of marked site boundaries (marked by the project engineers), to ensure no unnecessary clearance of habitat occurs;

- Kingfisher nesting sites (within 150 m of proposed piling works and 50 m of all other works);
- Badger breeding or resting sites (within 150 m of proposed piling works and 50 m of all other works);
- Red squirrel dreys (within 50 m of all works);
- Suitable amphibian spawning habitat (within 50m of works);
- Other protected mammal species (within 50 m of all works);
- Evidence of Barn Owl nesting/suitable nest sites (within 50 m of all works);
- Invasive species (within 50 m of all other works);
- Marsh Fritillary and food plant survey will be carried out within the ZoI in suitable habitat including wet grassland areas on both the eastern and western extents of the Proposed Road Development; and
- Trees with bat roost potential within the works footprint.

The Ecological Specialist will take necessary steps to mitigate survey limitations including for instance:

- Overseeing localised clearance of dense vegetation to search for Badger and Otter where the pre-construction survey window does not overlap winter/early spring (i.e. vegetation die-back);
- Survey Kingfisher nest sites where the pre-construction survey window does not overlap with the Kingfisher nesting season, or where areas with potential to contain Otter breeding or resting areas may exist following surveys; and
- Maintain observation records of protected species and highlight mitigation/licencing requirements if necessary.

Prior to commencement of construction, a suitably experienced ECoW will be engaged as part of the Contractor's Team. The ECoW will be a full member of a relevant professional institute such as the Chartered Institute of Ecology and Environmental Management (CIEEM), have relevant experience in the management of ecological constraints during construction. During construction and handover phases, the ECoW will oversee and advise the appointed Contractor(s) on implementation of mitigation. Also see 7.7.2.1.2 'Role of the Ecological Clerk of Works'. The Contractor will accommodate the ECoW, whose role will be to:

- Oversee and advise the appointed Contractor(s) on implementation of mitigation during construction and handover phases;
- Communicate relevant matters to the Contractor, the Client, and other stakeholders as required;
- Review and aid in the development of Contractor Method Statements for compliance with the mitigation requirements in this EIAR and the NIS;

- Conduct site monitoring including surface water monitoring, and monitoring of Annex I habitats as noted in this EIAR;
- Attend site meetings and give input to Contractor toolbox talks prior to commencement and during construction of the Proposed Road Development;
- The ECoW will ensure that the contractor is aware of and adheres to the required mitigation and will liaise with the clients' Ecological Specialist in terms of ecological considerations and mitigation;
- The ECoW will determine the potential requirement for licences outside the scope of this EIAR Chapter (e.g. Frogspawn translocation); and
- Pre-Construction Surveys.

7.7.1.1.3 Pollution Control Mitigation

7.7.1.1.3.1 Water Quality and Earthworks

The measures described in this section will be further refined and expanded by the appointed Contractor into a Construction Environmental Management Plan (CEMP) as more information becomes available in the course of detailed road design (e.g. including but not limited to construction methods and work schedule). The detailed CEMP will be prepared prior to commencement of construction and will be subject to the approval of GCC, and the appointed Ecological Specialist. The CEMP will remain at all times a live document, subject to amendment of adaptive management throughout construction as required (e.g. in response to extreme weather including flooding and/or alterations to design elements due to the availability of more cost efficient or effective techniques or materials). The following measures will be implemented as a minimum by the appointed Contractor:

- Drainage design, incorporating SuDS principals, inherent in the overall design, will prevent emissions to the river during the construction and operational phase of the Proposed Road Development, and facilitate water treatment;
- Woodland, scrub, treelines, and hedgerows which lie within, or along the boundary of the Proposed Road Development, that are not directly impacted by the Proposed Road Development or drainage will be retained, thus reducing the area for dust generation and risk of silt entry to watercourses. These areas will be protected for the duration of construction works and fenced off at an appropriate distance. Consideration will be made to ensure minimal disturbance of roots, and sensitive areas (including Root Protection Areas) will be cordoned off with post fencing to ensure no unnecessary damage to these habitats. Works will be done in accordance with 'Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes' (TII, 2006d).
- Control measures such as check dams, and silt fencing will be used throughout the construction phase to reduce the risk to Lough Corrib SAC. Regular monitoring and recording of the effectiveness of the control measures will be used and implemented with additional control measures employed if and when required.
- Supported silt fencing (supported by wooden posts or suitable alternative) along the route will be installed where watercourses, including drains, are at risk from silt entry. The base of these curtains will be buried into the ground to ensure the fences work effectively. Diversions of surface flows into swales is also envisaged, if necessary, to manage surface waters and prevent pollution incidents;
- Minimal hedge removal through 'stepping-in' of proposed fence lines near these habitats;
- Installation of cut-off drains, inherent in construction design, will aid in maintaining a drier works area, and limit surface waters within the construction area. This embedded mitigation will prevent risks to surface waters;
- Phasing and other silt control measures to be refined by the Contractor into an Erosion and Sediment Control Plan (CESCP), which will be agreed between GCC and the appointed Ecological Specialist;
- Phasing of works and other silt control measures to be refined by the CESCP, which will be agreed between the Contractor, ECoW and Client (and Client's Ecological Specialist). The CESCP will conform to requirements within this EIAR;
- Construction compounds will be required along in the vicinity of the Proposed Road Development. The current area for proposed compound areas are flat areas, deemed to be of low risk to the Lough Corrib SAC. Mitigation measures noted in this document, in relation to preventing surface water pollution, will be applied to the proposed compound area and conform to this EIAR and requirements outlined in the CESCP;

- Use of a single layer (and three layers if required) of high-performance silt fence around all works or stockpiles that have potential to affect waterbodies (surface or groundwater) or Annex I habitats; and specifically, and exclusively following installation methods outlined in published literature (Caraco, 2000) to maximize the effectiveness of particle filtration by geotextiles. Use of silt fencing to specification of Hy-Tex Terrastop Premium or similar, whose efficacy has been proven by credible evidence (Liddon, 2013) is required. Fencing will be inspected and assessed for its effectiveness and suitability by the ECoW and Client;
- Use of additional layers of high-performance silt fence, locally, if necessary, to avoid pollution to watercourses or Lough Corrib SAC/SPA;
- Supervision of installation and performance throughout construction of silt fencing and other pollution control measures by the ECoW and ER Team who will advise the Contractor on repairs required to maximize performance;
- Procedures for dewatering the working area to include adequate treatment of any resulting silt-laden surface water prior to discharge. Use of silt dewatering bags or tubes in conjunction with filter drains/check dams, silt fencing and other means necessary (including swales) to capture, attenuate, and treat surface water generated during construction prior to any discharge to watercourses. If silt is removed from surface/groundwater from mitigation measures, and no contamination is apparent, no adverse impact of the entry of such waters to the environment is envisaged and this practice is deemed satisfactory. No polluted waters/contaminated water is to be released/discharged to a watercourse without a required discharge licence approved by IFI;
- All bowsers onsite should be clean on arrival (internally and externally (to ensure that no pollutants were present within, that may otherwise enter the environment during use);
- Fuel handling and bunding procedures are to be in place during the works, with particular care near rivers, streams, and watercourse (See Chapter 09 Water). Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be located away from surface water gullies or drains, with no refuelling within 30 m of a watercourse;
- Stockpiles should have a minimum setback of 20 m and >20 m where possible, from watercourses. Adequate SuDS (e.g. surrounding cut-off drain, silt fencing, settlement ponds) will be installed if required to ensure environmental risks associated with silt are minimised. Seeding of stockpiles (to prevent erosion and dust creation) will be undertaken if deemed necessary by the ECoW or Ecological Specialist;
- Contractor to adopt, and provide evidence to GCC and the Ecological Specialist of staff training in Spill Response & Control Plan to minimize the risk of adverse impacts upon surface waters and groundwater in the potential event of accidental spillages, flooding, or other emergencies;
- Establishment of contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers, culverts);
- Control of mud at entry and exit points to the works area using wheel washes;
- Material and machinery/fuel storage to be outside flood-prone areas and removed from such areas in advance of floods to ensure environmental protection; and
- Mitigation measures relating to safeguarding water quality during the construction phase are outlined in Chapter 09 Water of this EIAR.

The following guidelines should be followed to ensure protection of the environment:

- IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, Dublin;
- CIRIA Guidelines Control of water pollution from construction sites –Guide to Good Practice (C532); and
- Control of water pollution from linear construction projects. Technical Guidance (C648).

7.7.1.1.4 Emergency Response and Environmental Training

The Contractor will produce an Emergency Response Plan (ERP) based on the Contractor's own Risk Assessment, which will be reviewed by the ECoW and Employer's Representative Team. The ERP will include:

- The Contractor's proposed training of relevant staff, including cover staff, in the implementation of the ERP and the use of spill kits;
- Details of procedures to be carried out by the Contractor in the event of the release of any sediment into a watercourse, or any spillage of chemicals, fuel or other hazardous wastes, non-compliance incidents with any permit or licence, or other such risks that could lead to a pollution incident, including flood risks;
- Confirmation of the number and specification of spill kits which will be carried by the Contractor; and
- Information on spill control procedures as specified in Section 7.5.2 or Chapter 09 Water of the EIAR.

7.7.1.1.5 Construction Environmental Management Plan

The Contractor will be required to implement the measures outlined in the CEMP, (also referred as Environmental Operating Plan (EOP)), in accordance with the TII Guidelines for the 'Creation and Maintenance of an Environmental Operating Plan'. The CEMP will set out the Contractor's approach to managing environmental issues associated with the construction of the road and provide a documented account to the implementation of the environmental commitments set out in the EIAR and NIS and measures stipulated in the planning conditions. Details within the plan will include:

- All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the NPWS as well as a method documenting compliance with the measures;
- A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and
- Outline methods by which construction work will be managed to avoid, reduce, or remedy potential adverse impacts on the environment.

To oversee the implementation of the CEMP, the Contractor will be required to appoint a responsible manager to ensure that the mitigation measures included in the NIS, EIAR and the CEMP are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.

7.7.1.1.5.1 Construction and Demolition Waste Management Plan

Included within the CEMP will be the Waste Management Plan (WMP) which clearly sets out the Contractor's proposals regarding the treatment, storage and recovery or disposal of waste. The plan itself will contain (but not be limited to) the following measures:

- Details of waste storage (e.g. skips, bins, containers) to be provided for different waste and collection times;
- Details of where and how materials are to be disposed of - landfill or other appropriately licensed waste management facility;
- Details of storage areas for waste materials and containers;
- Details of how unsuitable excess materials will be disposed of where necessary;
- Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner;
- Any waste/litter generated onsite will be removed offsite to a waste licensed facility and litter will be collected if seen; and
- Staff will be made aware of a zero-litter policy.

7.7.1.1.5.2 Construction Erosion and Sediment Control Plan

A CESCP will be prepared at detail design stage for the Proposed Road Development. All of the measures, mitigations, controls, requirements, procedures, etc. will be developed from industry environmental best practice to ensure that there are no significant adverse effects on the receiving environment during the construction of the Proposed Road Development. These mitigation measures will be implemented in full and will aim to ensure that sediment laden runoff from the construction site does not pollute watercourses or water bodies with an emphasis on the Lough Corrib SAC.

The contract documents for the Proposed Road Development will place an obligation on the construction contractor to further develop this plan to include any additional requirements stipulated by the consenting authority. The exact details of the plan, particularly in relation to construction phasing, sequence or layout, may be amended by the Contractor to reflect different construction approaches but shall, as an absolute minimum, include all the measures, mitigations, controls, requirements, procedures, etc. included the plan.

Also see Volume 04; Appendix 4-1 Outline Construction Environmental Management Plan.

7.7.1.1.5.3 Phasing of Earthworks

Construction works will avoid vegetation removal/destruction where possible. There will be no requirement for vegetation removal of riparian habitats within 5 m of the Abbert River, given the setback distances associated with the bridge abutments. In the event where the Contractor identifies a potential future flood event, the Contractor will communicate the details to GCC, the ER Team, and the ECoW who will agree the appropriate response to protect the working area and environment. Works area will be strictly adhered to for the duration of works.

7.7.1.1.5.4 Phasing of Piling (Disturbance to Fisheries)

A range of best practice control measures in relation to noise and vibration have been compiled in Chapter 12 Noise and Vibration of this EIAR. The proposed measures will have due regard to the QI of the Lough Corrib SAC and other protected species during the construction phase. The proposed measures will be carried out with a view to maintaining noise and vibration emissions at reduced levels.

One of the most effective measures to avoid noise and vibration impacts associated with drilling/piling on the QIs (Atlantic Salmon, Brook Lamprey and Otter) of the Lough Corrib SAC is to schedule construction works at periods deemed to have the least sensitivity on the species. The timing of works takes into account seasonal factors and migration preferences (i.e. life cycle, etc.) of the species. Having regard to the preferred migration periods for Atlantic Salmon, it is necessary that works associated with the piling in proximity to the Abbert River will be undertaken within the timeframe of 1 July to 30 September (inclusive) unless otherwise agreed with IFI. The IFI guidance document (Guidelines on Protection of Fisheries During Construction Works and Adjacent to Waters (2016)) advocates undertaking works in proximity to watercourses during the period July-September inclusive to minimise adverse impacts on the fisheries resource. It is envisaged that such works will be scheduled to coincide with periods of dry weather primarily during summer months and outside the core migration period for Atlantic Salmon.

To mitigate impacts to QI Brook Lamprey, a ‘soft-start’ to drilling/piing will also be employed to allow lamprey and other fish to move away before the full intensity of drilling/piling begins. The soft start will involve a gradual ramping up of drill head rotation speed, incrementally over a set time period to be agreed with the ER Team, until full operational power is achieved. Works giving rise to noise emissions are restricted to and permitted by GCC to 07.00 – 19.00 Hrs Monday – Friday; and 07.00 - 13.00 Hrs on Saturdays. Work outside of normal hours shall only take place where written permissions have been sought and received from GCC.

7.7.1.1.5.5 Artificial Lighting

Light spill onto the river channel during hours of darkness has the potential to form a barrier to the migration movement of nocturnal protected species (e.g. bats, some fish species and Otter). Turning off lights during periods of darkness throughout the construction phase will eliminate any risk of impacts to sensitive ecological receptors outside of work hours. The risk of impacts associated with artificial lighting on the Abbert River will be minimised by restricting lighting to the footprint of the Proposed Road Development works and avoiding any unnecessary light spill (i.e. turning lights off outside working hours) onto the surrounding area. Light spill from construction onto the Abbert River should not exceed 1 lux (equivalent to moonlight). In all cases, the Contractor will make retrospective amendments to restrict light spillage. The appointed ECoW will ensure that these measures are adhered to during the construction phase.

7.7.1.1.6 Air Quality and Dust

Best practice construction methodologies (e.g. watering of the construction site/access roads and road cleaning) and mitigation measures (including regulating vehicle speed, through implementation of speed limits) will minimise construction activity-related dust and aid in containing it within the boundary of the Proposed Road Development. The implementation of standard industry good practice mitigation measures as outlined in Section 10.8 of Chapter 10 Air Quality and mitigation requirements outlined within this chapter are required to be incorporated into the CEMP. Standard industry good practice mitigation measures will be applied to the Proposed Road Development site, including road sweeping, wheel- wash facilities and the implementation of a dust management plan. Further information is contained within Chapter 10 Air Quality.

Dust emissions control and mitigation measures during construction works require:

- The wetting of exposed earthworks areas and site haul roads during dry and/or windy conditions (this mitigation would be required when necessary, to prevent dust deposition on sensitive habitats) (Note see Chapter 10 Air Quality for Dust Monitoring);
- The provision and maintenance of wheel washes at site exit points; and
- Restriction of site plant and other vehicle speeds (e.g. 10-20 km/h on un-surfaced site road), the adequate covering of haulage vehicles when carrying loads that have the potential to emit dust, and the sweeping of hard surface roads within/accessing the site.

These procedures will also be set out in the CEMP which will include a schedule of monitoring, maintenance, and review of site dust management measures. Dust screens are to be used in areas of highest sensitivity which is to include the works areas within 20 m of the Abbert River and Lough Corrib SAC, where a 2 m dust screen will be employed. These measures will minimise construction activity-related dust and aid in containing it within the boundary of the Proposed Road Development.

The implementation of these mitigation measures, incorporated into the CEMP, along with careful works planning, will minimise the movement of material and reduce generation of dust. Mitigation measures will be followed in order to mitigate the impacts of dust deposition on Lough Corrib SAC and other habitat areas within the ZoI of the Proposed Road Development.

7.7.1.2 Operational Phase

7.7.1.2.1 Artificial Lighting

Embedded control measures have been incorporated into the design of the Proposed Road Development noted in Section 7.6.1. This embedded design will minimise light spill onto adjacent habitats and ecological features, including the Abbert River. Details of this lighting design are given below.

The rural road sections of the Proposed Road Development shall not be lit, and road lighting shall be confined to (see Volume 03; Figure 4-33):

- N63 roundabout (Junction 1) and immediate approaches, including tie-ins with existing road lighting in the village of Abbeyknockmoy;
- The existing road lighting in proximity to Newtown National School and Abbeyknockmoy Community Centre, between Junction 5 (L7138) and Junction 6 (L3110); and
- The proposed pedestrian and cycle facility along the existing N63 between the village of Abbeyknockmoy and Newtown National School/Abbeyknockmoy Community Centre.

A suitably experienced bat ecologist will visit the site during operation to measure, using a suitably calibrated light meter, light spill onto habitat within 100 m of the Abbert River. The findings of this assessment should detail the light levels of the Abbert River and assess whether they are below the prescribed lighting limit of 1 Lux (from the project specific lighting).

7.7.1.2.2 Hydrology

As outlined in Section 7.6, the operation of the Proposed Road Development is unlikely to have any significant adverse effects on the local hydrological environment due to the embedded control measures. The mitigation requirements are adequate to ensure that direct pollutant discharges to surface waters do not occur during the operational phase, provided they are followed. Embedded control measures having due regard to pollution prevention control during the operational phase are outlined in Chapter 09 Water of this EIAR. No additional ecological mitigation measures will therefore be required.

7.7.1.2.3 Noise

No significant long-term effects on species resulting from operational noise are envisaged. See Chapter 12 Noise and Vibration.

7.7.1.3 Specific Mitigation for Biodiversity Conservation Interests

7.7.1.3.1 Mitigation for Habitat (including Lough Corrib SAC)

Various measures as described in Sections 7.7 will protect water quality and the QI of Lough Corrib SAC. Additional measures for specific QI and Annex 1 or otherwise protected species are detailed below.

7.7.1.3.1.1 Pre-construction Phase Mitigation

Habitat Mitigation (Petrifying Springs)

Pre-construction Surveys

Monitoring and protection of Petrifying Springs to ensure protection of this habitat. Ecological monitoring will be undertaken (See 7.7.2. Monitoring). The location of the Petrifying Spring is included in Appendix 03; Figure A7-2.

7.7.1.3.1.2 Construction Phase Mitigation

Habitat Mitigation - Annex I Molinia Meadows

- The footprint of construction activities in the area will be minimised to only include the area required for land-take for the Proposed Road Development. All unnecessary tracking will be restricted. The area will be clearly marked and the area to be retained/protected will be cordoned off in advance of works to ensure damage prevention and habitat protection.
- To complement partial translocation, efforts should be made to protect remaining areas of this habitat either side of the development and the hydrology of the surrounding area.
- The ECoW will supervise setting out of the works area to avoid the potential for disturbing Annex I *Molinia* Meadows during works.
- Temporary signage will be installed to highlight the location of Annex I *Molinia* Meadows to construction personnel accessing the site.
- Any requirement for stockpiling, re-fuelling of machinery, etc. during the construction phase will be sited >50 m away from Annex I *Molinia* Meadows.
- There will be no interference with areas of Annex I *Molinia* Meadows during site works, outside of the proposed works footprint. The quantity of material to be translocated will be minimised through careful marking of the route footprint and supervision of works by the ECoW. A compensation area has been included in the Proposed Road Development design (see Volume 03;Figure A13.4 for location of the compensation area).
- Some Annex I *Molinia* Meadows will be disturbed by the Proposed Road Development as they are within the footprint of works. Care will be taken to translocate the area of this habitat that exists within the works footprint. The field adjacent to the southwest of the Annex I *Molinia* Meadow is an area with similar hydrological and soil conditions that is ideal for sod translocation, provided it was appropriately prepared (Volume 3 Figure A7-2 & Volume 4; Appendix 7-8).
- A detailed method statement will be developed (*Molinia* translocation management plan) by the contractor and a suitably qualified botanist and will be reviewed by GCC and the Ecological Specialist to translocate the area of this habitat from within the works footprint. This method statement will include the following mitigation and will be reviewed by the NPWS. The method statement will detail the translocation plan;

- The field for translocation will require advance consultation with and inspection by a suitably qualified botanist, to ensure it has been prepared appropriately in advance of translocation of sods;
- Sods will be carefully positioned, and not stacked, to avoid damage;
- Sod removal and sod translocation should coincide to maximise likelihood of sod development, and prevent disturbance of adjacent ground associated with tracking or for temporary storage;
- Translocation will only be undertaken under supervision of the ECoW and suitably qualified ecologist/botanist to ensure translocation success;
- Translocation should occur at a time (i.e. season) that will optimise the successful establishment of Annex I *Molinia* Meadow at the translocation area;
- Sods will be carefully cut, and handled with care, prior to being translocated to the compensation area;
- To complement partial translocation and habitat protection, works will be undertaken to protect remaining areas of this habitat (including translocated sods) and the hydrology of the area either side of the development through installation of suitably free-draining, clean, large, rounded, locally derived limestone under the road embankment;
- Hydrological impacts of the Proposed Road Development have been considered, and retention of hydrological characteristics of retained areas will also be accounted for during construction. The *Molinia* area on both sides of the Proposed Road Development area will be monitored monthly during the construction phase and areas within ownership of the Council will be managed as appropriate to ensure it retains good ecological status; and
- The ECoW and Client's Ecological Specialist will verify that the Contractor has left the site of the Proposed Road Development in a satisfactory condition, and where relevant direct the Contractor to remove any materials offsite.

Habitat Mitigation (Petrifying Springs)

Mitigation

- Strictly de-lineating the works area.
- Minimising any additional hard-surfaced areas to avoid increase of runoff.
- Changes in surface water hydrology would be considered in the drainage and overall construction design for the Proposed Road Development. It should be noted that groundwater investigations have concluded that it is unlikely that the construction works here will impact on groundwater conditions here. Therefore, it is highly unlikely that any hydrological impacts will occur on the petrifying spring habitat here.
- A groundwater risk assessment is to be carried out prior to construction works.
- A quarterly sampling programme will be undertaken for one year before construction throughout the duration of construction works. This will include scheduling samples for an inorganic suite of analysis, to include pH, electrical conductivity, ammonium, nitrate, fluoride, chloride and sulphate.
- The footprint of construction activities in the area should be minimised. The area should be clearly marked and areas to be retained/protected should be cordoned off in advance of works.
- The existing bank and hedgerows which acts as a barrier between the road and this habitat area shall be retained. As per the current scheme design.
- Temporary signage will be installed to highlight the location of the Petrifying Spring to construction personnel accessing the site.
- Any requirement for stockpiling, re-fuelling of machinery, etc. during the construction phase will be sited >50 m away from the Petrifying Spring.
- There will be no interference with areas of the Petrifying Spring during site works, outside of the proposed works footprint.
- The quantity of material to be translocated will be minimized through careful marking of the route footprint;
- Silt fencing and silt traps will be installed along the route to ensure any runoff from the works are in the vicinity of this habitat area is captured.

- A buffer zone of a minimum allowable distance of 10 m between works activities from this Annex I habitat is to be maintained throughout works.
- Clearance of existing vegetation is to be kept to an absolute minimum within 50 m of this habitat area.
- Clearance of topsoil/substrate is to be kept to an absolute minimum within 50 m of this habitat area.
- To prevent any impacts to the petrifying spring, imported material for base fill used within 100 m of the spring habitat would be made of limestone, if required, and would be of a size that permits flow of waters through it.
- In order to avoid any alteration to groundwater pH, only locally derived limestone shall be used in the construction within the ZoI of this habitat. This limestone for base fill will be of a size that permits flow of waters through it, if required. This mitigation measure may ensure no changes to the alkalinity of the Petrifying Spring and will support hydrological connectivity between the north and south side of the Proposed Road Development.
- The ZoI has been informed by hydrogeological investigation, and no impact is deemed likely on this habitat type. However, monitoring is to be carried out throughout the construction phase and further mitigation measures shall be devised and implemented as necessary. Minimising the compaction of soils and other substrates associated with construction within the ZoI of this habitat type would be required.
- Weekly visual checks will be undertaken of the spring while construction works are occurring within the ZoI, with photographs taken and written descriptions of flow recorded.
- Ecological monitoring is to be undertaken as per guidelines given by the NPWS (2016). This monitoring is to employ suitable indicator criteria as per Lyons & Kelly (2016) such as tufa type, surface water characteristics and field/ground flora.
- If ecological monitoring determines that flow rates are being influenced within the spring, additional mitigation measures may be required to ensure the protection of the spring (i.e. alterations of works area, and ground works to ensure that the spring is receiving suitable water).

Pollution Prevention

- Best practice protocols in construction will be followed for the duration of the works. These include the measures to protect water and prevent water pollution, avoid, and prevent the spread of invasive species, dust and air emissions, and prevention of unnecessary clearance (see Chapter 09 Water and Chapter 08 Land and Soils).

Non-Annex I Habitats

- An exclusion zone will be established to safeguard areas outside the Proposed Road Development to avoid any unnecessary disturbance or intrusion during site works. The ECoW will supervise setting out of all works and instruct the contractor on areas of other sensitive habitats to avoid;
- Where possible, woodland, scrub, treelines, and hedgerows which lie within, or along the boundary of the Proposed Road Development, that are not directly impacted by the Proposed Road Development or drainage will be retained. These areas will be protected for the duration of construction works and fenced off at an appropriate distance.
- Tree roots near works should be considered along the development and damage to roots should be prevented within the Root Protection Area of trees to be retained as per BS 5837-2012.
- Any vegetation (including trees, hedgerows or scrub adjacent to, or within, the Proposed Road Development boundary) which is to be retained shall be afforded adequate protection during the construction phase in accordance with the Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (TII, 2006d), as follows:
  - All trees along the Proposed Road Development boundary that are to be retained, both within and adjacent to the Proposed Road Development boundary (where the root protection area of the tree extends into the Proposed Road Development boundary), will be fenced off at the outset of works and for the duration of construction to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. The RPA will be defined based upon the recommendation of a qualified arborist;

- Where fencing is not feasible due to insufficient space, protection for the tree/hedgerow will be afforded by wrapping hessian sacking (or suitable equivalent) around the trunk of the tree and strapping stout buffer timbers around it;
- The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils, and chemicals);
- A buffer zone of at least 5 m will be maintained where possible between construction works and retained hedgerows to ensure that the root protection areas are not damaged;
- A qualified arborist shall assess the condition of, and advise on any repair works necessary to, any trees which are to be retained or that lie outside of the Proposed Road Development boundary but whose RPA is impacted by the works. Any remedial works required will be carried out by a qualified arborist; and
- Machinery access will be restricted to the confines of the Proposed Road Development footprint and the Contractor will agree locations of all access routes, temporary storage areas etc. with the appointed ECoW.

7.7.1.3.1.3 Operational Phase Mitigation

Habitat Mitigation - Annex I Molinia Meadows

A monitoring programme is to be established in order to assess the translocation of *Molinia* sods. This is will include quarterly visits by specialist ecologists who will assess species diversity and abundance over three years post completion of works. A similar monitoring programme is to be carried out on the remaining Annex I habitat areas to the north of the Proposed Road Development. It is recommended that this is carried out concurrently with the above programme.

The results of the above are to be used to draw up a management plan for the area within the boundaries of the development. This will set out appropriate methodologies for the management of the receptor site. Ecological monitoring will be ongoing, and some actions such as grazing, mowing, or invasive species treatment may be required to be acted upon.

Habitat Mitigation - Petrifying Springs

The operation of the Proposed Road Development will not have any significant adverse effects on the local hydrogeological environment due to the nature of the Proposed Road Development and the embedded control measures that have been incorporated into the Proposed Road Development site (as outlined in Chapter 04 Description of the Proposed Road Development). Surface water infrastructure will ensure that road runoff is directed away from this habitat area during the operational phase of the Proposed Road Development.

Non-Annex I Habitats

- The amount of higher local-value habitat has been quantified within the study area. Efforts have been made to compensate for losses of higher value habitat in the landscaping plan, which will encompass the development of ponds, treelines of native species and hedgerow creation.
- The landscape planting plan includes embedded control, which includes native, species-rich wildflower meadow, wetland habitats reinstatement and hedgerow communities and local reuse of spoil/vegetated turves.
- Settlement ponds will be retained post development (as part of embedded control), these compensate for loss of ponds and drains.
- Mitigation noted for Barn Owl has been incorporated into the landscaping plan, including planting of native Hawthorn and Blackthorn and other native species on banks adjacent to the road, to avoid attraction of this species to the road area, where collision risk may otherwise be high (Volume 3, Figure 13-2 to 13-7).
- Some of the grassland verge adjacent to the cycleway will be planted with native wild flowers suitable for pollinating species. A management plan to optimise mowing management of verges for pollinators will be developed and implemented.

7.7.1.3.2 Mitigation for Invasive Species

7.7.1.3.2.1 Preconstruction Phase Mitigation

The pre-construction survey will be carried out during the growing season (i.e. from April to September) prior to construction starting onsite to assess if new populations of invasive species have become established since the original surveys were completed in 2020/2021 to inform this EIAR.

An Invasive Species Site Assessment and Management Plan (ISSAMP) will be produced by the appointed Contractor as per the recommendations given by TII (2020a) and encompassing mitigation measures listed in this EIAR for invasive species management. This plan will determine the appropriate methods for treatment, control, and/or removal of the Invasive Species recorded as occurring onsite. The ISSAMP will be informed by a pre-construction survey and will incorporate measures to deal with and ensure no spread of land and river based invasive species from construction activities. The ECoW and Ecological Specialist will review the draft ISSAMP to ensure it has due regard for emerging best scientific knowledge.

The ISSAMP will include a biosecurity plan prepared by the appointed Contractor, which will be agreed with GCC. The ISSAMP and the biosecurity plan will consider both terrestrial and aquatic invasive species.

7.7.1.3.2.2 Construction Phase Mitigation

Developing codes of practice aims to reduce the risk from and impacts of invasive species and safeguards the Qualifying interests of the SAC. The Proposed Road Development will adopt best practice control measures to prevent the spread of invasive species. The project and ISSAMP will follow the following guidance and standards documents: 'The Management of Invasive Alien Plant Species on National Roads – Technical Guidance' (TII, 2020) and 'Management of Invasive Alien Plant Species on National Roads – Standard' (TII, 2020a). The project and ISSAMP will also have due regard to the relevant biosecurity measures throughout all phases of the project including:

- Clearly identify and mark out the infested areas of invasive species to inform construction personnel and operating machinery. Infested areas of invasive species will be fenced off (where applicable, if within the works footprint and signage will be installed to highlight the location of invasive species;
- Should any new species become established in the interim, stands will be clearly demarcated by temporary fencing and machinery tracking or otherwise within infested areas will be strictly avoided until a management plan is developed. The suitable buffer zone will be determined by the Ecological Specialist;
- All contractors and staff will be briefed about the presence, identification, and significance of invasive species before commencement of works;
- For any material entering the Proposed Road Development site, the supplier must provide an assurance that it is free of invasive species;
- A designated cleaning area for boots will be established within the site compound, to ensure all boots are cleaned prior to entry to works areas;
- Boats, waders and all associated aquatic equipment will be washed prior to and after being in the water. A disinfectant such as Virkon Aquatic or similar will be used to wash this equipment to ensure no spread of Crayfish plague. All equipment to be used in aquatic areas will be thoroughly cleaned prior to use, with no aquatic invasive species present on them;
- All Contractors will be made aware of biosecurity issues related to working in proximity to invasive species, watercourses, and watercourse vulnerability to aquatic invasive species (fauna and fauna). All Contractors will also be made aware of the crayfish plague. Invasive species and biosecurity measures to be implemented and adhered to on site are to be addressed within the site induction and site toolbox talks;
- Good construction site hygiene will be employed to prevent the spread of such species. All plant and equipment employed on the construction site (e.g. excavator etc.) will be thoroughly power-washed prior to arrival onsite to prevent the spread of invasive plant species present such as Japanese knotweed; and
- 'The Management of Invasive Alien Plant Species on National Roads – Standar*d'* (TII, 2020a) is a standard and must be applied and followed on this project. The treatment and control of invasive alien species will also follow TII guidelines on 'The Management of Invasive Alien Plant Species on National Roads – Technical Guidance' (TII, 2020).

7.7.1.3.2.3 Operation Phase Mitigation

Treatment of invasive species onsite will occur up until two years post construction, and signage for invasive species will be left in situ.

Biosecurity measure will be put in place for any investigatory surveys on bridge structures or works that require personnel to enter a watercourse and signage for invasive species will be left in situ.

7.7.1.3.3 Mitigation for Bats

7.7.1.3.3.1 Construction Phase Mitigation

Lighting

During the construction phase, an experienced bat ecologist will visit the Proposed Road Development site at regular intervals (nocturnal visits) throughout the construction phase to review, using a suitably calibrated light meter, potential light spill of construction lighting onto vegetated areas. The bat ecologist will make recommendations to minimise impacts of construction lighting to bats. As a minimum:

- Light spill from construction onto bat habitats known to be used by highly light sensitive species will not exceed 1 lux; and
- Light spill from construction onto bat habitats known to be used by other bats will not exceed 3 lux.
- No light spill from construction activity will be allowed onto the Abbert River. Light spill onto other commuting habitats such as hedgerows and treelines will be minimised to avoid bat disturbance.

In all cases, the Contractor will make retrospective amendments to light cowls, until the target lux level is reached.

Tree Felling

No trees with bat roosts were identified. However, this may be subject to change. Trees, hedge, and scrub should be felled at an appropriate time of year, ideally outside of bird nesting season (March 1st to August 31st) (to prevent impacts to nesting birds). Felling of any potential tree roosts will be undertaken during the period September – October as during this period bats are capable of flight and may avoid the risks from tree felling if proper measures are undertaken, but also are neither breeding nor in hibernation.

Trees should be resurveyed for bat roost potential prior to felling. Any tree identified with bat roost potential will be surveyed visually. An emergence survey using visual observation and bat detectors will be carried out on the night immediately preceding the felling operation to determine if bats are present. NPWS will be consulted of any planned works on trees with a confirmed bat roost. If a bat roost is subsequently identified, tree removal will be undertaken in accordance with NPWS recommendations and relevant licencing requirements relevant to bat roost protection.

Immediately prior to felling, trees should be shaken by a machine a number of times, with 30 second intervals, to alert any bats or other wildlife that may be in the tree. The tree should then be pushed to the ground slowly and should remain in place until it is inspected by a bat specialist. Felled trees should be left intact where they fall on the ground for 24 hours before sectioning and/or mulching unless pre-surveyed by an ecologist and deemed bat-free.

7.7.1.3.3.2 Operational Phase Mitigation

Lighting

- Detail on the design is outlined in Section 4.5.8 of Chapter 04 Description of the Proposed Road Development.
- A suitably experienced bat ecologist, with experience of input to light designs, will be consulted during the detailed design of the operational lighting plan. As a minimum, having regard for best scientific knowledge (including BCT and ILP (2018) and the design will minimise impacts to bat habitats, particularly at and surrounding the proposed Abbert River crossing. Suitable lighting (i.e. cowled or suitable alternative) is required throughout the Proposed Road Development to direct light spill away from both retained and created habitats;

- In the design, no lighting is provided at the bridge location and the approach to bridge. The risk of impacts associated with artificial lighting on the Abbert River will therefore be minimised by the adoption of the following design requirements:
  - The location of lighting columns along the rest of the Proposed Road Development will be designed to maximise the setback distance from the proposed bridge taking into account the ecological sensitivities associated with the Abbert River;
  - If bridge lighting is subsequently installed, the use of specialist bollard or low-level downward directional luminaires and red-light Emitting Diode (LED) fittings on the proposed bridge crossing should be fitted. Any proposed lighting system should have regard for the research indicating that light-sensitive bat species are equally active in such light, as in darkness (Spoelstra *et al*., 2017);
  - In all other areas, luminaires will be installed with warm white spectrum LEDs (ideally<2700 Kelvin), featuring peak wavelengths higher than 550 mm to avoid the component of light most disturbing to bats, where luminaires are mounted with no upward tilt, and with an upward light ratio of 0% with good optical control; and
  - The separation distance between light mast locations and vegetated features will be maximised wherever possible. Additive light spill (i.e. from the Proposed Road Development alone) onto any bat habitats known to be used by highly light sensitive species should not exceed 1 lux.

River Crossing

- Given the available data on use of culverts by the species of bats present (Bach *et al* 2004; Boonman, 2011; Abbott *et al*., 2012), the freeboard (>3 m) is, when combined with the clear span bridge design, predicted to provide sufficient height above water, and sufficient cross-sectional area to avoid any significant obstacle to bats commuting and feeding on the Abbert River corridor.

Bat Roosting

- 10 x Schwelger woodcrete maternity roost bat boxes will be installed locally, at suitable locations, as deemed appropriate, by a suitably qualified ecologist.

7.7.1.3.4 Mitigation for Badgers

Badgers, and their breeding and resting places, are protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure a Badger or to wilfully interfere with or destroy their breeding or resting places (setts).

A comprehensive suite of mitigation measures have been incorporated into the Proposed Road Development to ensure that Badgers are not intentionally killed or injured and that any impacts to their breeding or resting places will not affect their conservation status, at any geographic scale, and will not give rise to any likely significant effects on the species.

The mitigation measures described below follow the recommendations set out in the 'Guidelines for the Treatment of Badgers during the Construction of National Road Schemes*'* (TII, 2006b). These guidelines set out the best practice approach in considering and mitigating impacts on Badgers during construction works.

7.7.1.3.4.1 Pre-construction Phase Mitigation

As Badger setts may become established following the surveys reported here and the commencement of construction, a dedicated pre-construction mammal survey will be required within 12 months of the commencement of works.

7.7.1.3.4.2 Construction Phase Mitigation

If setts are found to have become established and require exclusion and removal, or temporary exclusion for the duration of the construction period, these measures will be undertaken in accordance with the methodology detailed in the 'Guidelines for the Treatment of Badgers during the Construction of National Road Scheme*s'* (TII, 2006b) as follows:

- In order to prevent any disturbance to Badger setts not directly affected by the Proposed Road Development no heavy machinery shall be used within 30 m of Badger setts at any time. No works shall be undertaken within 50 m of active setts during the breeding season. Lighter machinery (generally wheeled vehicles) shall not be used within 20 m of a sett entrance. Neither blasting nor pile driving shall be undertaken within 150 m of active setts during the breeding season (December to June inclusive);
- Prior to works commencing, a non-interference zone of 30 m will be established around each of the new Badger setts (if they are developed) within the ZoI of the Proposed Road Development. If the sett is active, a non-interference zone will be extended to 50 m during the breeding season (December to June inclusive). The fencing shall be of a sufficient durability to maintain the exclusion zone throughout the construction period or, if required, until such time as the sett in question is excluded/removed. NPWS will be informed of any new setts in the area and works in the vicinity of setts will only be undertaken under a licence from NPWS;
- In the unlikely event of the establishment of a Main Sett, an artificial sett will be required to mitigate for the loss of this sett. Any Badger setts requiring exclusion and removal will require a monitoring period of at least five days to confirm activity status in advance of any construction works commencing;
- If the sett is active, then it shall not be removed within the Badger breeding season (December to June inclusive). To exclude or remove an active Badger sett outside of this period, inactive entrances shall be soft and hard-blocked with one-way gates installed on active entrances. One-way gates will be tied open for three days before being set to exclude, and then monitored for a period of at least 21 days before the sett is deemed inactive and destroyed. If at any time during the monitoring period the sett becomes active, the exclusion process/programme must commence again from day 1 of the 21-day monitoring period; and
- For inactive setts, entrances will be soft-blocked (lightly blocked with vegetation and soil) and if all entrances remain undisturbed for a period of five days the sett should be destroyed immediately. This can be undertaken at any time of the year for inactive setts.

7.7.1.3.4.3 Operation Phase Mitigation

Habitat Severance/Range Restriction

Given that Badger activity was low within the footprint of the Proposed Road Development, no specific Badger underpasses are required. Pipe crossings (600 mm) will be installed for specific watercourses and could function as underpasses for Badger depending on flow condition. These crossings/structures will also allow mammal passage as none of these are substantial watercourses. (Volume 03, Figure 7-11).

Mortality Risk

Mammal-resistant fencing will be required to guide Badgers to the culvert/underpasses and will be installed in accordance with the specification outlined in 'Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes', and TII's mammal resistant fencing specification (currently CC-SCD-00320/00319) and will include Badger proofing of emergency access roads and other similar access points, in areas where mammal-resistant fencing is to be installed. The locations where mammal-resistant fencing should be installed are shown in Volume 3, Figure 7-11.

7.7.1.3.5 Mitigation for Otters

Otters are listed on Annex II and Annex IV of the EU Habitats Directive. Otter are strictly protected under the Birds and Habitats Regulations. Otter, and their breeding and resting places, are also protected under the Wildlife Acts and it is an offence under that legislation to intentionally kill or injure an Otter or to wilfully interfere with or destroy their breeding or resting places (holts/couches).

7.7.1.3.5.1 Construction Phase Mitigation

Habitat Degradation - Water Quality

The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 7.7 and detailed in Chapter 09 Water.

Loss of Breeding/Resting Sites

As in the future Otter could potentially establish new holt or couch sites within the ZoI of the Proposed Road Development, a pre-construction check of all suitable Otter habitat will be required within 12 months of any constructions works commencing.

7.7.1.3.5.2 Operation Phase Mitigation

Mortality Risk

Mammal resistant fencing is proposed for Badger and Otter, that will provide protection for Otter from road collision risk (Section 7.6.1). Culverts that are suitable for Otter passage will have been installed to ensure safe Otter passage to either side of the Proposed Road Development. Fencing will tie in either side of these culverts in order to protect Otter from mortality risk. An assessment of the effectiveness of mitigation measures for Otter is proposed post development, such that the effectiveness of mammal proof fencing will be assessed to ensure it is suitable for Otter. Any additional required mammal resistant fencing amendments will be made to ensure the safeguarding of the Otter population. Usage of pipe crossings by Otter, and habitat upstream of pipe crossings will be investigated to assess usage of these crossings and upstream areas by Otter. The use of areas by Otter, during the operation phase, will be identified through field surveys for Otter sign and deployment of trail cams.

Habitat Severance, Range Restriction and Barrier Effects

Otters use the Abbert River and potentially other watercourses crossed by the Proposed Road Development. To avoid Otter road casualties, Otter passage will be enabled under the clear-span bridge structure. Otter passage will also be enabled via the (minimum diameter 600 mm pipes) used on crossing drainage ditches, which have been designed primarily for drainage purposes. Dedicated Otter underpasses are not considered to be required at any location as existing ≥ 600 mm pipes within the design act as effective underpasses in most flow conditions. Prevention of accessibility to localised areas in flood events is not deemed to have any significant impact on Otter given the high availability of habitat in the wider environment.

Water Quality

The Proposed Road Development will incorporate an embedded drainage system design that will allow storm-water management. This will include petrol interceptors when outfalling to the Abbert River and attenuation ponds that will ensure adequate sufficient protection for Crayfish.

7.7.1.3.6 Mitigation for Other Mammal Species

7.7.1.3.6.1 Construction Phase Mitigation

Mortality Risk - During Clearance

There is no known or established methodology for the excluding of these mammal species (Hedgehog, Pygmy Shrew, Stoat, Red Squirrel, Pine Marten, Irish Hare) from nest/hibernation sites and therefore the seasonal clearance of vegetation for breeding birds will be implemented. This means that vegetation clearance will avoid March-August inclusive as far as practicable; which comprises a significant portion of the main breeding season for most of the above mammal species. This mitigation will simultaneously avoid the majority of the main breeding season for most small mammal species (Hayden & Harrington, 2001).

7.7.1.3.6.2 Operation Phase Mitigation

Habitat Severance, Range Restriction and Barrier Effects

Large 600 mm pipes/Underpasses prescribed for Badger and Otter commuting could also be used by some of these other mammal species in dry weather conditions. The clear-span structure proposed for crossing the Abbert River will also potentially allow movement of these species across the river. Measures to mitigate for Habitat Loss such as the planting of native tree and hedgerow species will allow both habitat creation and commuting routes for these other mammal species.

The landscape plan will provide dead wood piles locally, that will enhance the area for prey species of some mammals during the operation phase.

7.7.1.3.7 Mitigation for Birds

7.7.1.3.7.1 Construction Phase Mitigation

Pre-clearance Mitigation

The ECoW and Client will advise the Contractor on timing of vegetation clearance to protect nesting birds while having regard for other protected features present, such as breeding frogs and their spawn, removal of areas suitable for lizard hibernacula, and time constraints relating to the instream works season.

Vegetation clearance for most areas will be restricted to the period from March to August (inclusive) during the 'nesting season'. The exception of this is to facilitate earthworks required from the period July to September inclusive, at the proposed bridge abutments, in line with Inland Fisheries Ireland Guidelines. For the avoidance of doubt, it should be noted that birds may nest in grass and low scrub, in addition to hedgerows and trees.

Where unforeseen essential works require removal of vegetation during the breeding season, such works could be approved by the ECoW, who will (with reference to standard guidance on nest findings including Ferguson-Lees *et al.*, (2011)) make a detailed check of any suitable vegetation for nests prior to removal and advise the Contractor of any species-specific exclusion zones around potential or confirmed nests. Minor local area clearance, with appropriate equipment (handheld cutting tools) outside of the bird breeding season, should be conducted within 24 hours of bird surveys during the breeding season if no active nests were identified. The ECoW will advise the Contractor on any licensing implications for removing vegetation during the nesting season, in consultation with the NPWS. An exemption exists to permit clearance of vegetation for road construction within the bird nesting season, however, it is more ecologically favourable for clearance of vegetation to occur outside of the bird nesting season and therefore, clearance should be planned accordingly (as noted above) so as not to overlap with the bird nesting season.

The need to remove vegetation during the breeding season could arise if for instance, clearance works are delayed unexpectedly. To protect against this risk, an advance clearance contract, completed from September to February inclusive, could be carried out to greatly reduce the risk of birds nesting within the Proposed Road Development for much of that breeding season. The footprint for clearance is to be clearly marked in advance of clearance operations. Best efforts to retain habitat, and trees, where possible, and minimise disturbance, should be made.

Clearance of the bankside area, outside of the bird nesting season, where bridge development is planned, is advised, to avoid impacts or delays relating to Grey Wagtail and Kingfisher nesting within the bank. Bank surveys should be undertaken prior to sheet-piling to ensure that no active nests will be disturbed from works.

Pollution

Implementation of pollution prevention protocols as outlined in Section 7.7.1.3.1.2 are necessary to prevent pollution impacts to birds (e.g. exposure to oil).

Habitat Disturbance

The works will need to be executed in such a manner as to minimise the noise and vibration nuisance arising from the works activities. Activities should be programmed to prevent unnecessary clearance, tracking, movements, and habitat disturbance.

7.7.1.3.7.2 Operation Phase Mitigation

Lighting

Efforts will be made at detailed design stage to reduce light pollution and prevent overspill. The lighting design has been detailed and reflects efforts to minimise light spill onto sensitive habitats. The design ensures the avoidance of lighting of the river area, as specified in the fisheries and mammal section. This will reduce the overall ecological impact on bats, riverine bird communities, including Kingfisher, through ensuring reduced light overspill, and reduced light pollution of the local riverine and riparian environment (see Table 7-22). Lighting unit design selection will include for the incorporation of cowls, hoods, or louvres to prevent light pollution (see Section 7.6.4.7.2).

Barn Owl Mitigation

Some studies have linked high Barn Owl road casualties to sections of dual-carriageway and motorway where wide verges of open grassland habitat occur, potentially encouraging owls to hunt along these road verges and exposing them to collision risk (O'Clery *et al*., 2016; Taylor, 1994; Ramsden 2003). A landscaping plan that attracts Barn Owls to forage in close proximity to roads can lead to collision risks to this species. Therefore, landscaping has been considered, with awareness of TII (2021) Barn Owl standards. It is noted that wide grassland verge habitat adjacent to roads is unsuitable for Barn Owl.

The low flight hunting behaviour of the Barn Owl and their nocturnal activity make this species especially vulnerable to mortality through collisions with road vehicles. A new road, which might have higher speeds and volumes of traffic can have significant effects on local populations. Many Barn Owls are killed on roads in Ireland each year, with most being reported from motorways, particularly in the autumn when juveniles are dispersing (O'Clery et al., 2016).

The Barn Owl Trust (UK) provided extensive guidance on Barn Owls and major roads arising from a long-term research project (2003). In this guidance, they assess the various mitigation strategies that have been employed in terms of providing habitat for Barn Owl foraging and preventing road collision mortalities. Their research overwhelmingly supports the planting of roadside vegetation that will prevent low-level flight over roadways.

Following this above guidance, the following mitigation is incorporated into the landscape plan:

- In order to obstruct low-level flight across carriageways, continuous hedges and/or lines of closely spaced trees (>3 m high) should, wherever possible, be created adjacent to the metalled surface along both sides of the Proposed Road Development. This is especially important where the road is level with, or raised above, the adjacent terrain;
- Areas of grassland, which are likely to support small mammals, should only be allowed near the road if they can be sited behind continuous screens;
- In areas where continuous screens are not provided and the loss of verge grassland is acceptable, permanent ground cover such as dense bramble or gorse would be maintained across the entire width of both verges, in order to reduce the attractiveness of the verge to Barn Owls. This is especially important where roads are level with, or raised above, the adjacent terrain;
- As Barn Owl typically forage over areas of meadow and grassland, it is advised that landscaping immediately adjacent to the road should primarily consist of woodland as opposed to meadow to reduce the suitability of this verge for Barn Owl. Woodland comprising native species will have the most benefits for biodiversity. Advanced landscaping would include for full standard native trees (Volume 03; Figures 13-2 to 13-7).
- The mitigation as outlined in TII (2021): The Interactions between Barn Owls and Major Roads: Informing Management and Mitigation, should be followed. On proposed roads, the below measures should be targeted (if applicable) to: a) sections of road with wide verges (≥ 20 m) of suitable open grass/herbaceous cover, b) in proximity to junctions and road lighting, and (c) sections of road which traverse areas of a high probability of use by Barn Owls:
  - A 3 m strip of verge immediate to the hard shoulder should be maintained/managed as 'unsuitable' habitat for Barn Owls. This 3 m strip could be grass which is maintained at a maximum sward height of 100 mm through a regular mowing regime, or stone (the latter would require less management);
  - A 2 m strip of low and dense bramble (*Rubus fruticosus* agg. is preference) should be maintained along the verge, at a distance of 3 m from the hard shoulder;
  - A tree line should be planted so that the base of the trees are in line with the edge of the bramble furthest from the road (i.e. 5 m from the hard shoulder), or within the bramble. Trees should extend for a minimum of 4 m above the height of the carriageway (which is informed by the height of Heavy Goods Vehicles (HGVs) and on the basis that Barn Owl flight lines may drop above the surface of the road, after flying over the tree line when crossing the road). Therefore, on embanked sections of road the trees will need to be sufficiently high to compensate for the fact that the base of the tree will be lower than the height of the carriageway, which may require increasing the distance of the tree from the road;
  - The tree line should be continuous, without breaks and be the desired length based on the verge features. The following native tree species can be used: Willow (*Salix* species), Birch, Alder, Hawthorn, Mountain Ash or Hazel;

- It should be ensured that no areas of 'suitable' foraging habitat for Barn Owls exist between the natural barrier (bramble and tree line) and the road; and
- 'The remainder of the verge (between the tree line and boundary fence line) should be maintained as open grassland and managed as suitable habitat for Barn Owl and in line with pollinator enrichment management (species rich meadow and wildflower areas). Artificial perches can also be installed in this area of verge.

Habitat Compensation and Nest Box Installation

As part of the habitat compensation works, lost hedgerows and woodland will be compensated for through the landscaping master plan. Installation of a variety of suitable bird boxes (n=30) for cavity nesting and other woodland associated birds is proposed to offset temporary losses of nesting habitat and enhance areas for birds. Swift boxes (suitable for five breeding pairs) and Barn Swallow nest trays (suitable for five breeding pairs) will also be obtained, at suitable locations agreed with the local community (i.e. the nearby Abbey or Buildings). Locations for nest box installation will be decided and approved by the ECoW. Care should be taken to ensure boxes are installed to a high standard, to ensure stability and maximize likelihood of use by nesting birds through appropriate positioning. Nest boxes for cavity nesting birds will be positioned a minimum of 2.5 m above ground level, in mature and semi mature trees, or other appropriate areas with high usage potential.

The landscape plan will provide some dead wood piles (following site clearance) close to field boundaries locally, that will enhance the area for prey species of some birds during the operation phase.

7.7.1.3.8 Fish Mitigation

Mitigation Measures

In the absence of mitigation, negative effects are likely to arise from the Proposed Road Development on the attributes associated with the QI of the Lough Corrib SAC. This section prescribes the mitigation measures and appropriate control measures to block pathways with the potential to result in adverse effects thereby protecting the integrity of European sites and QI species during the construction and operational phases of the Proposed Road Development.

7.7.1.3.8.1 Construction Phase Mitigation

The project will adopt a number of construction measures that avoid the potential for any adverse impacts on the fisheries QI of the Lough Corrib SAC. The following measures will be incorporated into the works schedule:

- Control measures such as silt fencing will be used throughout the construction phase to reduce the risk to the Abbert River. Regular monitoring and recording of the effectiveness of the control measures will be implemented with additional control measures employed if and when required;
- Sheet piling will be required for abutment construction within 10 m of the riverbank. Piling of the proposed bridge abutments adjacent to the Abbert River should be programmed so as to avoid sensitive lifecycle periods for QI Atlantic Salmon and Brook Lamprey. Piling is advised to be scheduled from July to September inclusive, unless otherwise agreed with IFI;
- Light spill onto the river channel during hours of darkness has the potential to affect QI Atlantic Salmon. Turning off lights during periods of darkness whilst the construction phase is in close proximity to the river is recommended. Light spill from construction onto the Abbert River will not exceed 1 lux (equivalent to moonlight);
- Dewatering of open trenches requires silt mitigation. This could include the use of silt bags, settlement tanks and/or attenuation ponds. Excavation of drains will require waters to be over-pumped/piped/diverted and silt mitigation installed where necessary. Drain works should be undertaken in a manner, and in a timeframe to be agreed with IFI. It is noteworthy that some drain works are classified as 'instream works' and therefore time restrictions for these works may apply. Drain works could require the use of silt bags, settlement tanks and/or attenuation ponds to ensure no pollution to watercourses;
- To minimise the effects of habitat loss on fish species, all sections of river/stream channel within the Proposed Road Development boundary, but not within the footprint of the Proposed Road Development and associated infrastructure, will be protected from site clearance and construction works. Rivers/streams will be fenced off at a minimum distance of 10 m from the river bank and within 5 m for the specific circumstance of bridge development. Within this zone the natural riparian vegetation will be retained;

- All temporary crossing structures used to cross watercourses during construction will be designed in accordance with the Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters (IFI, 2016) and Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes (National Roads Authority (TII), 2005) to maintain fish and macroinvertebrate passage, and to prevent sedimentation and erosion;
- No abstraction of water for dust suppression from the Abbert River will occur unless agreed with IFI and GCC and if it is agreed, the suction head shall be screened with a fish proof mesh to make sure fish are not removed or damaged during the abstraction process;
- The drain identified as having fishery potential will need to have fish captured and removed, under licence, in a manner to be agreed with IFI (e.g. by 1. electrofishing and netting/2. dewatering with a pump (with a mesh suitable to stop fish suction into the pump) and netting. Live fish will need to be captured and released to the Abbert River. De-fishing will need to be undertaken under licence from IFI. No fishing will be required if the drain has dried out of natural causes and there is no fish potential in the drain; and
- No discharge of pollutants to the adjacent river, should occur.

7.7.1.3.8.2 Operation Phase Mitigation

The Proposed Road Development will incorporate an embedded drainage system design that will allow storm-water management. This will include petrol interceptors when outfalling to the Abbert River and attenuation ponds.

7.7.1.3.9 Amphibians

7.7.1.3.9.1 Construction Phase Mitigation

Habitat loss can be limited during clearance phase. Avoidance of most sensitive times (February to July, inclusive) will reduce likelihood of impacts on amphibians. A preconstruction survey of areas identified by this survey and other wetland sites suitable for supporting breeding amphibians should be carried out in order to determine whether breeding amphibians are present. In the case of Common frog, any frog spawn, tadpoles, juvenile or adult frogs present will be captured under licence from NPWS and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat, beyond the ZoI of the Proposed Road Development.

In the case of Smooth newt, individuals will be captured and removed from affected habitat either by hand net or by trapping and translocated to the nearest area of available suitable habitat, beyond the ZoI of the Proposed Road Development. If used, the type and design of traps shall be approved by the NPWS. This is a standard and proven method of catching and translocating Smooth Newt.

If the size or depth of the habitat feature is such that it cannot be determined whether all amphibians have been captured, it will be drained under the supervision of a suitably experienced ecologist to confirm that no amphibian species remain before it is destroyed or infilled. Any mechanical pumps used to drain the habitat feature will have a screen fitted, and be sited, such that no amphibian species can be sucked into the pump mechanism, or damaged by pumping. Any capture and translocation works will be undertaken immediately in advance of site clearance/construction works commencing, under licence from NPWS.

Suitable passage for aquatic species will be enabled through appropriate positioning of any culvert installation in any watercourse through an embedded placement with no barriers to migration (IFI, 2016).

7.7.1.3.9.2 Operation Phase Mitigation

Range-restriction or barrier effects will be prevented by the embedded design which includes for the installation and maintenance of drainage culverts at the sites of existing drains. The combination of the network of wildlife passage possible via culverts and the clear-span bridge structure will provide a high degree of landscape scale permeability along the Proposed Road Development. This will serve to maintain connectivity at a Local scale between sites used by amphibian species and is predicted to reduce any long-term severance or barrier effects associated with the Proposed Road Development such that the conservation status of amphibian species is not likely to be negatively affected. The locations of the wildlife passage facilities described above are shown in Volume 04; Appendix A7-10.

The landscape plan will provide dead wood piles located close to field boundaries, that will enhance the area for amphibians during the operation phase.In addition, the retention of settlement/roadside ponds will have a highly a positive impact on amphibian species and are likely to present an overall benefits to these species in the area, relative to the pre-construction environment.

7.7.1.3.10 Lepidoptera

7.7.1.3.10.1 Construction Phase Mitigation

Clear delineation of clearance areas and works areas will prevent unnecessary removal of habitat for these species.

7.7.1.3.10.2 Operation Phase Mitigation

No mitigation is proposed in addition to that inherent in the landscape planting plan, which will include the spread of native, species-rich wildflower meadow in well drained areas, Wetland habitat reinstatement will have involved the placement of turves and reuse of spoil/vegetated turves in the construction stage. Seeding of wetland/wet grassland habitat is not proposed in order to enable the existing seed bank to develop. This native seed in this soil could potentially include the seed of species assemblages that support the larvae of Marsh Fritillary. Hedgerow planting of native plant species communities will occur as part of the landscape planting plan which will serve to support Lepidoptera as the hedgerows develop.

No mitigation is proposed in relation to the potential (and assumed) presence of invertebrate species of least conservation concern presumed present in wetland, wet grassland, and wooded habitats. Landscaping will retain native plant species and vegetation as much as possible by reusing spoil and vegetated turves in addition to planting native species.

Suitable well drained, and poorly drained areas, including areas surrounding drains and verges will be planted with seed mix which represents community assemblage suitable for marsh fritillary larvae The implementation of the landscape plan is likely to improve the area for numerous Lepidoptera species.

7.7.1.3.11 White-clawed crayfish

7.7.1.3.11.1 Construction Phase Mitigation

A schedule of mitigation measures set out to ensure protection of surface water quality has been developed in Section 7.7. The proper implementation of these, which will be incorporated into the CEMP will ensure adequate protection for Crayfish.

7.7.1.3.11.2 Operation Phase Mitigation

The Proposed Road Development will incorporate an embedded drainage system design that will allow storm-water management. This will include petrol interceptors when outfalling to the Abbert River and attenuation ponds that will ensure adequate sufficient protection for Crayfish.

7.7.1.3.12 Other Protected and Notable Species

7.7.1.3.12.1 Construction Phase Mitigation

In order to minimise the risk of site clearance and construction works disturbing, or causing the mortality of, Common Lizard the following schedule of site clearance works will be followed:

- Grassland or scrub vegetation will be removed during the winter period, where possible, avoiding potential common lizard hibernacula sites (dry sites which provide frost-free conditions e.g. stone walls, underground small mammal burrows, piles of dead wood or rubble);
- Where winter clearance is not possible and clearance will be undertaken during the active season (March through to September, inclusive), vegetation will be cut first to approximately 15 cm, and then to the ground, under supervision of an ecologist. This will allow the opportunity for lizards to be displaced by the disturbance and leave the affected area; and
- Stone walls that have suitability for Common Lizard (or other potential hibernacula sites) (as determined by the Ecological Specialist) will be removed during the active season (March through to September, inclusive) under the supervision of an ecologist, when they are less likely to be in use by torpid lizards. These walls should also be surveyed in advance for bird nesting potential and follow the appropriate aforementioned procedures relating to nesting birds.

7.7.1.3.12.2 Operation Phase Mitigation

The landscape plan will provide dead wood piles locally and close to field boundaries, that will enhance the area for Common Lizard during the operation phase.

7.7.2 Monitoring

7.7.2.1 Construction-Phase Monitoring

7.7.2.1.1 Role of the Contractor

Ecological monitoring will be undertaken by the Contractor's ECoW, through site inspections. Additional monitoring will be undertaken by the client's Ecological Specialist. Monitoring will be undertaken through construction and works monitoring. Visual surveys will be undertaken of works to ensure that all required environmental protection measures are in place. Visual surveying of watercourses will also be undertaken, and water quality will be tested by the ECoW through the use of calibrated handheld equipment. Turbidity, pH and conductivity measurements will be taken at drain and riverine locations to assess the effectiveness of mitigation measures. The monitoring programme will require monitoring during construction works, at drain outfalls, and the main channel (both upstream and downstream of works). Ecological monitoring by the ECoW will focus on assessing and highlighting pollution risk and ensuring adequate mitigation and works practices are ongoing in line with this EIAR and CEMP, to ensure no adverse effects of works on the environment. The chronicling of mitigation, monitoring, and reporting of aspects of the Ecological Monitoring Strategy (EcMS) is the responsibility of the ECOW.

The Contractor will carry out a continuous programme of water quality monitoring during the construction phase, whose parameters and requirements will be agreed with the NPWS, IFI and the Client's Ecological Specialist (Refer to Chapter 09 Water). This monitoring programme will require, at a minimum, the deployment of an upstream and downstream continuous recording meter in the Abbert River between 50 to 500 m upstream and 250 m to 1 km downstream of the works area). These meters will monitor water quality and upload results, so that water parameters can be read in real time by the contractor and client to monitor water quality within the Abbert River (within Lough Corrib SAC).

7.7.2.1.2 Role of the Ecological Clerk of Works

The Contractor will appoint an ECoW for the duration of construction. The ECoW will be appointed to oversee, advise, and facilitate the proper implementation of all ecological mitigation measures by the Contractor, and fulfil the requirements of the EcMS (See 7.7.2.1.2.1: Ecological Monitoring Strategy), to include consultation input from the NPWS and IFI. Also See 7.7.1.1.2: Role of the Ecological Specialist and Ecological Clerk of Works.

7.7.2.1.2.1 Ecological Monitoring Strategy

The Ecological Specialist will review this EIAR, the NIS, planning conditions, post-consent consultations with statutory bodies, and the results of pre-construction surveys, to inform production of an 'Ecological Monitoring Strategy" (EcMS). The EcMS will be followed by the contractor, through their ECoW.

The function of the Ecological Monitoring Strategy (EcMS) will be to:

- Monitor and chronicle installation of mitigation, effectiveness of mitigation, results of mitigation and plan mitigation;
- Inform adaptive management measures to be agreed with GCC and advised to the Contractor;
- Provide an evidence-base to be communicated to the NPWS and IFI, on the effectiveness of mitigation measures proposed, to inform improvements to industry practice; and
- Track contractor performance in relation to implementation of the ISSAMP; CEMP, WMP, CESCP.

The specific aims of the EcMS will be to monitor and oversee the correct implementation of mitigation from this EIAR, and instruct the Contractor on how to adapt mitigation as required, with particular regard to (but not limited to):

- Results of pre-construction surveys which may identify new ecological constraints within the ZoI of the Proposed Road Development;
- Implementation of the ISSAMP; CEMP, WMP, CESCP and water quality monitoring;

- Phasing of works including piling, earthworks, and vegetation clearance in response to potentially unforeseen weather conditions or programme changes;
- Phasing of works in accordance with habitat and species-specific ecological recommendations i.e. bird nesting season, Common Lizard mitigation, amphibian mitigation, bat mitigation and the season for instream/drain works and piling and any other relevant considerations highlighted in this EIAR;
- Assessing condition and performance of silt fencing, silt de-watering sacs and other aspects of the CESCP, as informed by site observations by the ECoW, and the results of the Contractor's water quality monitoring;
- Assessing and advising on working methodologies for activities onsite;
- Ensuring directional lighting is used to minimise light spillage on the QI of the Lough Corrib SAC and the Abbert River;
- Ensuring construction and installation of mammal fencing (including lead-in planting, and access ramps);
- Ensuring appropriate installation of culverts and pipe crossings (to ensure and enable mammal, amphibian, and fish passage (TII (2005), IFI (2006));
- Ensuring the drafting and implementation of a habitat translocation, monitoring and maintenance plan, to translocate, maintain and enhance the Annex 1 *Molinia* Meadows;
- Implementation of Annex I *Molinia* Meadows and Petrifying Spring monitoring and conservation plan; and
- The appointed ECoW will report the actions taken under the EcMS to GCC, and the NPWS and IFI in agreement with GCC. The Ecological Specialist may also report on actions to NPWS and IFI.

7.7.2.2 Operation Phase Monitoring

GCC will be responsible, during operation, for the commission of a suitably experienced ecologist(s) to monitor effectiveness of; and make recommendations, where required, to adapt the measures set out in relation to specific species and habitats.

7.7.2.2.1 Annex I Molinia Meadows

An appropriate management plan for the sod translocation area will be developed and implemented, such as extensive grazing and/or a sensitive mowing regime, that will be informed by monitoring. Quarterly monitoring, for a three-year period will be required. The monitoring programme will assess the success of the translocation through ground water assessment using a piezometer and habitat surveying by specialist ecologists who will assess species diversity and abundance. A similar monitoring programme is to be carried out on the remaining Annex I habitat areas to the north of the Proposed Road Development. It is recommended that this is carried out concurrently. The success of the management regime will be assessed through habitat surveying. These findings will inform recommendations for any changes or alterations to the management that are needed.

7.7.2.2.2 Annex I Petrifying Springs

Weekly visual checks will be undertaken of the spring during construction works, with photographs taken and written descriptions of flow recorded. Following the programme of monitoring of the pH of the Petrifying Spring for the duration of the construction phase, a pH monitoring programme should be undertaken following commencement of operation. A quarterly sampling programme will be undertaken for two years after construction works. This will include scheduling samples for an inorganic suite of analysis, to include pH, electrical conductivity, ammonium, nitrate, fluoride, chloride and sulphate as well as groundwater volumes. Ecological monitoring is to be undertaken as per guidelines given by the NPWS (2016). This monitoring is to employ suitable indicator criteria as per Lyons & Kelly (2016) such as tufa type, surface water characteristics and field/ground flora.

7.7.2.2.3 Bat Monitoring and Lighting

Information on the proposed lighting is detailed in Section 4.5.8 of Chapter 04 Description of the Proposed Road Development. A suitably experienced bat ecologist will visit the Proposed Road Development site during operation to measure, using a suitably calibrated light meter, light spill onto habitat within 100 m of the Abbert River. Additive light spill (i.e. from the Proposed Road Development alone) onto any bat habitats known to be used by highly light sensitive species (i.e. the Abbert River) will not exceed 1 lux.

In accordance with CEDR (2016) guidance it is proposed that this post-construction monitoring will involve a minimum of two separate surveys in the breeding season and two separate (in time) surveys in mid-August to late-September, to reflect periods of landscape-scale movements, and that these surveys take place for two bat activity seasons (May-August) following completion of the construction of the Proposed Road Development. Monitoring will comprise acoustic detector recording at a minimum, along the river, pond areas and woodland areas adjacent to the Proposed Road Development. Particular emphasis will be placed on assessing bat activity at the location of the proposed new bridge.

7.7.2.2.4 Badger

In accordance with the recommendations described in the 'Guidelines for the Treatment of Badgers during the Construction of National Road Schemes*'* (TII, 2006b), quarterly monitoring of the effectiveness of the mitigation measures will be undertaken in the first year after the completion of construction works (e.g. inspection for Badger activity, fencing integrity and mammal underpass/≥600 mm pipe condition). The use of areas by Badger will be identified through field surveys for Badger sign and deployment of trail cams within the ZoI.

7.7.2.2.5 Otter

A monitoring programme will be undertaken post construction for a minimum of one year with quarterly surveys undertaken to assess habitat use by Otter and the effectiveness of mammal proof fencing to prevent road casualties and pipe crossings for enabling Otter movement. An assessment of the effectiveness of mitigation measures for Otter is proposed, such that use of pipe crossings by Otter, and use of habitat upstream of pipe crossings by Otter, is assessed. The use of areas by Otter will be identified through field surveys for Otter sign and deployment of trail cams within the ZoI.

7.7.2.2.6 Barn Owl

As per TII (2017) Barn Owl Surveying Standards for National Road Projects, resurveying of the ZoI for Barn Owls is required intermittently in order to assess the site for Barn Owl activity during construction and operation of the Proposed Road Development. It is recommended that dedicated surveys are conducted for Barn Owl within the ZoI during the construction and operational phase and for potential mitigation measures for Barn Owl should be implemented if necessary, based on survey outcomes over this period.

As noted in TII (2021), 'post-construction monitoring is a requirement on all National Road Projects where Barn Owl mitigation measures are applied in the landscape treatment. The specific requirements for post-construction monitoring must be set out in the EIAR. Post-construction monitoring must include a road casualty survey to assess Barn Owl mortality rates and locations on the Proposed Road Development and in relation to the mitigation measures. The methods for designing and undertaking the road casualty survey are specified in REENV-07004 'The interactions between Barn Owls and major roads: informing management and mitigation' (Lusby *et al*. 2021). Where post-construction monitoring of sections of road without mitigation measures identifies Barn Owl hotspots, or in areas where there is a high risk of vehicle collisions occurring, options for the installation of mitigation measures shall be considered where beneficial. Any post-construction measures shall be limited to minor works.'

Road casualty surveys are to be carried out for a period of two years (from the opening of the road) and will include one survey visit per week to record the number and location of all Barn Owl road casualties as per 'The Interactions between Barn Owls and Major Roads: Informing Management and Mitigation'. The survey will be undertaken along the route length by a Barn Owl Specialist (defined in TII (2021a)) (TII, 2021a).

7.7.2.2.7 Marsh Fritillary

Monitoring for Marsh fritillary and food plants will be undertaken for three years post construction within suitable habitat types along the Proposed Road Development.

7.8 Residual Impacts and Effects

This section should be read in conjunction with summary tables of potential impacts and effects in Section 7.10.6 (Table 7-21 and Table 7-22). The project-specific NIS should also be referred to. Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines (EPA 2017), the effects from the impacts that remain after all assessment and mitigation are referred to as 'Residual Effects'.

7.8.1.1 Designated Sites

Implementation of mitigation, including the adaptive management approach incorporated through monitoring, will ensure there will be no significant residual effects to Lough Corrib SAC, or other designated sites.

7.8.1.2 Annex I Habitats

7.8.1.2.1 Petrifying Springs

No residual impacts are predicted following correct implementation of mitigation. Note that this habitat is within Lough Corrib SAC but outside of the Proposed Road Development site boundary.

7.8.1.2.2 Molinia Meadows

A habitat enhancement and maintenance plan will be drafted, which will be guided by details outlined in this EIA and a monitoring programme, to maintain and enhance the Annex 1 *Molinia* Meadows. Following the full implementation of the mitigation outlined, there could be a minor loss of Annex I *Molinia* Meadows following translocation efforts. With the appropriate translocation, the area of this habitat has the potential to expand and colonise adjacent wet grassland areas.

7.8.1.3 Non-Annex Species and Habitats (Construction)

Other residual effects will be limited to being significant at Local level, namely:

- Permanent net loss of habitats which are not QIs of European sites, including scrub, hedge, and improved grassland habitat during construction;
- Permanent net increase of woodland, wet grassland, and wetland (pond) habitat; and
- Disturbance and/or mortality during construction to localised populations of nationally protected amphibians, reptiles' mammals, and birds.

7.8.1.4 Non-Annex Species and Habitats (Operation)

Residual effects during operation to species and habitats are predicted to be limited to Local level in all cases, namely in relation to:

- Localised, low level disturbance during operation to localised populations of nationally protected and unprotected species;
- Disturbance, severance and/or displacement impacts to foraging invertebrates, amphibians, reptiles' mammals, and birds from operation of Proposed Road Development; and
- Significant positive effects will also be expected; for example, ponds and landscaping design will provide opportunities for numerous species. Retention of ponds is likely to benefit amphibians, as well as some wetland bird species.

7.9 Do Nothing Scenario

The potential value of the Proposed Road Development to species of conservation value such as Otter and birds would continue, provided the landscape is managed as before. Trees, scrub, and woody vegetation would further mature and may sustain storm damage to provide greater suitability for bats or breeding birds. Current pressures on mobile fauna species from human disturbance associated with agricultural activities would continue. Pollution risks from current agricultural inputs and the existing roadway would continue to pose a threat to Atlantic Salmon, Brook Lamprey and other aquatic species listed for conservation in Lough Corrib SAC.

7.10 Cumulative Impacts and Effects

This assessment has particular regard for developments potentially affecting the Lough Corrib SAC, as the Proposed Road Development interacts with this site. The text in this section discussed considerations in assessing cumulative and in-combination effects. Findings are summarised in Table 7-21 and Table 7-22.

7.10.1 Threats to Lough Corrib SAC

The Natura Standard Site Synopsis for the Lough Corrib SAC (NPWS, 2015) highlights some activities as posing a threat of high importance to the SAC. "T*he main threats to the quality of this site are from water polluting activities resulting from intensification of agricultural activities on the eastern side of the lake, uncontrolled discharge of sewage which is causing localised eutrophication of the lake, and housing and boating development, which is causing the loss of native lakeshore vegetation*" (NPWS, 2015).

The mitigation outlined in this EIAR, to protect watercourses can adequately ensure that the Abbert River, and Lough Corrib SAC are protected from water pollution. The Proposed Road Development will not be associated with nutrient enrichment of watercourses or uncontrolled discharges of sewage during construction or operation. Therefore, the Proposed Road Development is not deemed to have adverse impacts on water quality and therefore no cumulative or in-combination impacts/effects on water quality or the ZoI are envisaged.

The impact of changes to groundwater on Annex I Petrifying Springs within Lough Corrib SAC, which is adjacent to the Proposed Road Development have already been considered. No cumulative impacts associated with the Proposed Road Development have been identified that would undermine the integrity of Lough Corrib SAC.

7.10.2 Planning Applications

A search was conducted of planning applications within the ZoI of the Proposed Road Development to identify applications which could act in-combination with the Proposed Road Development to impact European sites (see Volume 3; Appendix A1-1) . A desktop planning application search, using publicly available data from MyPlan.ie's National Planning Application database, GCC planning application portal, and An Bord Pleanála online database was undertaken. The majority of planning applications for the lands situated around the Proposed Road Development, predominantly relate to small scale residential developments, amendments, and extensions. Other projects are likely to be associated with removal of some habitat used by various species. This may result in reduced foraging and resting areas for wildlife. Additionally, such works could pose pollution risks to watercourses, with adverse effects on aquatic flora and fauna. Smaller scale projects identified are not deemed to have any likelihood of contributing to significant cumulative or in combination effects in conjunction with the Proposed Road Development due to their small-scale, small footprint, and regulatory requirements, that require adherence to standards and protocols that safeguard the environment. Given the widespread availability of suitable habitat in the surrounding landscape, cumulative or in combination effects are not deemed to be significant, at any geographic scale (Planning search was undertaken in July 2021).

Planning application are detailed within Volume 04; Appendix A1-1.

7.10.3 Ground Water

Hydrogeology and groundwater considerations associated with construction and operation of the Proposed Road Development are discussed in detail in Chapter 09 Water.

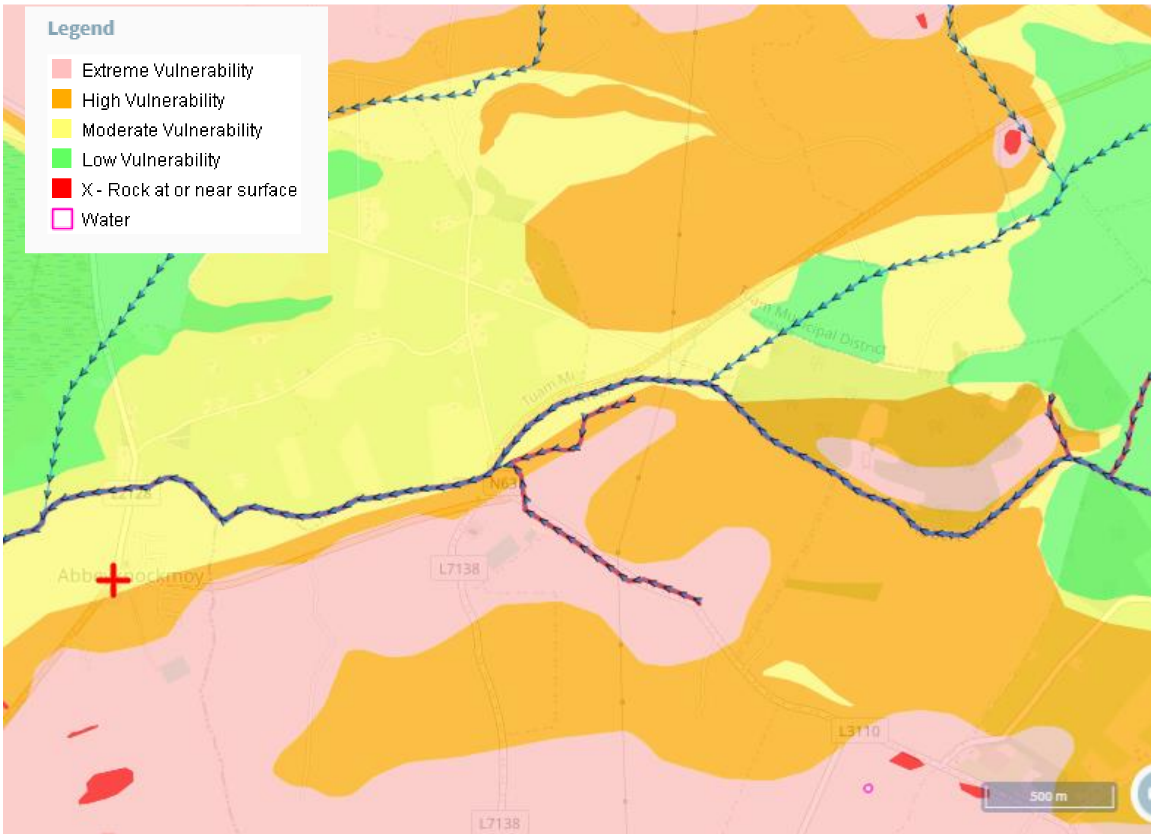

Figure 7-4 Groundwater vulnerability in the area of the Proposed Road Development.

(The red cross indicates the location of Abbeyknockmoy (www.epa.ie, last accessed March 2021)).

Groundwater 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. Groundwater vulnerability in the footprint of the Proposed Road Development is shown in Figure 7-4. Groundwater vulnerability maps are based on the type and thicknesses of subsoils (sands, gravels, glacial tills (or boulder clays), peat, lake and alluvial silts and clays), and the presence of karst features (Figure 7-4). There is a sealed drainage system embedded within the Proposed Road Development design, therefore no adverse effect on groundwater is anticipated. No cumulative or in-combination effects on groundwater or groundwater dependent habitats/species are anticipated.

7.10.4 Surface Waters

Surface water management is discussed in detail in Chapter 09. The existing water quality of watercourses upstream, adjacent, and downstream of the Proposed Road Development within the Corrib CMU offers a useful proxy metric for the pressure of existing projects and plans on the aquatic features within the Abbert River. The water quality status in the Abbert River is Moderate (Q3-4) (Q4 at the nearest EPA monitoring station in 2018) located within 1 km of the Proposed Road Development . This indicates the Abbert River may have a somewhat reduced assimilative capacity to absorb further silt loading and/or contaminants.

There is potential for consented and future development to act in-combination with the Proposed Road Development to additively or synergistically affect QIs of the SAC and Abbert River via changes in water quality in the Lough Corrib SAC. This may indirectly affect Kingfisher of the Abbert River through prey reductions.

However, there are binding obligations on all Irish local authorities including GCC to achieve good status of surface waters, under the terms of the EU Water Framework Directive 2000/60/EC, and in related policies in applicable county development plans. Furthermore, Irish Water, who has national statutory remit for wastewater and drinking water services, has committed to a 25-year programme of improvements to wastewater impacts on surface waters in their Water Services Strategic Plan (WSSP).

The second cycle RBMP (2018-2021) prioritises targeted measures to improve water quality in areas for action during the lifetime of the current RBMP. The targeted approach will continue in the third cycle (2021 – 2027) (DoHGLP, 2018-2021). As the Proposed Road Development is not envisaged to adversely affect water quality, no cumulative effects on water quality are envisaged as a result of this development.

7.10.5 Plans

Plans are referred to in Chapter 02 Need for the Scheme and Planning Policy Context. Key plans that are relevant to the environment are summarised below.

7.10.5.1 Project Ireland 2040

The Project Ireland 2040 National Planning Framework (NPF, 2018) does not list specific plans for the ZoI of the Proposed Road Development, and no in-combination effects are predicted. The RSES for the Northern and Western Region does not indicate any specific development within the ZoI, that is likely to lead to cumulative impacts (RSES, 2019).

7.10.5.2 Galway County Development Plan

A strategic aim of the plan is to promote regional development and growth through harnessing the economic and employment potential of the competitive advantages of County Galway such as its strategic location, quality of life, landscape, heritage and natural resources, in a sustainable and environmentally sensitive manner.

It is the policy of GCC, to support the conservation and enhancement of natural heritage and biodiversity, including the protection of the integrity of European Sites, the protection of Natural Heritage Areas and proposed Natural Heritage Areas and the promotion of the development of a green/ecological network within the plan area, in order to support ecological functioning and connectivity, create opportunities in suitable locations for active and passive recreation and to structure and provide visual relief from the built environment. The plan seeks to afford suitable protection to the environment and natural resources of the County and ensure the fulfilment of environmental responsibilities. A strategic aim of the plan is to prioritise development within the Hub town of Tuam, the Galway Metropolitan Area, Ballinasloe, the key towns and smaller towns, villages and settlements within the County, while supporting the role of the rural areas in sustaining the rural based economy (GCC, 2015, 2015a, 2018).

7.10.5.3 National Biodiversity Plan

National Biodiversity Plan strives for there to be no net loss of biodiversity (DoHGLP, 2017). The vision for is that ‘biodiversity and ecosystems in Ireland are conserved and restored, delivering benefits essential for all sectors of society and that Ireland contributes to efforts to halt the loss of biodiversity and the degradation of ecosystems in the EU and globally’. Successful implementation of this plan will result in improved biodiversity value in the surrounding landscape, In the context of the Proposed Road Development, mitigation including surface water management and a landscaping design have been developed. Construction and operational phase ecological recommendations and monitoring will be enforced. These considerations will ensure that disturbance to biodiversity is minimised and there will be a net overall improvement of habitat availability for some species and species groups. It is plausible that some other species groups will be adversely affected at a Local level.

7.10.5.4 All Ireland Pollinator Plan

Given the poor conservation status of many native pollinating species in Ireland (with approximately one third of native bee species threatened with extinction nationally), the All Ireland Pollinator Plan was developed to improve the suitability of the Irish landscape for pollinators and raise an appreciation for pollinator biodiversity and ecosystem services provided by pollinators. The All-Ireland Pollinator Plan aims to educate farmers, local authorities, schools, businesses and gardeners on the importance of pollinators and encourages and raises awareness of active ways of improving the landscape for pollinators, through habitat development, native species planting, mowing management and through the development of resting areas (NBDC, 2020).

7.10.5.5 Galway Biodiversity Plan

The County Galway development plan (2015-2021) promotes ‘the protection and enhancement of biodiversity and ecological connectivity within the plan area, including woodlands, trees, hedgerows, semi-natural grasslands, rivers, streams, natural springs, wetlands, stonewalls, geological and geo-morphological systems, other landscape features and associated wildlife where these form part of the ecological network and/or may be considered as ecological corridors or stepping stones in the context of Article 10 of the Habitats Directive’ (GCC, 2015).

7.10.5.6 Tuam Local Area Plan 2018-2024

Tuam is the closest large town, to the Proposed Road Development. GCC support and facilitate the sustainable development of the Tuam Local Area Plan 2018-2024 in line with the development strategy option, - Even Development with a Refined Plan Boundary (GCC, 2018). This policy strives to allow Tuam to develop in a manner that maintains and enhances the quality of life of the local community, promotes opportunities for economic development, sustainable transport options, connectivity and social integration, protects the cultural, built, natural heritage and environment and complies with relevant statutory requirements. The Core Strategy of the Galway County Development Plan 2015-2021 has identified a target population growth of up to 2,080 persons for Tuam to 2021, which results in a maximum requirement for 52.39 ha of zoned residential land. This increase in population could pose potential environmental risks to Lough Corrib SAC, however, an objective of the plan is to protect all water resources in the plan area, including rivers, streams, springs, wetlands, surface waters and groundwater quality, in accordance with the requirements and guidance in the EU Water Framework Directive 2000 (2000/60/EC), According to the Galway County Development Plan 2015-2021, the wastewater treatment capacity for Tuam is at adequate capacity following the Water & Sewerage Scheme – Network Contract completed in 2012 (GCC, 2015).

7.10.5.7 Galway County Heritage and Biodiversity Plan 2017- 2022

The aim of the Galway County Heritage and Biodiversity Plan 2017- 2022 (GCC, (document finalised in 2020)) is to place heritage and biodiversity at the heart of public life in the county. This will be achieved through increasing awareness, participation, enjoyment, knowledge and understanding of our shared heritage to lead to its proper conservation, management and protection and safeguarding it for future generations.

7.10.5.8 West County Galway Hedgerow Survey

Recommended Policies as outlined in the ‘West County Galway Hedgerow Survey’ are outlined below (GCC, 2007).

a. A county-wide hedgerow conservation policy should be developed. This could form part of Biodiversity Action Plan for the county and should be referred to in the County Development Plan.

b. Species- rich hedgerows, townland boundary hedges and hedgerows that rare species should be safeguarded more stringently in new developments and road widening schemes.

c. Best practice guidelines should be produced in relation to hedgerow management and conservation for planners, road engineers and other council officials.

d. As roadside hedgerows frame the countryside for all road users and increase the scenic value of the landscape, they should be retained where possible. The retention of roadside hedgerows helps maintain the integrity of the rural character of the landscape and lessens the impact of one-off housing on the landscape. e. Hedgerows should be retained where possible in small and large developments. They help maintain the wildlife value of new developments and integrate them into the landscape.

f. Hedges of agricultural land that has been re-zoned for development should be surveyed and those with significant biodiversity, historical value and/or containing rare species should be identified, incorporated into a GIS database, and retained where possible.

g. If a hedgerow must be removed, a new native hedgerow should be planted to mitigate against the impact of the hedgerow loss. The new hedgerow should link in to existing adjacent hedges where possible.

h. Enforcement of conditions that pertain to hedgerows should be enforced. This could be achieved by making the retention, re-location and/or re-establishment of hedgerows in planning consents the subject of a bond sought by the Galway County Council from those seeking planning permission, especially for large developments.

i. Local authority road schemes should plant native hedgerows where existing boundaries have to be removed (see below). The National Roads Authority has already committed to planting native trees and shrubs in all new road schemes.

j. No cutting during bird nesting season unless absolutely necessary from a road safety perspective. Ideally approval in writing from NPWS should be sought prior to any hedgerow cutting on behalf of the County Council that occurs within the prohibited period. New planting a. Native shrubs and trees should be specified for all new hedge planting or for infill planting of existing hedges. Where possible, locally provenanced native plant species should be used.

7.10.5.9 Flood Risk Assessment and Arterial Drainage Plans/Projects

The Environmental River Enhancement Programme (EREP), operated by IFI aims to reduce negative impacts caused by past OPW drainage projects (Annual reports available online[24]). The EREP is likely to positively influence the condition and quality of aquatic habitats and species in the Lough Corrib SAC.

7.10.5.10 Summary of Plans and Programs

No significant adverse cumulative in-combination impacts or effects of the aforementioned programmes, policies, and plans, with the Proposed Road Development, on biodiversity, are anticipated within the ZoI.

7.10.5.11 Concluding Statements on Cumulative and In-Combination Effects

7.10.5.11.1 Designated Sites

Having regard for Proposed Road Development within the ZoI, river enhancement works under the EREP, the legal protection for the Abbert River (within Lough Corrib SAC) as a European site (through legislation at national level, and policy initiatives at national, county and local levels), and proposed plans and projects, no significant cumulative or in-combination effects are predicted that will affect the Lough Corrib SAC.

7.10.5.11.2 Annex I habitats

It is envisaged that there will be no significant cumulative or in-combination effects predicted to Annex 1 *Molinia* meadow or Petrifying Springs habitat taking into consideration the avoidance of direct habitat loss and the implementation of mitigation prepared to maintain and enhance these habitat types.

7.10.5.11.3 Other Species and Habitats

No significant adverse cumulative or in-combination effects on protected fauna, flora or non-designated or Annex habitats from proposed projects and plans identified within the ZoI of the Proposed Road Development were identified.

When mitigation measures and the measures proposed within the Landscape Plan (Chapter 13) are applied, potential impacts from the Proposed Road Development alone will be reduced in significance to have temporary effects at Local level for most habitat types (including, scrub, hedgerow, wet grassland and woodlands).

Potential impacts to nationally protected faunal and floral species are not predicted to be raised above the Local geographic scale of effect significance for the Proposed Road Development, because the mitigation measures outlined in the EIAR are designed to minimise adverse impacts on these species. The Landscape Plan (Chapter 13) will increase the overall extent for some of these habitats (e.g. hedgerows). No adverse cumulative or in-combination effects on protected fauna were identified.

[24] https://www.fisheriesireland.ie/Projects/erep.html. Last accessed on various dates in 2019

7.10.6 Summary

Table 7-21 and Table 7-22 summarise the geographic scale of potential effect significance at construction and operational phase for the Proposed Road Development and summarises other assessment criteria from this environmental impact assessment.

Table 7-21 Summary of Potential Impacts and Effects on Designated Sites, Habitats and Flora

Ecological Feature (Sorted from International to Local)	Valuation	Potential Construction Phase Impacts and Effects	Significance of Potential Construction-Phase Impacts and Effects	Potential Operation Phase Impacts	Significance of Potential Operational Phase Impact and Effects (i.e. after Landscaping establishment)	Mitigation Proposed (non-embedded control outside project Design)?	Residual Effect Significance	Cumulative Residual Effect Significance (inclusive of Proposed Road Development)
European sites (Lough Corrib SAC)	International	Habitat loss and deterioration Invasive species Pollution Disturbance	International	None	N/A	Yes	Not significant	Not significant
Other national designated sites	National	None	N/A	None	N/A	No	Not significant	Not significant
FW1 Eroding/upland rivers (Lough Corrib SAC)	International	Habitat loss and deterioration Invasive species Pollution Disturbance	County-National	None	N/A	Yes	Not significant	Not significant
Annex I *Molinia* meadows on calcareous, peaty or clayey-silt-laden soils (outside Lough Corrib SAC)	County-National	Habitat loss and deterioration Invasive species	County	Habitat loss and deterioration	County - Habitat development (through landscape plan and monitoring and management)	Yes	Not significant	Not significant
Annex I habitat Petrifying Springs with Tufa Formation (Cratoneurion) (within Lough Corrib SAC)	International	Habitat loss, pollution and deterioration	County-National	None	N/A	Yes	Not significant	Not significant
FS1 Reed and large sedge swamp	Local (Higher value)	None	None	None	N/A	No	Not significant	Not significant

Ecological Feature (Sorted from International to Local)	Valuation	Potential Construction Phase Impacts and Effects	Significance of Potential Construction-Phase Impacts and Effects	Potential Operation Phase Impacts	Significance of Potential Operational Phase Impact and Effects (i.e. after Landscaping establishment)	Mitigation Proposed (non-embedded control outside project Design)?	Residual Effect Significance	Cumulative Residual Effect Significance (inclusive of Proposed Road Development)
FW4 Drainage ditches	Local (Higher value)	Habitat loss	Local	None	N/A	Yes	Local	Local
GS1 Dry Calcareous Grassland	Local (Higher value)	None	None	None	N/A	No	Not significant	Not significant
GS4 Wet grassland	Local (Higher value)	Habitat loss	Local	None	N/A	Yes	Local	Local
WD1 Broadleaved woodland	Local (Higher value)	Habitat loss	Local	None	Habitat gain (through landscape plan)	Yes	Not significant	Not significant
FP1 Calcareous Springs	Local (Higher value)	Habitat loss	Local	None	N/A	Yes	Not significant	Not significant
WS1 Scrub	Local (Higher value)	Habitat loss	Local	None	Positive Effect: Habitat gain (through landscape plan)	Yes	Local	Local
WL1 Hedgerows	Local (Higher value)	Habitat loss	Local	None	Positive Effect: Habitat gain (through landscape plan)	Yes	Local	Local
GA1 Improved agricultural grassland	Local	Habitat loss	Local	None	N/A	No	Local	Local

Table 7-22 Summary of Potential Impacts on Fauna

Ecological Feature	Valuation	Potential Construction Phase Impacts and Effects	Significance of Potential Construction-Phase Impact and Effects	Potential Operation Phase Impacts	Significance of Potential Operation-Phase Impact/Duration	Mitigation Proposed (non-embedded control outside project Design)?	Residual Effect Significance/Duration	Cumulative Residual Effect Significance /Duration
Fish (Atlantic Salmon, and Brook Lamprey) in the Abbert River	National- International (QIs of Lough Corrib SAC)	Noise Pollution Habitat loss and degradation (spawning and foraging habitat)	Local/Temporary	Water quality degradation Disturbance	Local/Temporary	Yes	Not significant	Not significant
White-clawed Crayfish	National-International (QI of Lough Corrib SAC)	Pollution Habitat degradation	Local/Temporary	None	N/A	Yes	Not significant	Not significant
Kingfisher	National-International (Breeding) Annex 1 species	Noise, Vibration Pollution, visual disturbance, nest disturbance	Local/Temporary	Light spill	Local/Temporary	Yes	Not significant	Not significant
Lesser Horseshoe Bat	National-International (QI of Lough Corrib SAC)	No effects are anticipated as none were observed within the works footprint. If they start foraging in this area: Noise, Light spill.	NA	NA	NA	Yes	Not significant	Not significant
Otter	National -International (QI of Lough Corrib SAC)	Noise Disturbance Pollution (indirect impact via prey [fish] population decline) Habitat loss and degradation	Local/Temporary	Mortality (through collisions) Water quality degradation Disturbance Habitat gain (ponds)	Local/Long-term	Yes	Not significant	Not significant
Brown trout, three-spined Stickleback, other non-QI species in the Abbert River	County-National	Noise Pollution	Local/Temporary	Water quality degradation Disturbance	Local/Temporary	Yes	Not significant	Not significant

Ecological Feature	Valuation	Potential Construction Phase Impacts and Effects	Significance of Potential Construction-Phase Impact and Effects	Potential Operation Phase Impacts	Significance of Potential Operation-Phase Impact/Duration	Mitigation Proposed (non-embedded control outside project Design)?	Residual Effect Significance/Duration	Cumulative Residual Effect Significance /Duration
		Habitat degradation (spawning and foraging habitat)						
Foraging bats (at least seven bat species)	Local-County	Habitat loss Light spill	Local/Temporary	Light spill Habitat severance Habitat gain (landscape plan)	Local-County/Long-term	Yes	Not significant	Not significant -
Trees with low suitability for roosting bats	Local (Higher value)	Habitat Loss, physical damage	Local/Temporary	Habitat gain (landscape plan)	NA	Yes	Not significant	Not significant
Common frog, smooth newt	Local (Higher value)	Habitat loss and degradation Disturbance during breeding season	Local/Temporary	Habitat loss Range restriction Habitat gain (habitat creation)	Local/Permanent	Yes	Local / Long-term (positive)	Local/Long-term (positive)
Badger, common lizard, pygmy shrew, Irish hare, pine marten, hedgehog and stoat (all confirmed or presumed present)	Local (Higher value)	Habitat loss and degradation, Range restriction Disturbance Noise pollution	Local/Temporary	Range restriction Disturbance Noise Lighting	Local/Long-term	Yes	Local / Long-term	Local/Long-term
Lepidoptera (excluding Marsh Fritillary (not identified and therefore not affected))	Local (Higher value)	Habitat Loss	Local/Temporary	Range restriction Habitat creation (landscape plan)	NA	Yes	Not significant	Not significant
Wintering birds	Local (Higher value)	Habitat loss Mortality Disturbance	Local/Temporary	Habitat loss Disturbance Habitat gain (pond associated birds)	Local/Long-term	Yes	Local / Long-term	Local/Long-term

Ecological Feature	Valuation	Potential Construction Phase Impacts and Effects	Significance of Potential Construction-Phase Impact and Effects	Potential Operation Phase Impacts	Significance of Potential Operation-Phase Impact/Duration	Mitigation Proposed (non-embedded control outside project Design)?	Residual Effect Significance/Duration	Cumulative Residual Effect Significance /Duration
Barn Owl	Local (Higher value)	Habitat loss Disturbance	Local/Temporary	Habitat loss Mortality (Road collision)	Local/Long-term	Yes	Not significant	Not significant
Breeding Birds	Local (Higher value)	Habitat loss Disturbance during breeding season	Local/Temporary	Habitat loss Habitat gain (pond associated birds)	Local/Short-term	Yes	Not significant	Not significant
Other species (rabbits, foxes and other unprotected species)	Local [Lower value])	Habitat loss Disturbance	Local/Temporary	Human presence Noise Range restriction Lighting	Local/Long-term	Yes	Not significant	Not significant

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 08: Land and Soils

Galway County Council

February 2022

Table of Contents

Tables

Volume 03 Figures

Figure A8.1 - Quaternary Sediments
Figure A8.2 - Bedrock Geology
Figure A8.3 - Aquifer Designations
Figure A8.4 - Groundwater Vulnerability

Volume 04 Appendices

Appendix A8-1 – N63 Liss to Abbey Realignment Scheme, Geophysical Survey
Appendix A8-2 – Geotechnical Borehole and Trial Pit Records

8. Land and Soils

8.1 Introduction

This chapter presents an assessment of the impacts of the Proposed Road Development on land, soils, geology and hydrogeology (groundwater). It defines the study area, the methodology used for developing the baseline and impact assessment. It also provides a description of the baseline environment in relation to land and soils and presents the findings of the impact assessment.

This chapter should be read in conjunction with Chapter 09 Water, Chapter 16 Material Assets Non-agriculture and Chapter 17 Material Assets Agriculture. Both of these chapters include an assessment of impacts from land take.

8.2 Legislation, Policy and Guidance

This chapter has been prepared with reference to the following:

- Environmental Protection Agency (EPA) draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2017' (EPA, 2017);
- 'Guidelines for Preparation of Soils, Geology, Hydrogeology Chapters of Environmental Impact Statements' (Institute of Geologists Ireland (IGI), 2013);
- 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (TII, 2009);
- 'Road Drainage and the Water Environment, DN-DNG-03065' (TII, 2015);
- European Union Water Framework Directive (WFD) (2000/60/EC). The following legislation in Ireland governs the shape of the WFD characterisation, monitoring and status assessment programmes in terms of monitoring different water categories, determining the quality elements and undertaking characterisation and classification assessments:
  - European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
  - European Communities Environmental Objectives (Surface Water) Regulations, 2009 ('S.I. No. 272 of 2009 as amended'), as amended in 2012 (by S.I. No. 327/2012), 2015 (by S.I. No. 386/2015) and 2019 (by S.I. No. 77/2019); and
  - European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010).
- European Communities Environmental Objectives (Groundwater) (Amendment) Regulations, 2016 (S.I. No. 366 of 2016);
- European Communities, Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report' (EC, 2017); and
- 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland', containing Draft IGVs for the Protection of Groundwater (EPA, 2003).

8.3 Methodology

8.3.1 Study Area

The study area with regard to land and soils encompasses the entire area within the boundary of the Proposed Road Development site. With respect to hydrogeology, the study area encompasses groundwater which has the potential to be impacted by contamination or drawdown during the construction and operation of the Proposed Road Development, which includes:

- Groundwater directly beneath the Proposed Road Development site;
- Groundwater down-gradient of the Proposed Road Development; and
- Groundwater within the zone of influence of pumping during the construction phase.

With respect to natural resources, as the Proposed Road Development will include the use of clean fill material from offsite sources, Irish quarries are also considered within this chapter.

8.3.2 Determination of the Baseline Environment

The baseline land and soils environment has been determined from desktop review and a site walkover survey. The sources used during the desktop review included:

- Geological Survey Ireland (GSI) website public viewer;
- GSI website groundwater vulnerability map/groundwater data viewer;
- EPA website for ground and groundwater information;
- Office of Public Works (OPW) Catchment Flood Risk Assessment and Management (CFRAM) website for flood data;
- Ground Investigation Report;
- Local authority web portals;
- Ordnance Survey of Ireland (OSI) website for historical maps of 1:2,500 scale and 1:10,560 scale (1837 to 1930) and aerial photographs (1995, 2000, 2005, 2013 and 2018); and
- Topography survey map (AECOM, March 2020).

8.3.3 Determination of Sensitive Receptors

The sensitivity of the existing environment identifies the ability of the receptor to respond to potential effects. Receptors have been identified during the baseline study and a qualitative assessment has been used to assign a sensitivity rating from low to extremely high based on the Transport Infrastructure Irelands (TII) 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (TII, 2009). Assigning a sensitivity rating (Table 8-1) considers an attribute's likely adaptability, tolerance and recoverability, as well as their designation. Consideration was also given to the EPAs draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (hereafter referred to as the 'EPA draft guidelines') (EPA 2017).

With regards to natural resource use, the materials themselves have been identified as the sensitive receptors. Consuming materials impacts upon their immediate and (in the case of primary materials) long-term availability; this results in the depletion of natural resources and adversely impacts the environment.

Table 8-1 Estimation of Importance of Geological and Hydrogeological Attributes

Importance	Criteria	Typical Examples
Extremely High	Attribute has a high quality or value on an international scale	• Hydrogeology: – Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. Special Area of Conservation (SAC) or Special Protected Area (SPA) status
Very High	Attribute has a high quality or value on a regional or national scale Degree or extent of soil contamination is significant on a national or regional scale Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale*	• Soil and Geology: – Geological feature rare on a regional or national scale (Natural Heritage Area, NHA) or of high value on a local scale (County Geological Site) – Large existing quarry or pit – Proven economically extractable mineral resource • Hydrogeology: – Regionally Important Aquifer with multiple wellfields – Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – NHA status – Regionally important potable water source supplying >2,500 homes – Inner source protection area for regionally important water source
High	Attribute has a high quality or value on a local scale Degree or extent of soil contamination is significant on a local scale Volume of peat and/or soft organic soil underlying route is significant on a local scale*	• Soil and Geology: – Contaminated soil onsite with previous heavy industrial usage – Large recent landfill site for mixed wastes – Geological feature of high value on a local scale (County Geological Site) – Well drained and/or highly fertility soils – Moderately sized existing quarry or pit – Marginally economic extractable mineral resource • Hydrogeology: – Regionally Important Aquifer – Groundwater provides large proportion of baseflow to local rivers – Locally important potable water source supplying >1,000 homes – Outer source protection area for regionally important water source – Inner source protection area for locally important water source
Medium	Attribute has a medium quality or value on a local scale Degree or extent of soil contamination is moderate on a local scale Volume of peat and/or soft organic soil underlying route is moderate on a local scale*	• Soil and Geology: – Contaminated soil onsite with previous light industrial usage – Small recent landfill site for mixed wastes – Moderately drained and/or moderate fertility soils – Small existing quarry or pit – Sub-economic extractable mineral resource • Hydrogeology: – Locally Important Aquifer – Potable water source supplying >50 homes – Outer source protection area for locally important water source
Low	Attribute has a low quality or value on a local scale Degree or extent of soil contamination is minor on a local scale Volume of peat and/or soft organic soil underlying route is small on a local scale*	• Soil and Geology: – Large historical and/or recent site for construction and demolition wastes – Small historical and/or recent landfill site for construction and demolition wastes – Poorly drained and/or low fertility soils – Uneconomically extractable mineral resource • Hydrogeology: – Poor Bedrock Aquifer – Potable water source supplying <50 homes

* Relative to the total volume of inert soil disposed of and/or recovered

Source: Based on criteria outlined within the TII's Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (TII, 2009)

8.3.4 Describing Potential Effects

The methodology used for describing the potential effects considers the “quality” of the effects (i.e. whether it is adverse or beneficial), the “probability” of the event occurring and the “duration” of the effects (i.e. whether it is short or long term) as per Table 3.3 of the EPA’s draft guidelines (EPA, 2017).

Specific assessment criteria and typical examples based on information within the TII’s ‘Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes’ (TII, 2009) are outlined in the Table 8-2.

Table 8-2 Criteria and Examples for Describing Potential Effects on Land and Soils Environment

Magnitude of Effect	Criteria for Effects	Typical Examples (Positive and Negative)
Large Adverse	• Results in loss of attribute	• Soil and Geology: – Loss of high proportion of future quarry or pit reserves – Irreversible loss of high proportion of local high fertility soils – Removal of entirety of geological heritage feature – Requirement to excavate/remediate entire waste site – Requirement to excavate and replace high proportion of peat, organic soils and/or soft mineral soils beneath alignment • Hydrogeology: – Removal of large proportion of aquifer – Changes to aquifer or unsaturated zone resulting in extensive change to existing water supply springs and wells, river baseflow or ecosystems – Potential high risk of pollution to groundwater from routine run-off – Calculated risk of serious pollution incident >2% annually
Moderate Adverse	• Results in impact on integrity of attribute or loss of part of attribute	• Soil and Geology: – Loss of moderate proportion of future quarry or pit reserves – Removal of part of geological heritage feature – Irreversible loss of moderate proportion of local high fertility soils – Requirement to excavate/remediate significant proportion of waste site – Requirement to excavate and replace moderate proportion of peat, organic soils and/or soft mineral soils beneath alignment • Hydrogeology: – Removal of moderate proportion of aquifer – Changes to aquifer or unsaturated zone resulting in moderate change to existing water supply springs and wells, river baseflow or ecosystems – Potential medium risk of pollution to groundwater from routine run-off – Calculated risk of serious pollution incident >1% annually
Small Adverse	• Results in minor impact on integrity of attribute or loss of small part of attribute	• Soil and Geology: – Loss of small proportion of future quarry or pit reserves – Removal of small part of geological heritage feature – Irreversible loss of small proportion of local high fertility soils and/or high proportion of local low fertility soils – Requirement to excavate/remediate small proportion of waste site – Requirement to excavate and replace small proportion of peat, organic soils and/or soft mineral soils beneath alignment • Hydrogeology: – Removal of small proportion of aquifer – Changes to aquifer or unsaturated zone resulting in minor change to water supply springs and wells, river baseflow or ecosystems – Potential low risk of pollution to groundwater from routine run-off – Calculated risk of serious pollution incident >0.5% annually

Magnitude of Effect	Criteria for Effects	Typical Examples (Positive and Negative)
Negligible	• Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Soil and Geology: – No measurable changes in attributes • Hydrogeology: – Calculated risk of serious pollution incident <0.5% annually
Minor Beneficial	• Results in minor improvement of attribute quality	• Minor enhancement of geological heritage feature
Moderate Beneficial	• Results in moderate improvement of attribute quality	• Moderate enhancement of geological heritage feature
Major Beneficial	• Results in major improvement of attribute quality	• Major enhancement of geological heritage feature

Source: Based on 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (TII, 2009)

8.3.5 Significance of Effects

As outlined in Chapter 01 Introduction, a qualitative approach was used to determine the significance of effects as per the EPA's draft guidance determination figure (Figure 3.5; page 53). Due account was taken of both the sensitivity of the attributes (Table 8-1) and the description of the potential effect (Table 8-2). It should be noted the control measures such as sealed drainage, as outlined in Chapter 04 Description of the Proposed Road Development, have been considered as embedded control in the project design and their application has been assumed in determining the significance of the effect. Mitigation measures have then been devised for each potential complete pollutant linkage (comprising a source, pathway and receptor).

Table 8-3 Significance Ratings

		Magnitude of Effect			
		Negligible	**Small**	**Moderate**	**Large**
Importance of Attribute	**Extremely High**	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/Moderate	Profound/Significant	Profound
	High	Imperceptible	Moderate/Slight	Significant/Moderate	Severe/Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

With regards to use of natural resources, the following significance criteria have been used:

Table 8-4 Significance Criteria for Assessment of Natural Resource Usage

Effect	Criteria for Effects of Material Assets Used	Significance
Major	Large decrease material assets availability greater than 5% of current baseline potentially causing significant burden to the national material asset market.	Significant
Moderate	Moderate decrease in material asset availability between 2% and 5% of current baseline potentially causing moderate burden to the national material asset market.	
Minor	Minor decrease in material asset availability between 0.1% and 1.9% of current baseline causing a minor burden to the national material asset market.	Not Significant
Negligible	Negligible decrease in material asset availability less than 0.1% of current baseline causing insignificant burden to the local and regional material asset market.	

8.4 Limitations and Assumptions

The location accuracy of wells and springs on GSI mapping is generally to 50 m. The GSI groundwater dataset may be incomplete as there is no statutory requirement to register boreholes unless there is an abstraction rate of 25 m^3/day (per site). Hence, the presence (historical or current) of boreholes not recorded on the website cannot be discounted.

8.5 Baseline Environment

8.5.1 Site Area Description

The CORINE (2018) land cover dataset indicates the study area consists of ‘Agricultural Areas’, described as ‘Pastures’. The existing N63 forms part of the Proposed Road Development site and crosses the Abbert River at the approximate chainage 11+600.

A number of drainage ditches pass through the study area, as described in Chapter 09 Water.

As detailed in Chapter 07 Biodiversity and Chapter 09 Water, the Proposed Road Development passes through a *Molinia* meadow and is adjacent to a petrifying spring and a calcareous spring.

Further details of the site area are presented in Chapter 04 Description of the Proposed Road Development.

8.5.2 Topography

The topography of the study area is generally flat, particularly along the Abbert River which flows parallel to the N63. South of the N63, the land rises gradually from approximately 50 m above sea level to approximately 170 m (Knockroe) over a two-kilometre distance.

8.5.3 Surrounding Land Use

The majority of the land use surrounding the study area is agricultural in nature.

Surrounding land uses are summarised in Table 8-5.

Table 8-5: Summary of Surrounding Land Uses

Direction	Description
North	Agricultural land, the Abbert River and single residential properties. A cemetery is approximately 500 m to the north-west.
East	Agricultural land, woodland and some residential properties.
South	Agricultural land and residential properties.
West	Residential properties with agricultural land beyond.

There are no recorded Industrial Emissions (IE) or Integrated Pollution Control (IPC) licences recorded within a 2 km radius of the study area.

8.5.4 Quaternary Deposits

Data relating to the geology of the study area was derived from the online GSI ‘Spatial Resources Viewer’ and site-specific data collected from site investigations.

Publicly available mapping indicates the Quaternary geology of the site locality predominantly comprises till derived from limestone, with areas of alluvium associated with the Abbert River (Volume 03; Figure A8-1).

8.5.5 Bedrock

According to the GSI ‘Spatial Resources Viewer’, the underlying bedrock is described as ‘pale grey clean skeletal limestone’ of the Burren Formation. No mapped faults are located within the study area (Volume 03; Figure A8-2).

8.5.6 Hydrogeology

8.5.6.1 Bedrock Aquifer

According to the GSI 'Spatial Resources Viewer' the bedrock aquifer consists of a 'Regionally Important Aquifer - Karstified (conduit)' (Volume 03; Figure A8-3).

During site investigation works, groundwater strikes were encountered at depths of between 0.9 m and 6.0 m below ground level (bgl), as well as during rotary coring in the bedrock. Groundwater was observed at surface following drilling, suggesting sub-artesian conditions.

8.5.6.2 Groundwater Vulnerability

Groundwater vulnerability in the study area consists of a mix of 'Extreme', 'High' and 'Moderate' vulnerability. The Abbert River is classified as 'Rock at or Near Surface or karst' with the area to the south of the river varying between 'Moderate' and 'Extreme', and the area to the north of the river classified as 'Moderate' (Volume 03; Figure A8.4).

There are no abstraction wells identified within the study area. According to GSI mapping, there are groundwater wells/springs located approximately:

- 500 m south of the study area (well type: Borehole; GIS name:1425SWW019; well use: group scheme; yield: 'poor' (10 m^3/day));
- 750 m southwest (well type: Borehole; GIS name:1423NWW028; well use: unknown; yield: 'good' (196 m^3/day));
- 900 m south (well type: Borehole; GIS name: 1421SWW009; well use: agricultural & domestic; yield: unknown);
- 1.5 km north (well type: Borehole; GIS name: 1423NWW010; well use: group scheme; yield: 'good' (262 m3/day)). This well lies within the mapped area of the Feigh East and West Group Water Scheme;
- 1.7 km southeast (well type: Borehole; GIS name: 1423NWW020; well use: group scheme; yield: 'good' (262 m3/day)); and
- 1.7 km northeast (well type: Spring; GIS name: 1423NWW023; well use: group scheme; yield: 'high spring' (5,000 m3/day)). This spring is at the southwestern extent of the mapped Mid-Galway Public Water Supply Scheme.

It is noted drinking water supply infrastructure is discussed in Chapter 16 Material Assets.

In addition to the above, a petrifying spring has been identified immediately to the south of the study area. This is referenced in Chapter 07 'Biodiversity'.

8.5.7 Designated Sites

There are no sites designated from a geological heritage perspective within the study area.

8.5.8 Ground Investigation

A geophysical survey was undertaken by Minerex in 2020 (Appendix A8-1; Volume 04), with the aim of determining ground conditions beneath the Proposed Road Development site. The survey indicated the overburden material was predominantly glacial till, with alluvium present near the Abbert River. It is stated in the survey that the top of the glacial till is likely weathered while the deeper glacial till is expected to be highly consolidated, suitable for heavy foundations and can provide protection against possible karstification of the deep rock. The alluvium was considered to have lower stiffness and compaction than the glacial till, with Minerex indicating it to be 'soft ground'.

Minerex's geophysical survey concluded the karst risk to be low. However, it was indicated there may be a zone of weathered or karstified limestone crossing below the river in a south to north direction. It was recommended this area be avoided for bridge construction, subject to additional site investigation. Shallow rock was indicated to be present at the western end of the Proposed Road Development site, near Abbeyknockmoy village.

IGSL undertook a site investigation at the Proposed Road Development site in 2020 (Appendix A8-2; Volume 04), comprising the following:

- Ten boreholes (BH01 to BH10) were advanced using a cable percussive rig, to between 2.2 and 7.9 m bgl. In four of these locations (BH04, BH05, BH09 and BH10), shallow obstructions resulted in re-drilling of the boreholes (BH04A, BH05A, BH09A and BH10A);
- Standard penetration tests (SPTs) were undertaken at regular intervals and samples were taken for laboratory analysis;
- Rotary coreholes (RC02 to RC07 and RC10) were advanced to depths of between 12.0 m bgl and 21.1 m bgl adjacent to corresponding boreholes to investigate the presence of bedrock; and
- Ten trial pits (TP01 to TP10) were excavated to a maximum depth of 3.0 m bgl.

Based on the results, the shallow deposits comprise topsoil over peat (particularly in close proximity to the river) and glacial till. To the south of the Abbert River, coarse grained glacial till was encountered in the form of gravels, while fine-grained glacial till was encountered to the north.

Bedrock was encountered in the form of limestone, with the surface of the stratum between 9.4 m bgl and 13.2 m bgl, generally becoming shallower towards the northeast.

8.5.9 Summary of Baseline Conditions

A summary of baseline conditions at the Proposed Road Development site is presented in Table 8-6.

Table 8-6 Summary of Baseline Conditions

Item	Description
Context	The Proposed Road Development site comprises primarily greenfield/agricultural lands and also includes a section of existing road. According to information available on the GSI website, ground conditions predominantly comprise till derived from limestone, with areas of alluvium associated with the Abbert River. The glacial till to the south of the river generally comprises gravels, with finer-grained till (predominantly silts) to the north. Bedrock comprises limestone of the Burren Formation. Ground Investigation identified water strikes in four of ten boreholes and five of ten trial pits. These were observed at depths between circa. 0.9 m to 6.0 m. The soil stratigraphy in the trial pits and boreholes included topsoil, silt/clay and peat with sand and gravel identified in some trial pits. Made ground was not encountered in boreholes or trial pits.
Character	Bedrock beneath the Proposed Road Development site is classified as a ‘regionally important’ aquifer. Groundwater vulnerability varies across the Proposed Road Development site: along the Abbert River, groundwater vulnerability is referred to as ‘rock at or near surface (X)’, with the vulnerability classified as ‘moderate’, high’ and ‘extreme’ moving from north to south. The Proposed Road Development site is not located within a groundwater source protection area. A search of the GSI well database identified a number of groundwater abstraction wells within a 2 km radius of the site. The yield of these wells varies from poor to good and they are described as having domestic, agricultural and group scheme use. The Abbert River forms part of the Lough Corrib SAC and passes through the Proposed Road Development site. Lands to the south and north of the Abbert River slope downward towards the river, indicating that surface run-off currently enters the river directly or via field drains/ditches.
Significance	The majority of the Proposed Road Development site consists primarily of agricultural land/existing road. The Lough Corrib SAC partially lies within the Proposed Road Development site as the Abbert River (part of the SAC) flows from east to west through the Proposed Road Development site. This area of the Proposed Road Development site is protected under the designation of SAC and significance could be described as designated. This aspect is assessed in more detail in Chapter 07 (Biodiversity) and Chapter 09 (Water) of this Environmental Impact Assessment Report (EIAR).
Sensitivity	Ground conditions beneath the Proposed Road Development site vary, generally consisting of topsoil over peaty alluvium and glacial till, which overly bedrock made up of limestone. The glacial till is likely to be reasonably well-draining to the south of the Abbert River and poorly-draining to the north, where it comprises fine-grained till. The bedrock aquifer is classified as ‘Regionally Important’, with groundwater vulnerability ranging from ‘moderate’ to ‘extreme’. While the Proposed Road Development site is not located within a groundwater drinking water protection area, there are a number of groundwater abstractions and a petrifying spring within a 2 km radius. The soil environment can be considered of **LOW** sensitivity, while the groundwater environment can be considered **HIGH** sensitivity.

8.6 Assessment of Impacts

An analysis of the potential impacts and associated effects from the Proposed Road Development on the soils, geological and hydrogeological environment during the construction and operational phases is outlined below. Due to the inter-relationship between land, soils and water (hydrology), the following impacts will be considered applicable to Chapter 09 Water and will be discussed in relation to surface water in that chapter.

8.6.1 Embedded Control Measures

The assessment of impacts assumes the implementation of embedded control measures, as set out in Chapter 04 Description of the Proposed Road Development. These include:

- Provision of a sealed surface water drainage and attenuation system fitted with control valves and interceptors;
- Provision of a sub-surface drainage system of the road pavement to control groundwater levels in the vicinity of the Proposed Road Development and to drain the road foundation;
- Planting of attenuation ponds to aid pollution control;
- Provision of cut-off drains to intercept overland flow;
- Provision of flood connectivity culverts;
- Sizing of culverts to accommodate adequate flows;
- Design of watercourse diversions to minimise impacts to existing flows; and
- Bridge design which takes into account geotechnical properties of underlying soils and bedrock, as well as flood modelling.

8.6.2 Construction Phase

The Proposed Road Development is assessed to have a number of impacts on the land, soils and hydrogeology of the area during the construction phase. This is based on the design of the Proposed Road Development, as presented in Chapter 04 'Description of the Proposed Road Development' of this EIAR.

8.6.2.1 Excavation and Infilling

Excavation earthwork impacts will mainly relate to removal of topsoil and shallow subsoils, although piles for the bridge foundations will extend approximately 2 m into bedrock, while infill earthwork will mainly relate to the import and compaction of acceptable fill material for the construction of embankments to achieve the required engineering design and road grades.

To achieve the required engineering design, the Proposed Road Development will consist of approximately 21% at-grade (i.e. no cut as level with surrounding land), 6% cut and 73% formed along raised embankments created using fill.

Table 8-7 At-grade, Embankment and Cutting Requirements for the Proposed Road Development

	Overall Length [m]	%
At-grade	475	21%
Embankment	1,685	73%
Cutting	140	6%
Total	**2,300**	**100%**

The Proposed Road Development will have a gross earthworks deficit (i.e. more importation of fill is required than removal), with a total general fill requirement (excluding capping and pavement) of 78,000 m^3 consisting of an import volume of 77,000 m^3 required to be brought onto the Proposed Road Development site and a re-use volume of 1,000 m^3. The total fill requirement including capping material is approximately 84,100 m^3.

In addition to that, the construction of the proposed bridge structure, including associated abutment and foundation, will require the import of the following quantities of materials, 430 tonnes of structural steel, 2,200 m^3 of concrete and 350 tonnes of reinforcement.

The balance of materials is shown in the table below. The total volume of unacceptable material (U1) as defined in the Specification for Road Works Series 600 (TII, 2013) requiring disposal is also indicated. The disposal of waste soils is considered further in Chapter 16 Material Assets.

Table 8-8 Earthworks Volumes

Item	Earthworks Aspect	Volume (m^3)
1	Total General Cut Volume* - Underside of topsoil to base of capping	2500
2	Acceptable material for re-use bulked	1000
3	Unacceptable material bulked (U1)	2000
4	Fill requirements for embankments - underside of topsoil to base of capping	78000
5	Excavation and fill requirements to replace peat/alluvium below formation	0
6	Class 4 fill requirements (visual and noise bunds)	0
7	Total general fill required (excluding capping)	78000
8	Cut to fill (excluding capping)	77000
9	Disposal volume U1	2000
10	Import requirement including capping	84100
11	Import requirement including capping and pavement	93000
A	Total topsoil volume to be removed	18000
B	Capping volume	7100
C	Pavement volume (including sub-base)	8900
D	Total topsoil volume for re-use	4500

As indicated above, the fill required for the construction of embankments is not available in full, from the cut of existing soils present on the Proposed Road Development site and additional fill material will therefore be imported from offsite locations.

Excavation of soils (till and alluvium) will be required as part of the bridge foundation construction for the river crossing and in areas along the Proposed Road Development where levels need to be reduced. These excavations are likely to be limited in area and depth (approximately 6% of the Proposed Road Development will require soil removal).

Stockpiling of unsuitable soils will be undertaken prior to removal from site. In the absence of mitigation, this would have the potential to impact on soil and groundwater, through the leaching of contaminants.

The classification of groundwater vulnerability beneath the Proposed Road Development site varies from 'Moderate' to 'Rock at or near surface or karst'. Where subsoil removal is required, it will be replaced by fill material and paved road surfaces, therefore groundwater vulnerability is unlikely to change. Where soils are to be imported for embankment purposes, fill material will be used where possible and this will increase the soil cover above groundwater bodies beneath the Proposed Road Development site, reducing groundwater vulnerability in these areas.

Excavation and infilling impacts will result in a **permanent direct** effect of **neutral** quality which will have an imperceptible effect on the character of the environment but is certain to occur and irreversible. This is considered to be a **moderate** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **slight.**

With regard to groundwater, excavation and infilling impacts will result in a **small** effect on an environment of **high** sensitivity and the significance of the effect is considered **moderate/slight**.

8.6.2.2 Accidental Spills and Leaks

During construction of the Proposed Road Development, there is a risk of accidental pollution incidents from the following sources:

- Spillage or leakage of chemicals stored and used onsite as part of construction works;
- Spillage or leakage of oils and fuels from construction machinery or site vehicles; and
- Spillage of oil or fuel from refuelling machinery onsite.

Accidental spillage of fuels or chemicals could potentially result in the impact of soils and groundwater underlying the Proposed Road Development site if inappropriately handled or stored, during construction. Potential contaminants could migrate through the subsoils and impact underlying groundwater.

A number of groundwater wells have been identified within a 2 km radius of the Proposed Road Development site, as per Section 8.5.6.2, with the closest located 500 m to the south. However, it is noted that groundwater flow direction is likely to be towards the Abbert River and that all identified wells are therefore likely to be hydraulically up-gradient of the Proposed Road Development. Any water quality impacts from the Proposed Road Development on these receptors is therefore considered unlikely. There will, however, exist the potential for impact to the aquifer, the quality of which will be considered under the WFD, as well as the petrifying spring.

A preliminary risk assessment has indicated the spillage risk associated with the scheme as being 1 in 15,336 years (Chapter 04 Description of the Proposed Road Development; Section 4.5.3.11).

This is considered a **direct negative** effect and, if it occurs, would be confined to one-off releases. The impact could alter the character of soil and/or groundwater at the local site but would be temporary in nature. The impact would therefore result in a **small** effect on a **low** sensitivity soil environment and the significance of the effect is **imperceptible** with regard to soils.

It is considered to be a **small** effect on a **high** sensitivity environment and the significance of the effect is **moderate/slight** with regard to groundwater.

8.6.2.3 Use of Natural Resources

It is expected that there will be a requirement for approximately 93,000 m^3 of appropriate fill material for the road embankments comprising general fill, capping and pavement material. The source of imported fill material will involve careful selection and vetting in order to check that it is of a known origin and that it is 'clean' (i.e. will not cause contamination to the environment).

Aggregates will also be imported to the Proposed Road Development site for use in the establishment of the contractor's compound(s), building works and the road. These aggregates will be sourced from authorised quarries, situated locally where possible.

Aggregates and concrete components are natural non-renewable resources and their use results in depletion of the national stock of these resources. While Ireland produces approximately 36 million tonnes of aggregates annually (ICF, 2019), a proportion of this is exported. Therefore, the Proposed Road Development's requirements have been assessed against national demand for aggregates based on recent industry figures (ICF, 2019), rather than production, to determine the significance of natural resource use. The outcome is summarised in Table 8-9.

Table 8-9 Natural Resource Requirements

Material	Approximate Volume Required for Proposed Development (m^3)	Annual National Demand (m^3)	Project Volume as % of National Demand	Effect
Aggregate	93,000	32,810,000*	0.28	Minor
Concrete	2,200	4,800,000	0.046	Negligible

** Irish Concrete Federation figure of 12 tonnes per capita, converted using population of 4,921,500 (Central Statistics Office (CSO) 2019) and assumed bulking factor of 1.8 tonnes/m^3*

The aggregate requirement for the project has been calculated as 0.28% of the national demand, while the concrete requirement has been calculated as 0.046%.

Based on the calculated percentages of national demand and the significance criteria in Table 8-4, the overall significance of effect from the use of natural resources is considered to be **not significant**.

8.6.2.4 Use of Concrete and Lime

Lime and concrete (specifically, the cement component) is highly alkaline and any spillage which migrates through subsoil could impact groundwater quality. The activities most likely to result in contamination include concreting during road and bridge construction, piling for bridge foundations and concreting for culverts and ponds.

As noted above, any impacts are considered unlikely to impact on identified groundwater wells and springs but may impact the WFD groundwater body.

The impacts will result in a **direct negative** effect but unlikely to occur and, if they occur, would be confined to one-off releases. The impact could alter the character of soil and/or groundwater at the local site but would be **temporary** in nature. Therefore, it is considered to be a **small** effect to a **high** sensitivity environment and the significance of the effect is **moderate/slight**.

8.6.2.5 Disturbance of Soil Containing Aspergillus

During the construction stage, there is the possibility of aspergillus, a common mould, being disturbed by the excavation works. However, it is noted that there are no nearby vulnerable sites such as hospitals and the significance of the effect is considered to be **imperceptible**. Reference should be made to Chapter 10 Air Quality for additional information.

8.6.2.6 Compaction of Substrata

This impact applies to embankments only. The construction of embankments over existing ground will cause compression of the sub-strata, thus affecting the current properties of the ground. The magnitude of such an effect, however, is deemed to be **small** due to the small footprint of the embankment areas relative to the local environment. Therefore, it is considered to be a **negligible** effect to a **low** sensitivity environment and the significance of the effect is **imperceptible.**

8.6.2.7 Loss of Agricultural Land

The construction of embankments and the excavation of cuts in areas of agricultural land will result in the loss of this resource. The area lost or removed will comprise the width of the embankment or cut, plus the footprint required for construction activities. Reference should be made to Chapter 17 Material Assets – Agricultural.

Given the area of land being lost (**small** effect) and the quantity of agricultural land in the wider area (**low** sensitivity), the significance of the potential effect is **imperceptible**.

8.6.2.8 Changes in Groundwater Levels

A minor cutting section (0.5 to 1.0 m deep) between Ch. 2+725 and 2+875 is included in the Proposed Road Development, approximately 100 m to the east of the Annex 1 petrifying spring. Cut-off drains or channels will be provided at the top of cutting slopes where the adjoining land slopes towards the cutting. These cut-off drains will discharge to existing watercourses where the topography permits and to the road drainage system in areas with no suitable outfall location. De-watering is not anticipated to be required in association with the section of cut. The section of the Proposed Road Development closest to the petrifying springs is also over the footprint of the existing N63 and changes to hardstanding cover will be minimal in this area, associated only with the cycleway.

A sub-surface drainage system of the road pavement will be provided in order to control groundwater levels in the vicinity of the Proposed Road Development and to drain the road foundation. This will be required in areas of cuttings and low embankments (<1.5 m). In general, this will be achieved using a network of filter drains or narrow filter drains.

Taking into account the embedded control measures, this will represent a **negligible** effect on a receptor of **high** sensitivity and the significance of the potential effect is **imperceptible**.

8.6.3 Operational Phase

The Proposed Road Development is assessed to have a number of impacts on the land, soils and hydrogeology of the area during the operational phase. This is based on the proposed road alignment as outlined in Chapter 04 Description of the Proposed Road Development.

8.6.3.1 Accidental Spills and Leaks

There is the potential for accidental spills and leaks to occur from vehicles using the Proposed Road Development during its operation. However, the impacts are unlikely to occur due to embedded control measures that have been incorporated into the Proposed Road Development (See Chapter 04 Description of the Proposed Road Development). For example, releases of fuel or chemicals from accidental spills associated with potential road traffic accidents or runoff from rainwater that has passed over impermeable surfaces will be prevented from polluting the local surface waters as all surface water runoff from the paved areas will be collected in a closed drainage network and will pass through petrol interceptors prior to discharge to ponds before entering the Abbert River.

In addition to this, the outlet of the ponds will be fitted with a shut-down facility so that in the event of a catastrophic spill, the spillage will be contained within the attenuation pond to be removed by tanker. The risk of such an event is discussed in Chapter 18 Major Accidents and Disasters.

However, if impacts from accidental spillage and leaks occur, these would be confined to one-off releases. The impact could alter the character of soil and/or groundwater at the local site but the effect would be **temporary** in nature. Therefore, it is considered to be a **negligible** effect on a **high** sensitivity groundwater environment and the significance of the effect is **imperceptible**. It is also considered to be a **negligible** effect on a **low** sensitivity soil environment and the significance of the effect is **imperceptible.** Specific mitigation measures are therefore not required.

8.6.3.2 Water Balance Changes

The construction of impermeable areas such as roads and footpath pavements will prevent rainfall percolation to ground beneath these areas. However, as drainage from all paved areas will be directed via a series of interceptors and ponds to the river, this will result in a reduction in the amount of current direct rainfall recharge to groundwater below the Proposed Road Development site.

The Proposed Road Development involves the construction of a new sealed 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. 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.

Flows from the Proposed Road Development will be attenuated prior to discharge to the receiving watercourse so that the post development peak flow rate will not be greater than the original greenfield runoff rate. It is proposed to use three ponds and a lined drainage ditch upstream of the discharge point to the Abbert River for the greenfield section of the Proposed Road Development. A flow restricting device such as a vortex flow control device will be installed upstream of the outlet to a receiving waterbody.

Overall, water balance changes are considered to be a **negligible** effect to **high** sensitivity environment and the significance of the effect is **imperceptible**. Specific mitigation measures are therefore not required to address potential water balance changes.

8.7 Mitigation and Monitoring Measures

8.7.1 Construction Phase

In order to prevent/minimise potential significant effects, a number of mitigation measures will be adopted as part of the construction works. The main areas of potential impact and mitigation measures are set out below:

- Soil excavation and filling – control of soil excavation and fill placement works;
- Accidental spills and leaks – fuel and chemical handling, transport and storage;
- Use of concrete and lime – concrete and cement during road and culvert construction;
- Monitoring and protection of *Molinia* Meadows and Petrifying Springs; and
- Use of natural resources – sources of fill and aggregates for the project.

A Construction Environmental Management Plan (CEMP) will be prepared for the Proposed Road Development which will incorporate relevant environmental avoidance or mitigation measures to reduce potential environmental impact. The CEMP will include a Construction, Erosion and Sediment Control Plan (CESCP), a Soil Management Plan (SMP) and a Construction and Demolition Waste Management Plan (WMP). It will be drafted by the Contractor as necessary in accordance with Department of Environment, Community & Local Government guidelines and any construction-related requirements imposed as conditions of any planning permission granted. It will also include details of proposed environmental monitoring for the duration of the construction works, be this good practice or as a planning condition requirement. The CEMP will be produced based on AECOM's Outline CEMP (Volume 04, Appendix A4-1).

8.7.1.1 Soil Excavation and Filling

Temporary storage of soil will be carefully managed in such a way as to prevent potential negative impact on the receiving environment. Spoil and temporary stockpiles including stone stockpile areas will be positioned in locations which are distant from drainage systems and retained drainage channels and away from areas subject to flooding so as not to cause potential run off to soil and groundwater. The CEMP will outline proposals for the excavation and management of excavated material. Movement of material will be minimised in order to reduce degradation of soil structure and generation of dust. In order to minimise the potential environmental impact of stockpiles, the CEMP will contain the following mitigation measures that will be implemented during the construction phase:

- Position spoil and temporary stockpiles in locations which are distant from drainage systems;
- Defined maximum stockpile heights; and
- To help shed rainwater and prevent ponding and infiltration, the sides and top of the stockpiles will be regraded to form a smooth gradient with compacted sides reducing infiltration and silt runoff.

It is estimated that approximately 20,500 m^3 of spoil will be generated from the removal of topsoil and cutting to lower sections of the Proposed Road Development to the appropriate level. This spoil will primarily consist of topsoil, alluvium and till.

Soil requiring offsite disposal will be managed in accordance with relevant waste legislation (Classification, Labelling and Packaging Regulation (CLP) European Waste Catalogue and Hazardous Waste List (EPA, 2002), EU Council Decision (2003/33/EC) of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of Annex II to Directive 19999/31/EC, Council Directive 1999/31/EC on the landfill of waste, Waste Management Act 1996, the Environment (Miscellaneous Provisions) Act 2011 (No. 20 of 2011).

In general, materials will be hauled along the route of the Proposed Road Development between the various sections without the need to use the public road network. The imported fill materials will be brought to the Proposed Road Development site on the public road network, prior to being distributed along the path of the Proposed Road Development site via the haul routes. Any hard core required to form this haul route during the construction stage will be re-used, where possible (most likely in the capping layer).

Some localised construction stage access routes will be needed close to the bridge abutment to cater for beam lifting; these will represent minor elements in terms of earthworks volumes.

Temporary drainage during construction stage will be addressed in the CEMP and will be managed so as to reduce the direct runoff to ground and water.

8.7.1.2 Accidental Spills and Leaks

In order to prevent spillages to ground of fuels, and to prevent consequent soil or groundwater quality impacts, it will be necessary to adopt mitigation measures during the construction phase, which include:

- Designating a bunded storage area at the contractor's compound(s) for all oils, solvents and chemicals used during construction. Oil and fuel storage tanks will be bunded to the greater volume of either 110% of the capacity of the largest tank/container within the bunded area or to a volume of 25% of the total capacity of all the containers. Drainage from the bunded area will be diverted for collection and safe disposal. All containers within the storage area will be clearly labelled so that appropriate remedial action can be taken in the event of a spillage. When moving drums from the bunded storage area to locations along the Proposed Road Development a suitably sized spill pallet will be used for containing any spillages during transit;
- Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be away from surface water gullies or drains. Spill kit facilities will be provided at the fuelling areas in order to provide for accidental releases or spillages in and around the area. Any used spill kit materials will be disposed of using a licenced hazardous waste contractor in accordance with relevant legalisation; and
- Where mobile fuel bowsers are used on the Proposed Road Development, in the event of a machine requiring refuelling outside of the designated area, fuel will be transported in a mobile double skinned tank. Any flexible pipe, tap or valve will be fitted with a lock where it leaves the container and locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training.

8.7.1.3 Use of Concrete and Lime

Mitigation measures will include the following:

- Ready-mixed concrete will be brought to the Proposed Road Development site by truck. A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated water to the underlying subsoil and groundwater; and
- The pouring of concrete will take place within a designated area protected to prevent concrete runoff into the soil/groundwater media. Washout of concrete transporting vehicles will take place at an appropriate facility, offsite where possible, alternatively, where wash out takes place onsite, it will be carried out in carefully managed onsite wash out areas.

8.7.1.4 Monitoring and Protection of Molinia Meadows and Petrifying Springs

Molinia Meadows

Works will be undertaken to protect areas of Annex I *Molinia* Meadow habitat (including translocated sods) and the hydrology of the area either side of the development through installation of suitably free-draining, clean, large, rounded, locally derived stone under the road embankment and minimising the works footprint in this area. Other relevant mitigation is described in Chapter 07 Biodiversity.

Petrifying Springs

The minor cutting approximately 100 m to the east is only 0.5-1.0 m deep and is unlikely to impact upon the spring's flow regime. During site investigation, the trial pits closest to the cutting and spring (TP06, to 2.5 m bgl and TP07 to 3.0 m bgl) were noted in logs to be dry. The borehole closest to the cutting and springs (BH10A/RC10) was noted to have slow water ingress at 1.3 m bgl, which is beneath the proposed cut level. However, as a precautionary measure, the following will be implemented.

- A quarterly sampling programme of the petrifying spring will be undertaken for 6-12 months before, during and two years after construction works. This will include monitoring/recording descriptions of flows', and scheduling samples for an inorganic suite of analysis, to include pH, electrical conductivity, ammonium, nitrate, fluoride, chloride and sulphate. Monitoring data from the pre-construction phase and construction phase will be reviewed to determine whether any additional mitigation requirements are required (see Chapter 07 Biodiversity).
- Weekly visual checks will be undertaken of the spring during construction works, with photographs taken and written descriptions of flow recorded.
- Clearance of topsoil/substrate is to be kept to an absolute minimum within 50 meters of this habitat area.

- In order to avoid any alteration to groundwater pH, only locally derived limestone shall be used in the construction within 100 m of this habitat. This limestone for base fill will be of a size that permits flow of waters through it, if required. This mitigation measure would ensure no changes to the alkalinity of the Petrifying Spring and will support hydrological connectivity between the north and south side of the Proposed Road Development (Other specific mitigation is outlined in Chapter 07 Biodiversity).

8.7.1.5 Use of Natural Resources

It is estimated that a small volume (approximately 5,500 m^3) of soils from the Proposed Road Development site will be suitable for re-use within the Proposed Road Development. The remaining fill material requirement will be sourced where possible from local quarries, providers of recycled aggregates or suitable donor sites under Article 27 of the European Communities (Waste Directive) Regulations 2011. A number of local quarries have been identified, and prior to construction, these shall be reviewed and only those quarries that conform to all necessary statutory consents will be used in the construction phase. Soils/fill material to be brought to the Proposed Road Development site will be vetted with chemical soil testing if necessary, in order to check that it is of a reputable origin and that it is ‘clean’ (i.e. will not introduce contamination to the environment; soil and groundwater). All potential suppliers will be vetted for the following criteria:

- Environmental management status; and
- Regulatory and legal compliance status of the company.

‘Clean’ fill material will be sourced from suppliers which comply with the above requirements. If recycled aggregate is used as imported fill, chemical testing will be undertaken to confirm that it is ‘clean’ (i.e. would not introduce contamination to the environment).

According to the GSI Spatial Resources website, the following active quarries are located within a 20 km radius of the Proposed Road Development:

Table 8-10 Active Quarries Identified Within 20 km of the Proposed Road Development

Quarry Name	Resource	Distance from Proposed Road Development Site (approximately)
Cortoon Pit	Sand and gravel	13 km north
Mortimers Quarry	Limestone	14 km west
Coshla Quarries	Limestone	15 km southwest
Cathill Pit	Sand and gravel	18 km north
Esker Readymix Quarry	Limestone	19 km south

Source: Geological Survey of Ireland Spatial Resources Website (January 2021)

8.7.2 Operational Phase

The operation of the Proposed Road Development will not have any significant adverse effects on the local geological/hydrogeological environment due to the nature of the Proposed Road Development and the embedded control measures that have been incorporated into the Proposed Road Development site (as outlined in Chapter 04 Description of the Proposed Road Development). Therefore, no additional mitigation or monitoring measures are proposed.

8.8 Residual Impacts and Effects

Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines, the effects from the impacts that remain after all assessment and mitigation are referred to as ‘Residual Effects’. These are summarised in Table 8-11 and discussed below in terms of the construction and operational phases.

Table 8-11 Summary of Residual Impacts and Effects

Impact	Effect Significance Pre-Mitigation	Mitigation Measures	Residual Effect Post-Mitigation
Construction Phase			
Excavation and Infilling	**Moderate** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **slight**. **Small** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **moderate/slight**.	Refer to Section 8.7.1.1	**Small** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **imperceptible**. **Negligible** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **imperceptible**.
Accidental Spill sand Leaks	**Small** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **imperceptible**. **Small** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **moderate/slight**	Refer to Section 8.7.1.2	**Negligible** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **imperceptible**. **Negligible** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **imperceptible**.
Use of Natural Resources	**Not significant**	Refer to Section 8.7.1.5	**Not significant**
Use of Concrete and Lime	**Small** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **moderate/slight**.	Refer to Section 8.7.1.3	**Negligible** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **imperceptible**.
Disturbance of Soil Containing Aspergillus	**Imperceptible**	N/A	**Imperceptible**
Compaction of Substrata	**Negligible** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **imperceptible**.	N/A	**Negligible** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **imperceptible**.
Loss of Agricultural Land	**Small** effect on an environment of **low** sensitivity and the significance of the effect is considered **imperceptible**.	N/A	**Small** effect on an environment of **low** sensitivity and the significance of the effect is considered **imperceptible**.
Changes in Groundwater Levels	**Negligible** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **imperceptible**.	N/A	**Negligible** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **imperceptible**.
Operational Phase			
Accidental Spill sand Leaks	**Negligible** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **imperceptible**. **Negligible** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **imperceptible**	N/A	**Negligible** effect on a soil environment of **low** sensitivity and the significance of the effect is considered **imperceptible**. **Negligible** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **imperceptible**
Water Balance Changes	**Negligible** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **imperceptible**	N/A	**Negligible** effect on a groundwater environment of **high** sensitivity and the significance of the effect is considered **imperceptible**

8.8.1 Construction Phase

As outlined in Table 8-11, the implementation of mitigation measures highlighted above will significantly reduce the likelihood and magnitude of the potential effects on land, soils and groundwater occurring during the construction phase.

With respect to land and soils, the significance of the potential effects of the Proposed Road Development is considered to be **imperceptible** on the soil and groundwater environment.

8.8.2 Operational Phase

There are no likely significant permanent geological or hydrogeological effects associated with the Proposed Road Development. The significance of residual effects during the operational stage has been assessed as **imperceptible**.

8.9 Do-Nothing Scenario

In the case where no road is developed there would be no resulting effects on soils, geology and hydrogeology along the Proposed Road Development site.

8.10 Cumulative Impacts and Effects

Cumulative impacts and associated effects have been assessed with consented projects in the vicinity of the Proposed Road Development are discussed below.

A planning search of granted and pending planning applications made within the vicinity of the Proposed Road Development site (5 km of the Proposed Road Development site boundary) within the last ten years is presented in Volume 4; Appendix A1-1 (Planning History Search).

The majority of planning applications within 5 km of the Proposed Road Development site are related to development of and alterations to residential properties and are considered to be small in scale.

The following Part 8 Application of potential relevance has been recorded:

Table 8-12 Summary of Relevant Part 8 Applications

Reference Number	Development Address	Brief Development Description	Application Received
LA0420	Brooklodge, Tuam, Co. Galway	Permission for the development of a burial ground including provision for off road vehicular parking at Ballyglooneen Townland, Tuam, Co. Galway.	09/09/2020

Given the distance of the above development (approximately 5 km) from the site and the imperceptible impacts from the Proposed Road Development on the land, soil and groundwater environment, cumulative impacts are not considered to be of significance.

Following a review of the above proposed and consented project cumulative effects will be **imperceptible** on the geology and groundwater as a result of the Proposed Road Development identified.

8.11 Summary

In summary:

- The baseline study identified that the general ground profile at the Proposed Road Development site consists of topsoil over alluvium and till deposits, beneath which is limestone bedrock.
- During construction, potential impacts include accidental spills and leaks, excavation and stockpiling of soils, removal of hardstanding, pumping of groundwater, use of concrete and lime and depletion of non-renewable natural resource:
  - An imperceptible effect to soil and groundwater from the excavation of soils and creation of embankments;
  - An imperceptible effect to soil and groundwater from accidental spillage and leaks of fuels and chemicals during construction;
  - The depletion of non-renewable resources associated with quarried aggregates and concrete for the Proposed Road Development is not significant;
  - An imperceptible effect from local temporary pH alterations of soil and groundwater resulting from the use of concrete and lime;
  - An imperceptible effect from the disturbance of soil potentially containing Aspergillus;
  - An imperceptible effect associated with the removal of land from agricultural use; and
  - An imperceptible effect associated with changes in groundwater levels during construction.
- During operation, potential impacts include accidental spills and leaks and water balance changes:
  - An imperceptible effect to soil and groundwater from accidental spillage and leaks of fuels during operation of the Proposed Road Development; and
  - An imperceptible effect to groundwater associated with potential water balance changes resulting from the introduction of hardstanding to previously open areas of land.
- Mitigation (including embedded mitigation) and monitoring will ensure groundwater dependent habitats of high conservation value are protected from adverse impacts of construction and operation.
- It is considered that residual negative effects of the Proposed Road Development on soil, geology and hydrogeology will overall be imperceptible provided that appropriate mitigation measures are applied.
- It was concluded cumulative effects will be imperceptible.

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 09: Water

Galway County Council

February 2022

Table of Contents

Tables

Volume 03 Figures

Figure A9.1 - EPA-recognised surface water features within the study area

Volume 04 Appendices

Appendix 09 Water
Appendix A9-1 Flood Risk Assessment Report, AECOM 2021

9. Water

9.1 Introduction

This chapter presents an assessment of the impacts of the Proposed Road Development upon the water environment. It defines the study area, the methodology used for developing the baseline and impact assessment, provides a description of the baseline environment in relation to water, and presents the findings of the impact assessment focused on water, hydrology and flooding issues associated with the Proposed Road Development.

The assessment considers the potential for non-conformance with the European Union (EU) Water Framework Directive (WFD, Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for the Community action in the field of water policy) objectives and checks that:

- The need for the avoidance and reduction of impacts on the water environment is taken fully into account in the environmental evaluation; and
- The selection of appropriate means of preventing significant predicted impact is made through modification of the drainage design, choice of discharge location(s) and/or adoption of runoff treatment methods, with the objective of designing-out potential adverse environmental impacts.

This chapter should also be read in conjunction with Chapter 07 Biodiversity, Chapter 08 Land & Soils, Chapter 11 Climate and Chapter 16 Material Assets of this Environmental Impact Assessment Report (EIAR), which pay particular attention to the potential for impacts upon the aquatic/riparian environment, hydrogeological environment, flood risk due to climate change, and water usage respectively.

9.2 Legislation, Policy and Guidance

This chapter has been prepared in accordance with the following:

- Environmental Protection Agency (EPA) draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports, 2017' (EPA, 2017);
- 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (National Roads Authority (NRA) (now Transport Infrastructure Ireland (TII)), 2009);
- 'Road Drainage and the Water Environment, DN-DNG-03065' (TII, 2015);
- European Union WFD (2000/60/EC), which was adopted as a single piece of legislation covering rivers, lakes, groundwater and transitional (estuarine) and coastal waters. The following regulations in Ireland governs the shape of the WFD characterisation, monitoring and status assessment programmes in terms of monitoring different water categories, determining the quality elements and undertaking characterisation and classification assessments:
  - European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
  - European Communities Environmental Objectives (Surface Water) Regulations, 2009 ('S.I. No. 272 of 2009 as amended'), as amended in 2012 (by S.I. No. 327/2012), 2015 (by S.I. No. 386/2015) and 2019 (by S.I. No. 77/2019);
- The EU Floods Directive 2007/60/EC;
- European Communities (Assessment and Management of Flood Risks) Regulations, 2010 (S.I. No. 122 of 2010);
- European Commissions (EC) 'Environmental Impact Assessment of Projects – Guidance on the preparation of the Environmental Impact Assessment Report' (EC, 2017); and
- 'River Basin Management Plan 2018-2021' (DHPLG, 2018).

9.3 Methodology

9.3.1 Study Area

The study area for surface water receptors encompasses the entire area within the Proposed Road Development site, and water features within a 1 km radius. The study area is considered appropriate based on professional judgement of the potential spatial extent of potential impacts.

9.3.2 Determination of the Baseline Environment

The baseline water environment has been determined from desktop review, site walkovers and site studies/investigations, as follows:

- Ordnance Survey Ireland (OSI) website for historical maps of 1:2,500 scale and 1:10,560 scale and aerial photographs;
- OSI Discovery series of 1:50,000 scale;
- Geological Survey of Ireland (GSI) website for public viewer and groundwater maps;
- EPA website ‘Envision’;
- Local authority web portals;
- Topography maps; and
- Flood information mapping.

In addition, a Flood Risk Assessment (see Volume 04, Appendix A9-1) has been prepared for the Proposed Road Development. Stage 1 of the Flood Risk Assessment (FRA) investigated the flooding risk to the Proposed Road Development. In order to determine the flood zone, a “Stage 2 – Initial FRA” was undertaken. Subsequent to this, to determine the flood extents and levels for the Proposed Road Development, a “Stage 3 Detailed FRA” was required. A hydraulic model of the watercourse was developed based on detailed survey information. Three model scenarios were developed; Baseline, Proposed without Mitigation and Proposed with Mitigation. The Flood Policy Review Report (2004) produced by the Office of Public Works (OPW) states that climate change considerations should be taken into consideration when undertaking flood risk assessments. Sensitivity testing using the ‘Mid-Range Future Scenario’ (MRFS) has been undertaken by increasing the flood flow estimates by 20% respectively.

9.3.3 Determination of Sensitive Receptors

Receptors were identified during the baseline study and a qualitative assessment (Table 9-1) has been used to assign a sensitivity rating from ‘negligible’ to ‘high’, based on the EPA draft ‘Guidelines on the Information to be Contained in Environmental Impact Assessment Reports’ (hereafter referred to as the ‘EPA draft guidelines’) (EPA, 2017) and the TII’s ‘Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes’ (TII, 2009). Assigning a sensitivity rating considers an attribute’s likely adaptability, tolerance and recoverability, as well as their designation.

Table 9-1: Estimation of Importance/Sensitivity of Hydrology Attributes

Importance	Criteria	Typical Examples
Extremely High	• Attribute has a high quality or value on an international scale	• River, wetland or surface water body ecosystem protected by EU legislation e.g. ’European sites’ designated under the Habitats Regulations or ‘Salmonid waters’ designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations,1988.
Very High	• Attribute has a high quality or value on a regional or national scale	• River, wetland or surface water body ecosystem protected by national legislation – NHA status • Regionally important potable water source supplying >2,500 homes • Quality Class A (Biotic Index Q4, Q5) • Flood plain protecting more than 50 residential or commercial properties from flooding • Nationally important amenity site for wide range of leisure activities

Importance	Criteria	Typical Examples
High	• Attribute has a high quality or value on a local scale	• Salmon fishery • Locally important potable water source supplying >1,000 homes • Quality Class B (Biotic Index Q3-4) • Flood plain protecting between 5 and 50 residential or commercial properties from flooding • Locally important amenity site for wide range of leisure activities
Medium	• Attribute has a medium quality or value on a local scale	• Coarse fishery • Local potable water source supplying >50 homes • Quality Class C (Biotic Index Q3, Q2-3) • Flood plain protecting between 1 and 5 residential or commercial properties from flooding
Low	• Attribute has a low quality or value on a local scale	• Locally important amenity site for small range of leisure activities • Local potable water source supplying <50 homes • Quality Class D (Biotic Index Q2, Q1) • Flood plain protecting 1 residential or commercial property from flooding • Amenity site used by small numbers of local people

Source: Based on criteria outlined within the TII's Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (TII, 2009)

9.3.4 Describing Potential Effects

The methodology used for describing the potential effects considers the "quality" of the effects (i.e. whether it is adverse or beneficial); the "probability" of the event occurring; and the "duration" of the effects (i.e. whether it is short- or long-term) as per the EPA draft guidelines (EPA, 2017).

Specific assessment criteria and typical examples based on information within the TII's 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (TII, 2009) are outlined in Table 9-2:

Table 9-2: Criteria and Examples for Describing Potential Effects on Water Environment

Magnitude of Effect	Criteria	Typical Examples (Positive and Negative)
Large Adverse/Major Beneficial	• Results in loss of attribute or results in major improvement of attribute quality	• Loss or extensive change to a waterbody or water dependent habitat • Increase/reduction in predicted peak flood level >100 mm • Extensive loss of fishery • Calculated risk of serious pollution incident >2% annually • Extensive reduction in amenity value • Reduction in predicted peak flood level >100 mm
Moderate Adverse/Beneficial	• Results in impact on integrity of attribute or loss of part of attribute or results in moderate improvement of attribute quality	• Increase/reduction in predicted peak flood level >50 mm • Partial loss of fishery • Calculated risk of serious pollution incident >1% annually • Partial reduction in amenity value • Increase/reduction in predicted peak flood level >50 mm • Calculated reduction in pollution risk of 50% or more where existing risk is >1% annually
Small Adverse/Minor Beneficial	• Results in minor impact on integrity of attribute or loss of small part of attribute or results in minor improvement of attribute quality	• Increase in predicted peak flood level >10 mm • Minor loss of fishery • Calculated risk of serious pollution incident >0.5% annually

Magnitude of Effect	Criteria	Typical Examples (Positive and Negative)
		• Slight reduction in amenity value • Increase/reduction in predicted peak flood level >10 mm • Calculated reduction in pollution risk of 50% or more where existing risk is <1% annually
Negligible	• Results in an impact on attribute but of insufficient magnitude to affect either use or integrity	• Negligible change in predicted peak flood level • Calculated risk of serious pollution incident <0.5% annually

Source: Based on the TII's 'Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes' (TII, 2009)

9.3.5 Significance of Effects

A qualitative approach was used to determine the significance of effects as per the EPA's draft guidance determination figure (Figure 3.5) (EPA, 2017). Due account was taken of both the sensitivity of the attributes (Table 9-1:) and the description of the potential effect (Table 9-2). It should be noted the drainage control measures, as outlined in Chapter 04 Description of the Proposed Road Development and summarised in the relevant sections below, have been considered embedded in the project design and their application has been assumed in determining the significance of the effect. Mitigation measures will be devised for each potential complete pollutant linkage (comprising a source, pathway and receptor).

Table 9-3: Significance Ratings

		Magnitude of Effect			
		Negligible	**Small**	**Moderate**	**Large**
Importance of Attribute	**Extremely High**	Imperceptible	Significant	Profound	Profound
	Very High	Imperceptible	Significant/Moderate	Profound/Significant	Profound
	High	Imperceptible	Moderate/Slight	Significant/Moderate	Severe/Significant
	Medium	Imperceptible	Slight	Moderate	Significant
	Low	Imperceptible	Imperceptible	Slight	Slight/Moderate

9.4 Limitation and Assumption

No limitations or assumptions were identified during this assessment.

9.5 Baseline Environment

9.5.1 Site Area Description

The Proposed Road Development runs in a south-west to north-east direction across the Abbert River between the western tie-in on the eastern edge of Abbeyknockmoy and the eastern tie-in along the existing N63 (east of the junction with the existing L6234). The location is characterized by the presence of open agricultural land with some wooded areas along the Abbert River. The Abbert River is part of Lough Corrib Special Area of Conservation (SAC). The southern side of the existing N63 is lined with residential properties.

9.5.2 Surface Water Features

The study area is located within the Corrib catchment area (Code: 30) and the Clare [Galway] sub-catchment (Code: 30_12; area 231.8 km^2).

The Abbert River, a tributary river of Lough Corrib SAC, is the main watercourse flowing through the study area. According to the EPA map viewer, the Abbert River is not a source of drinking water that has extra protection by law. The Abbert River has not been identified as a river with significant abstraction pressures. Two tributaries of the Abbert River – labelled as 'Lindsay's Farm' and 'Derreen' on EPA mapping – join the Abbert from the south immediately to the south of the Proposed Road Development at a chainage of approximately 1+630. The Lecarrow flows from the northeast into the Abbert River approximately 250 m upstream of the Proposed Road Development. The Feagh East flows from the northeast into the Abbert River approximately 500 m to the west (downstream) of the Proposed Road Development.

EPA-recognised surface water features within the study area are shown on Figure 9.1, Volume 03. In addition to these, a number of field drains and springs are present within the study area, discharging into the Abbert River.

9.5.3 Surface Water Quality

The Abbert River is considered by the EPA as being 'At Risk' of achieving and maintaining 'Good' ecological status under the WFD. The WFD River Waterbody Status (2013-2018)[1] within the study area ranges from 'good' to 'moderate'.

9.5.4 Surface Water Amenity

As mentioned in Chapter 07 Biodiversity, the Abbert River is noted for its fishery potential with respect to salmon and brown trout.

9.5.5 Drainage

9.5.5.1 Natural Drainage

Natural ground at flood plain level, along the Abbert River, generally comprises very poorly drained, saturated soils. The soil series north and south of the river is a sandy loam Brown Earth – Mullabane Series (Code *1100q*). This free-draining soil is suited mainly to improved grassland.

There is potential for buried field drains to be present within the agricultural lands.

As described in Chapter 08 Land and Soils, springs have been identified, including a petrifying spring immediately south of the Proposed Road Development. This is listed as an Annex I habitat, as discussed in Chapter 07 Biodiversity. In addition, an Annex I *Molinia* meadow is identified to the north of the study area, which is a form of species-rich grassland on poorly drained soils.

9.5.6 Topography

The topography of the study area is generally flat, particularly along the Abbert River which flows parallel to the existing N63. South of the existing N63, the land rises gradually from approximately 50 m above sea level to approximately 170 m (Knockroe) over a two-kilometre distance.

[1] https://gis.epa.ie/EPAMaps/

9.5.7 Hydrogeology

The hydrogeological regime beneath the study area is described in Chapter 08 Land & Soils, Section 8.4.6.

9.5.8 Flood Risk

The study area has not previously been modelled in any degree of detail by OPW or others and no published flood maps are available for the study area. The Flood Maps also show no past flood events were recorded within or close to the study area. However, OSI Flood Maps indicate areas of land 'Liable to Flooding' within the footprint of the Proposed Road Development. The study area also partly falls within an area of Benefitting Land indicated on the OPW Arterial Drainage Maps.

Additionally, onsite observations confirmed that the lands immediately adjacent to the Abbert River are likely to be prone to flooding as this area is relatively flat and at a lower elevation than surrounding lands. In addition, the vegetation present in this area is characteristic of flood plain flora as discussed in Chapter 07 Biodiversity.

According to the OPW Flood Studies Update (FSU) programme, the standard average annual rainfall (SAAR) in the area is recorded as 1,093 mm.

9.5.9 Designated Sites

The Abbert River, which is a tributary of the Clare River, forms part of Lough Corrib SAC (site code: 000297) and is located within the study area (although no construction works will take place within the SAC). The closest Special Protection Area (SPA) is Lough Corrib SPA which is located circa 20 km west of the study area.

Killaclogher Bog Natural Heritage Area (NHA) (site code: 001280) is located circa 3.5 km southeast of the study area.

9.5.10 Ground Investigation Results

Ground investigation was undertaken in 2020 by IGSL and draft logs indicate the geological sequence to generally comprise peaty silt/clay over gravelly-clay. Bedrock was typically described as strong to very strong fresh to locally slightly weathered limestone.

9.5.11 Summary of Baseline Conditions

In line with EPA's draft guidance (EPA, 2017), a summary of the existing environment baseline conditions in the study area are presented in Table 9-4.

Table 9-4: Summary of Baseline Conditions

Item	Description
Context	The study area comprises primarily greenfield/agricultural lands. The route crosses the Abbert River between chainage 550 and 600 and a number of drainage ditches. Regionally, the study area lies within the Corrib hydrometric area (30). The study area lies within the Clare (Galway) sub catchment (30_12) of the Corrib WFD Catchment (30). The Standard Annual Average Rainfall (SAAR) recorded within the catchment is 1093 mm2.
Character	Lands to the south and north of the Abbert River slope downward towards the river, indicating that surface run-off currently enters the river directly or via field drains/ditches. The study area does not contain any designated flood zones, according to OPW mapping however other data sources suggest flooding may occur. The river has a WFD Status of 'good' to 'moderate'. However, the river is deemed 'at risk' by the EPA. The Abbert River forms part of Lough Corrib SAC and is important as a fisheries amenity for brown trout and salmon.
Significance	The majority of the study area consists primarily of agricultural land in a rural area. Lough Corrib SAC partially lies within the study area as the Abbert River flows from east to west through the site. This area of the study area is protected under the designation of SAC. This aspect is assessed in more detail in Chapter 07 Biodiversity of this EIAR. Two Annex 1 habitats have been identified within the study area, a calcareous spring and *Molinia* meadows.

[2] https://opw.hydronet.com/ Accessed 19/05/2021

Item	Description
Sensitivity	The water environment can be considered of extremely high sensitivity, given the designation of SAC. With respect to flood risk, the sensitivity is considered to be high. Based on the FRA, an increase in flood levels will only impact agricultural land and no residential developments however it is noted that residential properties are in close proximity to the edge of the predicted flood extents.

9.6 Assessment of Impacts

An analysis of the potential impacts and associated effects from the Proposed Road Development on the water environment during the construction and operational phases is outlined below. Due to the inter-relationship between land, soils and water (hydrology), the following impacts will be considered applicable to Chapter 08 Land and Soils and will be discussed in relation to groundwater in that chapter.

9.6.1 Embedded Control Measures

The assessment of impacts assumes the implementation of embedded control measures within the design of the project, as set out in Chapter 04 Description of the Proposed Road Development. These include:

- Provision of a sealed surface water drainage and attenuation system fitted with control valves and interceptors;
- Provision of a sub-surface drainage system of the road pavement to control groundwater levels in the vicinity of the Proposed Road Development and to drain the road foundation;
- Planting of attenuation ponds to aid pollution control;
- Provision of cut-off drains to intercept overland flow;
- Provision of flood connectivity culverts;
- Sizing of culverts to accommodate adequate flows;
- Design of watercourse diversions to minimise impacts to existing flows; and
- Bridge design which takes into account flood modelling.

9.6.2 Construction Phase

The risk of potential impacts occurring during the construction phase (in the absence of adequate management and mitigation measures) can arise from several activities. These typically will include:

- Polluted drainage and discharges from the Proposed Road Development site;
  - Discharge of vehicle wash-down water;
  - Discharge of construction materials, e.g. uncured concrete;
  - Uncontained spillage of wastewater effluent;
  - Uncontrolled sediment erosion and contaminated silty runoff; and
  - Refuelling facilities, chemical and waste storage or handling areas.
- Changes to the existing drainage network including interception and redirection of natural and artificial watercourses (e.g. drainage channels);
- Increased runoff from cleared and capped areas (relative to greenfield values);
- Construction of watercourse crossings;
- Construction of bridge over the Abbert River;
- Works within water; and
- Outfall points.

During construction, pollution from mobilised suspended solids will generally be the prime concern, but spillage of fuels, lubricants, hydraulic fluids and cement from construction plant may lead to incidents, especially where there are inadequate pollution mitigation measures.

9.6.2.1 Sedimentation (Suspended Solids)

Various construction activities have the potential to release sediment and cause unacceptable sediment levels in the catchment area and impacts to the Lough Corrib SAC. Site stripping and bulk earthworks, including creation of embankments and a cutting, will leave deposits exposed to temporary erosion by wind or rain and this could potentially lead to temporary increases in sediment loading of the surface water network. Contamination from suspended sediments could also be caused by construction of the bridge, culverts, diversions of drains and runoff from material stockpiles. The bridge abutments will be located outside the river channel to remove the need for instream works for construction of the bridge over the Abbert River.

Runoff containing large amounts of suspended solids could potentially adversely impact on surface water. The impact will likely result in a **direct** effect of a **negative** nature and **temporary** duration given it is associated with the construction programme. Large volumes of run off containing large amounts of suspended solids entering watercourses is considered unlikely to occur given the scale/phased nature of the development and distance of the majority of the route from the watercourses, and should it occur is likely to be temporary. Therefore, it is considered to be a **small** effect to an environment of **extremely high** sensitivity/significance and the significance of the effect is **significant.**

It is noted the effect of sedimentation on aquatic habitats and organisms is addressed in Chapter 07 Biodiversity.

9.6.2.2 Accidental Spillage and Leaks

Any construction activities carried out close to surface waters involve a risk of pollution due to accidental spillage and leaks. While liquids such as oils, lubricants, paints, bituminous coatings, preservatives and weed killers present the greatest risk, fuel spillages from machinery operating close to watercourses also present a risk. The refuelling of general construction plant also poses a significant risk of pollution, depending on how and where it is carried out. Pollution as a result of accidental spillage could potentially affect fish, aquatic flora and could also have a dramatic effect on invertebrate communities.

Accidental spillage could potentially result in a direct or indirect effect to surface water should contaminants enter surface waters directly or migrate through the subsoils and underlying groundwater to surface waters. The impact will likely result in a **direct** effect of **negative** nature and **temporary** duration given it is associated with the construction programme. Accidental spillages and leaks are considered unlikely to occur and should they occur are likely to be temporary or confined to one-off releases. Therefore, it is considered to be a **small** effect to an environment of **extremely high** significance/sensitivity and the significance of the effect is **significant.**

9.6.2.3 Use of Concrete and Lime

Lime and concrete (specifically, the cement component) is highly alkaline and any spillage could enter surface water or migrate though subsoils and groundwater impacting surface water quality or potentially smothering the river bed, given a spill of sufficient volume. The activities most likely to result in contamination include concreting during road and bridge construction and concreting for culverts.

The impact could result in a **direct** effect of a **negative** nature and of a **temporary** duration given it is associated with the construction programme. Impacts associated with the use of concrete and lime are considered unlikely to occur and should they occur are likely to be confined to one-off releases. Therefore, the construction phase use of lime and concrete is considered to result in a **small** effect to an environment of **extremely high** significance/sensitivity and the significance of the effect is **significant**.

9.6.2.4 Foul Sewer

Foul sewage arising from temporary toilets and sanitary facilities on the Proposed Road Development site will initially be discharged to an onsite receptacle which will be emptied by tanker on a regular basis for disposal.

If a canteen is provided onsite, provisions will be made for a grease trap at the canteen drain outlet and this drain will connect to the onsite receptacle. Drumming of waste cooking oil within the canteen will also be provided. As the above control measures will be incorporated into the site set-up, this is considered to be a **negligible** effect to an **extremely high** significance/sensitivity environment and the significance of the effect is **imperceptible**. Additional specific mitigation measures are therefore not required to address foul sewage during the construction phase and are not discussed further in following sections.

9.6.3 Operational Phase

The potential adverse impacts during the operational phase, in the absence of adequate management and mitigation measures are as follows:

- Accidental spillage and leaks;
- Siltation of storm water drainage system and attenuation ponds; and
- Flooding associated with earthworks and surfacing.

9.6.3.1 Accidental Spillage and Leaks

There is the potential for accidental spills and leaks to occur from vehicles using the Proposed Road Development during its operation. The impacts are unlikely to occur due to the embedded control measures that have been incorporated into the Proposed Road Development site (see Chapter 04 Description of the Proposed Road Development). For example, releases of fuel or chemicals from accidental spills associated with potential road traffic accidents or runoff from rainwater that has passed over impermeable surfaces will be prevented from polluting the local surface waters, including the Lough Corrib SAC, as all surface water runoff from the paved areas will be collected in a closed drainage network and will pass through petrol interceptors prior to discharge to ponds before entering the Abbert River.

In addition to this, the outlet of the ponds will be fitted with a shut-down facility so that, in the event of a catastrophic spill, the spillage will be contained within the attenuation pond to be removed by tanker. The potential risk of a catastrophic spill is considered further in Chapter 18 Major Accidents and Disasters.

A preliminary risk assessment has indicated the spillage risk associated with the scheme as being 1 in at least 15,336 years (Section 4.65, Chapter 04 Description of the Proposed Road Development).

However, if impacts from accidental spillage and leaks occur, these would be confined to one-off releases. The impact could lead to a **direct** effect on surface waters; however this would be **temporary** in nature. Therefore, it is considered to be a **negligible** effect on an **extremely high** significance/sensitivity environment and the significance of the effect is **imperceptible**. Specific mitigation measures are therefore not required.

9.6.3.2 Drainage

The total new paved area of the Proposed Road Development is 34,050 m^2, comprising 26,000 m^2 of carriageway and 8,050 m^2 of footpath and cycle track. There is the potential for sediment and pollutants such as road salt, heavy metals, etc. to accumulate within the drainage network from road run-off. However, embedded control measures have been included in the design, as described in Chapter 04 Description of the Proposed Road Development, to reduce the potential for impacts.

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. 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.

As the Proposed Road Development will cross the Lough Corrib SAC, and due to the use of kerbs on the road section, a sealed drainage system will be used. Road runoff will be collected through gullies located at regular intervals or kerb drains where necessary. Sealed pipes will convey the flows to the downstream attenuation systems.

The proposed road drainage system has been divided in to four separate networks. The road drainage will outfall at four locations into existing ditches, which eventually outfall into the Abbert River. The road drainage will outfall via a lined drainage ditch at one location and via attenuation ponds at three locations. The temporary and permanent land acquisition required to undertake these works and associated attenuation systems has been incorporated into the CPO. The outfalls and drainage requirements are shown in Figure A4-20 to Figure A4-25 inclusive, contained in Volume 3 of this EIAR.

A surface water collection system will be provided so as to comply with the design requirements of DN-DNG-03022 – Drainage Systems for National Roads. This will include providing suitably sized longitudinal carrier drains to accommodate a 1-year return period storm in-bore without surcharging, with no flooding of the proposed carriageway for a 1 in 5-year return period for filter drains. Where combined surface and ground water drains are proposed, a 1 in 5-year return period storm will not rise above the formation level, or sub-formation level where a capping layer is present. The drainage networks are designed to include an increase of 20% in rainfall depth to cater for the impact of climate change.

A sub-surface drainage system of the road pavement will be provided in order to control groundwater levels in the vicinity of the Proposed Road Development and to drain the road foundation. This will be required in areas of cuttings and low embankments (<1.5 m). In general, this will be achieved using a network of filter drains or narrow filter drains.

Drainage of the proposed bridge structure will be managed so as to achieve the requirements set out in DN-DNG-03022 – Drainage Systems for National Roads. For the length of the bridge over the Abbert River a combined kerb and drainage system will capture the runoff on the bridge deck, transport it along the length of the bridge and connect into the proposed carriageway drainage system.

Flows from the Proposed Road Development will be attenuated prior to discharge to the receiving watercourse so that the post development peak flow rate will not be greater than the original greenfield runoff rate. It is proposed to use three ponds and a lined drainage ditch upstream of the discharge point to the Abbert River for the greenfield section of the Proposed Road Development. A flow restricting device such as a vortex flow control device upstream of the outlet to a receiving waterbody.

The attenuation systems have been designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. This design ensures that there is no increase in the risk of flooding in the receiving watercourse due to construction of the road up to the 100-year return period.

The attenuation ponds have been designed to accommodate the first flush surface water runoff within a forebay. First flush flows are those that arrive at the outfall first after a rainfall event. The first flush is defined as 10% of the five year storm peak flow and contains the heaviest contaminant load. The plan area of the sediment forebay should be at least 10% of the total basin area. The connection from the forebay area to the main body of the pond will be via a permeable bund. Due to the environmentally sensitive nature of the area and because the ponds will be used for spillage containment, the ponds will be lined.

It is therefore considered that the general operational phase works will pose a **negligible** effect to an **extremely high** significance/sensitivity environment (land drains) and the significance of the effect is **imperceptible**. Additional specific mitigation measures are therefore not required.

9.6.3.3 Flooding

Structures such as bridges, culverts and water course diversions can, in the absence of appropriate design, impact negatively on upstream water levels and downstream flows.

The results of hydraulic modelling undertaken as part of the FRA displayed that approach embankments and the span of the bridge could have, in the absence of mitigation, restricted the overland flow path, resulting in a large increase (maximum of 83 mm in-channel and 169 mm in the floodplain for the 1% Annual Event Probability (AEP)) in flood level upstream of the proposed river crossing.

The proposed with Mitigation scenario included upsizing of two proposed ditch culverts and the addition of three flood connectivity culverts to improve the conveyance of flow through the proposed approach embankments. Model output for the Proposed with Mitigation scenario indicated a slight increase (maximum of 33 mm in-channel and 33 mm in the floodplain for the 1% AEP) in flood level upstream of the proposed crossing. The increase is attributed to the impact of the approach embankments and the span of the bridge restricting the overland flow path.

For 1%+climate change (CC) and 0.1% AEP events, a maximum increase in cross section level of 67 mm and 86 mm was noted respectively, however, this was noted to reduce back to a negligible difference over approximately 300 m length.

A number of flood connectivity culverts have been included in the design and the culverts conveying existing surface waters have been designed to maintain existing flows. Appropriate approvals in this regard have been obtained under Section 50 of the Arterial Drainage Act.

The attenuation systems have been designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. This design will ensure that there is no increase in the risk of flooding in the receiving watercourse due to construction of the road up to the 100-year return period.

The crossing has been designed as a single span structure, with no works proposed within the Lough Corrib SAC. Abutments will be outside the river channel and set back by a minimum of 5 m from the river banks.

The potential impact to the water environment, is therefore considered to be a **small adverse** effect to a **high** significance/sensitivity environment and the significance of the effect is **moderate/slight**.

Taking into account the climate change scenario, it is considered a **moderate** effect on an environment of **high** sensitivity and the significance of the effect is **significant/moderate**. There is no additional risk posed to nearby properties with increases only within agricultural lands.

9.7 Mitigation and Monitoring Measures

The following mitigation measures have been proposed for the construction and operational phases:

9.7.1 Construction Phase

9.7.1.1 Construction Environmental Management Plan

A Construction Environmental Management Plan (CEMP) will be prepared for the Proposed Road Development which incorporates relevant environmental avoidance or mitigation measures to reduce potential environmental impact. The CEMP will include a Construction Erosion and Sediment Control Plan (CESCP) and a Construction and Demolition Waste Management Plan (WMP), to be prepared in accordance with Department of Environment, Community & Local Government guidelines[3] and any construction-related requirements imposed as conditions of any planning permission granted. It will also include details of proposed environmental monitoring for the duration of the construction works, be this good practice or as a planning condition requirement. The CEMP will be developed based on the Outline CEMP prepared as part of this EIAR (Volume 04 A4-1)

Works to proposed structures over existing watercourses will be undertaken following approval by the OPW under Section 50 of the Arterial Drainage Act. Details of required stream partial realignments in the vicinity of the structures have also been submitted and approved.

Ongoing consultation will be undertaken with relevant statutory bodies, including Inland Fisheries Ireland (IFI) and National Parks and Wildlife Service (NPWS). Construction works over/near watercourses will be undertaken with cognisance of the relevant guidance, including:

- CIRIA C532 Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors;
- CIRIA C648 Control of Water Pollution from Linear Construction Projects, technical guidance;
- CIRIA C649 Control of Water Pollution from Linear Construction Projects, site guide;
- CIRIA C793 The SuDS Manual; and
- Guidelines on Protection of Fisheries During Construction Works (IFI, 2016).

9.7.1.2 Sedimentation (Suspended Solids)

A CESCP will be prepared as part of the CEMP, which will be based on the sedimentation control measures in the Outline CEMP prepared by AECOM. During the construction phase, the following mitigation measures will ensure that no sediment contamination, contaminated runoff or untreated wastewater will enter watercourses on or near the Proposed Road Development site.

- The Contractor will construct elements of the permanent drainage system as early as practicable, such as the interceptor drains, to facilitate earthworks haul routes and control drainage from the works, to avoid flows onto adjacent land and/or untreated discharges to watercourses.
- Excavations will only remain open for limited time periods to reduce groundwater and surface water ingress and water containing silt will be passed through a settlement tank or adequate filtration system prior to discharge. A discharge consent will be obtained as necessary for disposal of water arising from pumping (if any) or such water may be disposed of as construction site run off where appropriate. Spoil and temporary stockpiles including stone stockpile areas will be positioned in locations which are distant from drainage systems and retained drainage channels, away from areas subject to flooding. They will be appropriately graded and kept to maximum heights to reduce the potential for sediment run-off. Runoff from spoil heaps will be prevented from entering watercourses by diverting it through onsite settlement ponds and removing material as soon as possible to designated storage areas.

[3] Department of the Environment, Heritage and Local Government "*Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*" July 2006

- Drainage channels and streams will be clearly identified onsite and shown on method statements and site plans. Construction compounds will be located at least 25 m from watercourses and 10 m from field drains.
- Drains carrying high sediment load will be diverted through settlement ponds, located between the construction area and the nearest surface water drain. Surface water runoff from working areas will not be allowed to discharge directly to the local watercourses. To achieve this, the drainage systems will be constructed prior to the commencement of major site works or the Contractor will provide an alternative means of silt management. Discharge from settlement/treatment ponds will be controlled and maintained at greenfield runoff rates to avoid impacting existing surface water flow rates. The attenuation systems have been designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse
- Silt traps will be placed across the works boundary in any areas adjacent to watercourses to avoid siltation of watercourses. These will be maintained and cleaned regularly throughout the construction phase. Attention will also be paid to preventing the build-up of dirt on road surfaces, caused by trucks and other plant entering and exiting the Proposed Road Development site.
- During the construction activities, there will be a requirement for diverting rainwater away from the construction areas, into nearby drainage channels and streams. Water will be filtered to prevent sediment from entering drainage channels and water streams.
- A monthly water sampling regime for the Abbert River will be put in place by the Contractor during construction activity onsite, to include sampling for pH and total suspended solids. Parameters will be agreed with Galway County Council (GCC) and IFI ahead of works. The frequency of monitoring will be increased to weekly during works over the river, including bridge construction. In addition daily visual checks of the Abbert River will be in place for the duration of the Proposed Road Development
- A temporary cut-off wall will be installed, in order to reduce the risk of sediments generated during bridge construction works mobilising to the Abbert River.
- As per Chapter 07 Biodiversity, works will, where possible, be phased taking into account sensitive periods for aquatic ecology, such as spawning seasons.

The drainage system has also been designed to offset risks to the *Molinia* meadows, by allowing drainage beneath the carriageway at Chainage 1+950 to 2+050. In order to mitigate the impact of the Proposed Road Development it is proposed to provide a layer of free-draining granular material at the base of the embankment to maintain the hydraulic connectivity across the embankment. It is also proposed to omit any pre-earthworks drainage/interceptor ditches within the area of the *Molinia* Meadow to prevent over drainage of the area. Weekly visual checks of the *Molinia* Meadow will be undertaken during construction works, with photographic records maintained.

9.7.1.3 Accidental Spills and Leaks

In order to prevent spillages to ground of fuels, and to prevent any consequent migration through the subsurface to surface waters or direct spillages to watercourses, it will be necessary to adopt mitigation measures during the construction phase, which include:

- Designating a bunded storage area at the Contractor's compound for all oils, solvents and chemicals used during construction. Oil and fuel storage tanks will be bunded to the greater volume of either 110% of the capacity of the largest tank/container within the bunded area or to a volume of 25% of the total capacity of all the containers. Drainage from the bunded area will be diverted for collection and safe disposal. All containers within the storage area will be clearly labelled so that appropriate remedial action can be taken in the event of a spillage. When moving drums from the bunded storage area to locations along the Proposed Road Development site a suitably sized spill pallet will be used for containing any spillages during transit;
- Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be away from surface water gullies or drains. Spill kit facilities will be provided at the fuelling areas in order to provide for accidental releases or spillages in and around the area. Any used spill kit materials will be disposed of using a hazardous waste contractor;
- Drip trays will be used during refuelling operations if performed outside of a contained area and spill kits will be carried in the fuel bowser vehicle. Any used spill kits will be disposed of using a hazardous waste disposal contractor and in accordance with all relevant EU and Irish waste management legislation;
- Where mobile fuel bowsers are used on the Proposed Road Development site, in the event of a machine requiring refuelling outside of the designated area, fuel will be transported in a mobile double-skinned tank. Any flexible pipe tap, or valve will be fitted with a lock where it leaves the container and locked shut when not

in use. The pump will also be locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training;

- All water runoff from designated refuelling areas shall be channelled to an oil interceptor or an alternative treatment system prior to discharge;
- Leaking or empty fuel drums shall be removed from site immediately and disposed of via an appropriately licensed waste disposal contractor;
- The Contractor will develop an emergency response plan to be followed in the event of spills and leaks; and
- Where use of herbicides, pesticides or artificial fertilisers is required, this will be done in accordance with legislation. The use of plant protection products (PPPs) will be in accordance with TII's guidance document *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance*.

9.7.1.4 Use of Concrete and Lime

As detailed in Chapter 08 Land and Soils, the following measures will be implemented:

- Ready-mixed concrete will be brought to the Proposed Road Development site by truck;
- A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated water to the underlying subsoil and groundwater, from which it could migrate to surface water;
- The pouring of concrete will take place within a designated area protected to prevent concrete runoff into surface water;
- Washout of concrete transporting vehicles will take place at an appropriate facility, offsite where possible, alternatively, where wash out takes place onsite, it will be carried out in carefully managed onsite wash out areas;
- In order to minimize potential impacts to the Lough Corrib SAC from the bridge construction works, abutments and embankments will be outside the SAC and abutments will be set back from the Abbert River by a minimum of 5 m; and
- During construction works suitable drainage, settlement and silt control measures will be implemented to mitigate disturbance to the Lough Corrib SAC. The bridge span will be constructed using precast beams.

9.7.2 Operational Phase

The operation of the Proposed Road Development is unlikely to have any significant adverse effects on the local hydrological environment due to the nature of the development and the embedded control measures that have been incorporated into the Proposed Road Development.

Embedded control measures, as outlined in Section 9.6.3.2, include the inclusion of a sealed drainage and attenuation system; control valves and interceptors; and the planting of attenuation ponds. Proper management and regular inspection and maintenance of these drainage discharge facilities will significantly reduce the risk of pollution impact on the Lough Corrib SAC. The Local Authority will be responsible for the maintenance of the drainage network during the operational phase.

9.8 Residual Impacts and Effects

Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines, the effects from the impacts that remain after all assessment and mitigation are referred to as 'Residual Effects'. These are summarised in Table 9-5 and discussed below in terms of the construction and operational phases.

Table 9-5: Summary of Residual Impacts and Effects

Impact	Effect Significance (Pre-Mitigation)	Mitigation Measures	Residual Effect (Post-Mitigation)
Construction Phase			
Run-off of sediments during construction leading to increases suspended solids in surface waters	**Small** effect on a water environment of **extremely high** sensitivity and the significance of the effect is considered **significant**.	Refer to Section 9.7.1.2	**Negligible** effect on a water environment of **extremely high** sensitivity and the significance of the effect is **imperceptible**.
Accidental spills and leaks leading to pollution of surface waters	**Small** effect on a water environment of **extremely high** sensitivity and the significance of the effect is considered **significant**.	Refer to Section 9.7.1.3	**Negligible** effect on a water environment of **extremely high** sensitivity and the significance of the effect is **imperceptible**.
Release of concrete and lime to surface waters, leading to pH increase	**Small** effect on a water environment of **extremely high** sensitivity and the significance of the effect is considered **significant**.	Refer to Section 9.7.1.4	**Negligible** effect on a water environment of **extremely high** sensitivity and the significance of the effect is **imperceptible**.
Release of untreated foul sewerage leading to pollution of surface water features	**Negligible** effect on a water environment of extremely high sensitivity and the significance of the effect is considered **imperceptible**.	N/A	**Negligible** effect on a water environment of **extremely high** sensitivity and the significance of the effect is **imperceptible**.
Operational Phase			
Accidental Spills and Leaks from vehicles leading to pollution of surface waters	**Negligible** effect on a water environment of **extremely high** sensitivity and the significance of the effect is **imperceptible**.	N/A	**Negligible** effect on a water environment of **extremely high** sensitivity and the significance of the effect is **imperceptible**.
Sediment building up in drainage network and being released to surface water features	**Negligible** effect on a water environment of **extremely high** sensitivity and the significance of the effect is **imperceptible**.	N/A	**Negligible** effect on a water environment of **extremely high** sensitivity and the significance of the effect is **imperceptible**.
Flooding of surrounding land due to flood level increases associated with embankment and bridge construction	**Small** effect on an environment of **high** sensitivity and the significance of the effect is **moderate/slight**. In the climate change scenario, a moderate effect on an environment of **high** sensitivity and the significance of the effect is **significant/moderate.**	N/A	**Small** effect on an environment of **high** sensitivity and the significance of the effect is **moderate/slight**. In the climate change scenario, a **moderate** effect on an environment of **high** sensitivity and the significance of the effect is **significant/moderate.**

9.8.1 Construction Phase

The implementation of mitigation measures highlighted above will significantly reduce the likelihood and magnitude of the potential effects on water during the construction phase. With respect to water, the magnitude of the potential residual effect during construction phase is therefore considered to be **negligible** on an environment of **extremely high** significance/sensitivity, therefore the significance of the potential effect of the Proposed Road Development is considered to be **imperceptible** on the water environment.

9.8.2 Operational Phase

There are no likely significant permanent effects associated with the Proposed Road Development on the water environment. The significance of effects during the operational stage has been assessed as **moderate/slight**, based on the modelled increase in flood levels associated with the proposed river crossing.

In the climate change scenario, the significance of effects during the operational stage has been assessed as **significant/moderate**. However, under the climate change and 0.1% AEP scenario this effect (with mitigation) will only locally occur at the abutments on adjacent fields. A maximum increase in cross section level of 67 mm and 86 mm respectively presents upstream of the proposed crossing point, which reduces back to a negligible difference over approximately 300 m length. There is a negligible change on the levels downstream of the crossing point.

The proposed scheme with mitigation scenario included upsizing of two proposed ditch culverts and the addition of three flood connectivity culverts to improve the conveyance of flow through the proposed approach embankments. Model output for the proposed with mitigation scenario indicated a slight increase (maximum of 33 mm in-channel and 33 mm in the floodplain for the 1% AEP) in flood level upstream of the proposed crossing.

9.9 Do-Nothing Scenario

In the case where no road is developed there would be no resulting impacts on the water environment in the vicinity of the Proposed Road Development site.

9.10 Cumulative Impacts and Effects

The cumulative impacts of the Proposed Road Development and with consented projects in the vicinity of the Proposed Road Development are discussed below.

A planning search of granted and pending planning applications made within the vicinity of the site (5 km of the Proposed Road Development site boundary) within the last ten years is presented in Volume 04; Appendix A1-1.

The majority of planning applications within 5 km of the Proposed Road Development site are related to development of and alterations to residential properties and are considered to be small in scale.

The following Part 8 Application of relevance has been recorded:

Table 9-6: Summary of Relevant Part 8 Applications

Reference Number	Development Address	Brief Development Description	Application Received
LA0420	Brooklodge, Tuam, Co. Galway	Permission for the development of a burial ground including provision for off road vehicular parking at Ballyglooneen Townland, Tuam, Co. Galway.	09/09/2020

Given the distance of the above development (approximately 5 km) from the site and the likely dilution and attenuation processes between the Proposed Road Development and the above development, cumulative impacts are not considered likely.

Following a review of the above proposed and consented projects, there were no cumulative effects on the hydrology as a result of the Proposed Road Development identified.

9.11 Summary

The impacts and associated effects to the water environment from the Proposed Development are summarised as follows:

- During construction, potential impacts include sedimentation, accidental spills and leaks, use of concrete and lime, bridge construction, culverting and drainage works;
- With the implementation of a number of mitigation measures, there will be no significant adverse effects to the water environment during the construction of the Proposed Road Development:
  - An imperceptible effect to water from the runoff of suspended solids during construction;
  - An imperceptible effect to water from accidental spillage and leaks of fuels and chemicals during construction;
  - An imperceptible effect from local temporary pH alterations of surface water resulting from the use of concrete and lime during construction; and
  - An imperceptible effect from foul sewerage generated during construction.
- During operation, potential impacts include accidental spills and leaks, discharges to surface water, flooding resulting from the Proposed Road Development and impacts of flooding on the Proposed Road Development.
- A number of embedded control measures will ensure there will be no significant adverse effects to the surface water environment during operation of the Proposed Road Development:
  - An imperceptible effect to water from accidental spillage and leaks of fuels during operation;
  - An imperceptible effect associated with the sedimentation of drainage systems during operation; and
  - A moderate/slight effect associated with changes in flood levels, which rises to significant/moderate for a short section of river when climate change is considered.
- There will be no significant cumulative effects on hydrology as a result of the Proposed Road Development.

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 10: Air Quality

Galway County Council

February 2022

Table of Contents

Figures

Tables

Volume 03 Figures

Volume 04 Appendices

10. Air Quality

10.1 Introduction

This chapter presents an assessment of the potential impacts the Proposed Road Development will have on air quality. The chapter defines the air quality study area, the methodology used for developing the baseline and impact assessment, provides a description of the baseline environment, and presents the findings of the air quality impact assessment.

This chapter should also be read in conjunction with Chapter 04 Description of the Proposed Road Development, Chapter 05 Traffic Analysis, Chapter 06 Population & Human Health, Chapter 07 Biodiversity, Chapter 08 Land & Soils, Chapter 11 Climate, and Chapter 16 Material Assets - Non-Agriculture of this Environmental Impact Assessment Report (EIAR), which pay particular attention to the potential for impacts the Proposed Road Development will have on the environment.

10.2 Legislation, Policy and Guidance

10.2.1 European and National Legislation

The Air Quality Standard Regulations 2011 implement the European Union Directive 2008/50/EC on Ambient Air Quality and Cleaner Air for Europe (CAFE) and designate the Environmental Protection Agency (EPA) as the competent authority responsible for assessing ambient air quality in the territory of the State. They also establish Limit Values (LVs) and alert thresholds for concentrations of certain pollutants in ambient air, to prevent or reduce harmful effects on human health and the environment. LVs were published for seven pollutants, with alert thresholds for an additional five pollutants.

These European Union Limit Values (EULVs) are legally binding and of the seven pollutants for which EULVs have been set, national assessments have demonstrated that there is no risk of carbon monoxide (CO), 1,3-butadiene, benzene, lead and sulphur dioxide (SO_2) concentrations exceeding the limits due to emissions from traffic anywhere in Ireland and therefore not considered in this assessment. Volatile organic compounds (VOCs) as a group are similarly scoped out. There are no EULVs for VOCs as a group, and as discussed above, benzene and 1,3-butadiene, which are types of VOCs, are not at risk of exceedance.

The EULVs for the remaining pollutants are displayed in Table 10-1. These are nitrogen dioxide (NO_2) and particulate matter in the fractions of <10 µm (PM_{10}) and <2.5 µm ($PM_{2.5}$). The selection of these three pollutants for further assessment is consistent with Section 1.3 'Pollutants of Concern and Air Quality Standards' of the Transport Infrastructure Irelands (TII, formerly the National Roads Authority (NRA)) document 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes', 2011 'TII Guidance'. Limit values are expressed in one of two ways: as annual mean concentrations which are not to be exceeded without exception, due to their chronic effects; or as shorter term (24-hour or one-hour) mean concentrations for which only a specified number of exceedances are permitted within a specified time frame, due to their acute effects.

Table 10-1 Air Quality Limit Values

Pollutant	Averaging Period	Concentration (µg/m3)	Permitted Exceedances
NO_2	Annual mean	40	None
	1-hour mean	200	Not to be exceeded more than 18 times a year
PM_{10}	Annual mean	40	None
	24-hour mean	50	Not to be exceeded more than 35 times a year
$PM_{2.5}$	Annual Mean	25	None

Source: The Air Quality Standard Regulations 2011

An annual mean LV for nitrogen oxides (NOx) of 30 μg/m^3 is set for the protection of vegetation. In addition, critical loads for nitrogen and acid deposition have been determined which represent (according to current knowledge) the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem. Critical loads are set for different types of ecosystems based on their respective sensitivity to nutrient nitrogen and acidity and have been obtained for each designated site with the potential to be affected by the Proposed Road Development (see Section 10.7.2.3).

There are no national or European Union (EU) limits for dust deposition; however, the Technical Instructions on Air Quality Control (Technische Anleitung zur Reinhaltung der Luft (BMU, 2002) provide a guideline for the rate of dust deposition of 350 mg/m^2/day averaged over one year. The EPA concurs that this guideline may be applied, although applied as a 30-day average (Environmental Management in the Extraction Industry (non-scheduled minerals, EPA, 2006).

10.2.2 Air Pollution Act 1987 (as amended) (Number 6 of 1987)

The Air Pollution Act 1987 (as amended) provides local authorities with the primary responsibility for monitoring air quality, including the nature, extent and effects of emissions within their administrative area.

Local authorities are also given powers under the Act to take measures to prevent or limit air pollution in their administrative area. For this Proposed Road Development, the responsible local authority is Galway County Council (GCC). GCC are not undertaking monitoring within the study area.

10.2.3 Environmental Protection Agency Act 1992 (As Amended) (Number 7 of 1992)

The Environmental Protection Agency Act 1992 (as amended) established the remit of the environmental regulator in Ireland to make further and better provision for the protection of the environment and the control of pollution.

Amongst the many duties of the Agency is the monitoring of local air quality across the country and the regulation of licenced activities with emissions to air.

10.2.4 National Planning Policy

10.2.4.1 Project Ireland 2040

Project Ireland 2040 is the Government's long-term overarching strategy for future development and infrastructure in Ireland. It consists of several documents, including the National Planning Framework, which is the Government's high-level strategic Plan for shaping the future growth and development of Ireland up to 2040 (Government of Ireland, 2019a).

The Framework includes the following overarching aim that is relevant to this assessment:

> *"Creating a Clean Environment for a Healthy Society:*
>
> *Promoting Cleaner Air: Addressing air quality problems in urban and rural areas through better planning and design."*

The Framework includes National Policy Objective 64, which stresses the importance of improving ambient air quality:

> *"National Policy Objective 64: Improve air quality and help prevent people being exposed to unacceptable levels of pollution in our urban and rural areas through integrated land use and spatial planning that supports public transport, walking and cycling as more favourable modes of transport to the private car, the promotion of energy efficient buildings and homes, heating systems with zero local emissions, green infrastructure planning and innovative design solutions."*

Project Ireland 2040 also includes the Government's National Development Plan, which is currently under review. This document is focused on Ireland's long-term economic, environmental and social progress up to 2027, and references improvements in air quality as an additional benefit to improving energy efficiency for the primary purpose of reducing carbon emissions.

10.2.5 Local Planning Policy

10.2.5.1 Galway County Development Plan 2015-2021

The Galway County Development Plan sets out the Council's proposed policies and objectives for the development of the County over the Plan period of 2015 to 2021 (GCC, 2015). The Development Plan seeks to develop and improve, in a sustainable manner, the social, economic, environmental and cultural assets of the County.

Section 8.5 of the Development Plan includes a range of policies specific to Climate Change, Air Quality and Radon policies and objectives. Air Quality objectives include:

> *"**Objective CC 6** – Air Quality Galway County Council shall promote the preservation of best ambient air quality compatible with sustainable development in accordance with the EU Ambient Air Quality and Cleaner Air for Europe (CAFE) Directive (2008/50/EC) and by ensuring that all air emissions associated with new developments are within Environmental Quality Standards as set out in the Air Quality Standards Regulations 2011 (SI No. 180 of 2011) (or any updated/superseding documents).*
>
> ***Objective CC 7** – Air Purification: The Council shall encourage landscaping and deciduous tree planting in an environmentally sensitive manner within towns and villages as a means of air purification, the filtering of suspended particles and the improvement of their micro-climate."*

10.2.5.2 Galway County Development Plan 2022-2028

In May 2021 GCC published the Draft Galway County Development Plan 2022-2028 for public consultation. The Draft Plan sets out a range of proposed policy objectives for sustainable and environmentally sensitive development up to 2028.

Section 7.9 of the Draft Plan includes a range of policies specific to Environmental Protection, including Air Quality. Air Quality policy objectives include:

> *"**AQ 1 Ambient Air Quality** – To promote the preservation of best ambient air quality compatible with sustainable development in accordance with the EU Ambient Air Quality and Cleaner Air for Europe (CAFÉ) Directive (2008/50/EC) and ensure that all air emissions associated with new developments are within Environmental Quality Standards as set out in the Air Quality Standards Regulations 2011 (SI No. 180 of 2011) (or any updated/superseding documents).*
>
> ***AQ 2 Assessment of Air Quality** – To require developments which would have the potential to have adverse impacts on air quality to carry out assessments of the impact of the development on air quality.*
>
> ***AQ 3 Air Quality Mitigation Measures** – To require the use of appropriate mitigation measures such as dust dampeners to minimise the potential impacts of developments on air quality.*
>
> ***AQ 4 Air Purification** – The Council shall encourage landscaping and deciduous tree planting in an environmentally sensitive manner within towns and villages as a means of air purification, the filtering of suspended particles and the improvement of their micro-climate.*
>
> ***AQ 5 Radon** – The Council shall have regard, to the specific guidance on radon prevention measures for new homes as contained within the existing Building Regulations (including any updated/superseding Regulations that may be published within the lifetime of this Development Plan).*

10.2.6 Contemporary Guidance and Tools updates

The TII Guidance, when published in 2011, incorporated contemporary guidance from other organisations. This included:

- Highways Agency - Design Manual for Roads and Bridges (DMRB) air quality guidance HA207/07 published in 2007; and
- Environmental Protection - UK's guidance document on planning and air quality (EPUK) published in 2010.

Where applicable, this assessment has incorporated more recent guidance that has replaced the above guidance including:

- Highways England– LA105 'Air Quality', published in 2019; and
- Environmental Protection UK (EPUK)/Institute of Air Quality Management (IAQM) - Land-Use Planning & Development Control: Planning for Air Quality published in 2017.

Additionally, further recent IAQM guidance and Chartered Institute of Ecology and Environmental Management (CIEEM) guidance has also been utilised to supplement the TII approach to the evaluation of designated habitat sites.

Similarly, the TII guidance cross referenced air quality tools available at the time of publication including the DMRB screening model published by the Highways Agency in 2007. Since the publication of the TII guidance, this tool has been updated to version 8. The main difference between these two screening tools is the use of more up to date emission rates, taken from the Department of Environment, Food and Rural Affairs (Defra) Emissions Factors Toolkit (EFT) version 10 and the incorporation of speed bands intended to capture congestion effects. Additionally, two accompanying tools have been issued by Highways England as part of gap analysis (versions 1.0 and 1.1). These tools are discussed further in Section 10.3.

10.3 Methodology

10.3.1 Overall Approach

The air quality assessment has been undertaken with reference to the EPA draft 'Guidelines on the information to be contained in environmental impact assessment reports' (hereafter referred to as the 'EPA draft guidelines') (EPA, 2017). The assessment has been undertaken for both the construction and operational phases of the Proposed Road Development. The assessment methodology follows the guidance set out within the TII's (formerly NRA) document 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes', 2011 'TII Guidance'. In particular the air quality assessment is based on Figure 2 of the TII Guidance and the following key tasks for the route selection phase have been completed:

- Calculations of index of overall change in exposure for the assumed opening year; and
- Screening model calculations at worst case receptor points for the assumed opening year.

Additionally, calculations of total emissions have been undertaken for the baseline year, opening and design years have been completed and a qualitative assessment of construction impacts has been undertaken.

10.3.2 Study Area

10.3.2.1 Construction Phase

The study area for the construction dust assessment is defined as the area up to 100 m from dust-generating activities. As according to TII Guidance, over these distances significant effects from dust may occur for schemes. Additionally, the TII Guidance also notes that designated habitats at extended distances up to 200 m should also be identified.

The proposed site boundary for the Proposed Road Development has been chosen as a proxy for the area within which dust-generating activities will occur. Therefore, the study area is up to 100 m from the site boundary. This is a worst case conservative assumption as dust-generating activities are unlikely to occur right at the site boundary.

According to the TII Guidance, a change in Annual Average Daily Traffic (AADT) flow of more than 10% near to sensitive receptors is considered significant change in traffic and as such concentrations of NO_2, PM_{10} and $PM_{2.5}$ should be calculated following the methodology described above using the DMRB screening methodology. Taking into consideration the scale of the Proposed Road Development and the existing AADT flow on the nearby roads, it is unlikely that the criteria will be met and therefore the assessment of vehicle emissions during the construction phase was scoped out.

10.3.2.2 Operational Phase

The assessment of operational phase impacts considers impacts on local air quality at the resolution of selected individual receptors, following the approach set out in DMRB LA105 guidance (Highways England, 2019), and impacts over the wider study area will be considered following the Index of Overall Exposure approach set out in TII Guidance.

The study area for the air quality assessment for the operation of the Proposed Road Development differs for each type of assessment.

The Index of Overall Exposure considered receptors located within 50 m of the carriageway of the existing N63 and the Proposed Road Development and all road links that will experience a significant change in traffic. A significant change in traffic is a change in AADT flows of 5% or more. These criteria to define a significant change in traffic were also applied to determine the study area for the regional assessment.

The local air quality assessment study area is defined based on the DMRB LA 105 (Highways England, 2019) screening criteria for the changes in traffic between the Do-minimum (DM) scenario (without the Proposed Road Development) and the Do-something (DS) scenario (with the Proposed Road Development) in the assumed opening year:

- Road alignment will change by 5 m or more; or
- AADT flows will change by 1,000 or more; or
- Heavy duty vehicle (HDV) (vehicles greater than 3.5 tonnes, including buses and coaches) flows will change by 200 AADT or more; or
- There will be a change in speed band.

The focus of the local air quality assessment in the TII Guidance is on locations within 50 m and for designated habitats up to 200 m.

The operational phase assessment has focused on the assumed opening year of the Proposed Road Development as this is anticipated to be the worst case year of assessment. This is because by later years (e.g. design year) further improvements (reductions) in vehicle emissions and background pollutants are expected to outweigh the increase in emissions due to traffic growth in later years. This approach is consistent with the guidance described in DMRB LA105 for operational assessments.

10.3.3 Determination of the Baseline Environment

A review of available baseline data in the vicinity of the Proposed Road Development was undertaken from the following sources, building on the previous stages of assessment:

- The EPA website which details the range and scope of monitoring undertaken throughout Ireland and provides both monitoring data and the results of previous air quality assessments. Relevant documents include “Air Quality in Ireland 2019 – Indicators of Air Quality” (EPA, 2020);
- Ireland’s Environment – An integrated Assessment 2020, Chapter 3 Air Quality (EPA, 2021); and
- GCC monitoring.

A local roadside monitoring survey has not been conducted for this Proposed Road Development as the EPA monitoring in Zone D confirmed that levels of NO_2 and particulate matter are low in the study area and well below (<50%) the relevant EULVs. Therefore, roadside monitoring was not considered an essential requirement. In addition, due to the Covid-19 pandemic, there has been a noticeable change in travel behaviour from the ‘norm’ in the area, as indicated by the information provided by the permanent traffic counter located near to the study area (TMU N63 080.0 W). As such, any monitoring survey undertaken in 2020 would not have provided representative base year concentrations (2019). This is also supported by the findings reported in the EPA’s ‘Ireland’s Environment – An integrated Assessment 2020’ (EPA, 2021) report, which states that NO_2 concentrations decreased by up to 50% during the pandemic due to the reduction in road transport.

The baseline air quality data is compared against the relevant air quality standards where possible.

10.3.4 Determination of Sensitive Receptors

There are two types of receptors that will be considered in the air quality assessment as follows:

- Public Exposure Receptors – these are sensitive locations where relevant exposure for air quality criteria being assessed could occur e.g. residential properties, schools, hospitals, places of worship, sports centres and shopping areas; and
- Designated Ecological sites - which include Natural Heritage Areas (NHA), proposed Natural Heritage Areas (pNHA), Special Areas of Conservation (SAC), Special Protection Areas (SPA), National Parks, Nature Reserves, Refuges for Fauna, Refuges for Flora, Wildfowl Sanctuaries, Ramsar Sites, Biogenetic Reserves and UNESCO Biosphere Reserves.

The Limit Values (as set out in the Air Quality Standards Regulations 2011) have been set at concentrations that provide protection to all members of society, including more vulnerable groups such as the very young, elderly or unwell. As such the sensitivity of receptors was considered when setting the objectives and therefore no additional subdivision of human health receptors on the basis of building or location type is necessary.

Designated ecological sites can be affected by increases in oxides of nitrogen (NO_x) concentrations and associated increases in nitrogen deposition rates with higher NO_x emissions from vehicles. Construction dust can also affect ecosystems through deposition that acts as a barrier physical to photosynthesising plants and through the effects of its chemical constituents on sensitive ecological receptors.

Receptors have been selected for the relevant assessments from mapping and online aerial photography such as Google Earth and Google Streetview to identify building use e.g. residential, commercial as well as the Eircode website. A site visit has not been necessary due to the good coverage of this area from these sources of baseline information. The project ecologists have been consulted to aid in the determination of relevant designated conservation area receptors.

10.3.5 Describing Potential Effects

The assessment has been carried out with reference to TII's Guidance and EPA's draft guidelines (EPA, 2017).

As described in the TII Guidance document, the following elements were considered for the air quality assessment:

1. Baseline air quality conditions (qualitative);
2. Calculation of the Index of Overall Change of Exposure for the existing route and the preferred route (quantitative);
3. Determine the pollutant concentration (NO_2, PM_{10} and $PM_{2.5}$) at worst case sensitive receptors (quantitative);
4. Consideration of impacts on sensitive ecosystems (quantitative); and
5. Calculation of regional emissions (NO_2, PM_{10} and CO_2) associated with the Proposed Road Development.

The Stage 2 options appraisal considered six route options. Route B1 has been taken forward as the preferred option; however, the alignment has been refined since Stage 2 and therefore tasks 2 to 5 above have been updated. No additional information has been collected regarding baseline air quality conditions since the assessment was prepared for Stage 2.

In addition to the above, the potential impacts during the construction phase are considered.

10.3.6 Traffic Data

The traffic data utilised in the air quality assessment is summarised in Table 10-3. For further information, reference should be made to Chapter 05 Traffic Analysis.

Speeds in the base year were not modelled and therefore were not pivoted as defined in LA 105; however, the following approach was used to define the speed bands assigned to road links and is considered to be a robust methodology. The transportation consultant primarily used two traffic survey datasets:

- The Automatic Traffic Counts (ATC) recorded the speed on two sections of the existing N63; and
- Information regarding the average travel time/speed over the entire length of the existing N63 within the study area was derived from mobile phone/GPS data (i.e. Google Maps).

Based on the available information and professional judgement the transportation consultants then defined the speed band for each road link.

The traffic data indicates that the Proposed Road Development will result in a re-distribution of traffic which currently uses the existing N63 onto the Proposed Road Development, with no notable additional traffic being drawn to the local area. As such, no roads in the wider area have been identified as having a change in traffic composition (AADT, HDV %, speed) due to the Proposed Road Development. The additional local roads considered and found to also have no change in traffic composition due to the Proposed Road Development, are the L7138 Lisch Road, the L3110 Monivea Road, the L21821, the L6159 and the L6234.

The DMRB Screening model V8, requires speed bands to be assigned to each road link, rather than speeds. This ensures that the speeds from the traffic model are used to reflect different states of driving conditions with an assigned emission factor. Table 10-2 provides the speeds band categories for each speed range for roads in an urban environment, as defined in Highway England's LA105 (Highways England, 2019). Each link for which traffic data was provided was assigned an appropriate speed band category (Table 10-2).

Table 10-2 Speed Bands

Category	Speed Range (kph)	General Description
Heavy Congestion	5-20	Traffic with a high degree of congestion.
Light Congestion	20-45	Typical urban traffic with a reasonable degree of congestion.
Free Flow	45-80	Typical urban traffic with limited or no congestion.
High Speed	80-112	High speed urban single or dual carriageway

Source: LA105, Highways England, 2019

Table 10-3 Traffic Data used in the Air Quality Assessment

			Base Year 2019				Assumed Opening Year 2023 DM				Assumed Opening Year 2023 DS			
ID	Description	Length (km)	AADT	%HGV	Speed (kph)	Speed band	AADT	%HGV	Speed (kph)	Speed band	AADT	%HGV	Speed (kph)	Speed band
1	Existing N63 between the eastern end of Abbeyknockmoy and L7138	1.20	4,859	5.6%	80	High Speed	5,405	6.0%	80	High Speed	-	-	-	
2	Existing N63 between L7138 and L3110	0.14	4,639	5.7%	30	Light Congestion	5,161	6.1%	30	Light Congesti on	1,750	5.1%	50	Free flow
3	Existing N63 between L3110 and L6159 (at Liss Bridge)	0.19	3,764	6.8%	25	Light Congestion	4,190	7.2%	25	Light Congesti on	-	-	-	
4	Existing N63 between L6159 and L6234	0.75	3,499	6.5%	80	High Speed	3,895	6.9%	80	High Speed	-	-	-	
5	Proposed N63 between the eastern end of Abbeyknockmoy and proposed roundabout	0.17	-	-	-		-	-	-		5,405	6.0%	50	Free flow
6	Proposed N63 between proposed roundabout and L6159 (at proposed river crossing)	1.25	-	-	-		-	-	-		3,411	6.7%	100	High speed
7	Proposed N63 between L6159 and L6234	0.86	-	-	-		-	-	-		3,895	6.9%	100	High speed
8	Existing N63 between proposed roundabout and L7138	1.10	-	-	-		-	-	-		1,994	4.9%	50	Free flow
9	Proposed local link between L3110 and N63/L6159 junction	0.34	-	-	-		-	-	-		484	8.8%	50	Free flow

Note: Links 1, 3 and 4 are replaced in the DS scenario by links 5, 7, 8 and 9.

10.3.7 Calculation of Index of Overall Change in Exposure

In line with TII's Guidance, a Calculation of the Index of Overall Change in Exposure has been carried out, which allows the overall impact of the preferred route to be calculated. The Index is calculated considering the number of sensitive receptor locations within 50 m of the carriageway of all road links that will experience a significant change in traffic flow. According to TII's Guidance (Appendix 3), 50 m represents the distance within which detectable impacts of traffic emissions might be experienced. A significant change in traffic flow is considered to be a change in AADT flow or speed of 5% or more. The number of properties is then multiplied by the predicted change in the pollutant concentration along that link, and then summed across all links.

10.3.8 Calculation of Local Scale Pollutant Concentrations

As there is limited information about existing air quality in the study area and sensitive receptors are located in close proximity to the Proposed Road Development (i.e. within 10 m of the edge of the road), pollution concentrations were predicted for 2019 to inform baseline conditions. Annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations were also predicted at worst case receptor locations in the assumed opening year, with and without the Proposed Road Development operational.

10.3.8.1 DMRB Screening Model

A 'Simple' local air quality assessment using the latest DMRB Screening Model (V8_EFTV10) was deemed appropriate. This is consistent with TII's guidance that indicates detailed modelling is only required when pollutant concentrations are predicted to be greater than 90% of the standard or where receptors are located close to complex junctions. The Stage 2 assessment concluded that pollutant concentrations were predicted to be less than 10 µg/m^3 and although all the options will result in a change to the existing road network and traffic flows, these changes will not be so complex to the road layout to warrant a 'Detailed' assessment.

The outputs of the DMRB Screening Model are road-contributed NO_X and PM_{10} concentrations (exhaust and non-exhaust contributions). In line with TII Guidance (TII, 2011), $PM_{2.5}$ concentrations have been calculated from PM_{10} concentrations by using a factor of 0.9.

A verification factor of 1 has been applied to the modelled road pollutant concentrations and considered suitable for the assessment consistent with Stage 2. This factor was chosen because the DMRB Screening Model is conservative and aims to overestimate pollutants compared to detailed modelling techniques and there are also no local factors present in the study area, such as street canyons, elevated roads, or roads in cuttings or significant congestion, that will suggest that using a higher factor is necessary. However, to understand the sensitivity of the results to the use of a higher verification factor a sensitivity test has been carried out using a verification factor of 2.

10.3.8.2 NOx to NO_2

In this study, modelled road contributed NO_X concentrations have been converted to total NO_2 concentrations using Defra's 'NO_X to NO_2' calculator (V8.1) (Defra, 2020). The year and local authority area for which the modelling has been undertaken are specified. The calculation then applies an appropriate factor of NO_X emitted as NO_2.

The calculator includes Local Authorities in Northern Ireland and the TII Guidance recommends the use of 'Craigavon' as the choice for local authority when using the calculator. The local authority 'Armagh, Banbridge and Craigavon' was therefore selected as this provides the most suitable relationship between NO_2 and NO_x for Ireland. The "All Other Non-Urban UK Traffic" traffic mix option was used.

10.3.9 Impacts upon Sensitive Ecosystems

The methodology adopted for assessing impacts upon sensitive ecosystems has been prepared in accordance with Appendix 9: Impacts upon Sensitive Ecosystems of the TII 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes' (TII, 2011), with reference to the IAQM guidance 'A guide to the assessment of air quality impacts on designated nature conservation sites' (IAQM, 2020) and the CIEEM guidance 'Advisory note: Ecological assessment of air quality impacts' (CIEEM, 2021).

Designated ecological sites within 200 m of the carriageway with a significant change in traffic flow were identified. At each site, NOx concentrations and nitrogen (N) deposition rates are calculated in a transect up to 200 m away from the road. Annual mean NOx concentrations are calculated for the assumed year of opening, with and without the Proposed Road Development operational. The estimates are made using the 'Local' application of the DMRB Screening Model. The concentrations are then compared with the air quality standard for vegetation criterion for NOx (30 µg/m^3). If the Proposed Road Development is predicted to cause an increase in NO_x concentrations greater than 2 µg/m^3 and the concentrations predicted are very close to or exceed the standard (i.e. above 90% of the standard), then the sensitivity of the relevant species should be assessed by the project ecologists.

To calculate N deposition rates, the methodology described above is followed to determine road NO_2 concentrations, which is converted to dry nutrient N deposition rate. The following conversion rates of NO_2 concentration (1 µg/m^3) to N deposition kg N/ha/yr are used and have been derived from Highway England's LA105 guidance document (HE, 2019):

1) Grassland and similar habitats: 1 µg/m^3 of NO_2 = 0.14 kg N/ha/yr; and

2) Forests and similar habitats: 1 µg/m^3 of NO_2 = 0.29 kg N/ha/yr.

The road N deposition rate for the base and assumed opening year, with and without the Proposed Road Development is added to the background N deposition for each point along the transect and then comparison with the publish critical loads in the TII guidelines.

10.4 Significance of Effects

10.4.1 Human Receptors

The criteria to assess the significance of the effects is based on an approach developed by Environment Protection UK/Institute of Air Quality Management (EPUK/IAQM, 2017), this approach has been selected as Appendix 10 of the TII Guidance on air quality published in 2011 utilised contemporary EPUK/IAQM guidance on the evaluation of significance for air quality effects. The use of the 2017 EPUK/IAQM guidance has enabled the air quality assessment to consider the latest version of this guidance. According to the guidance, air quality effects of the Proposed Road Development may be considered to be significant if air quality limit values are predicted to be breached or if the Proposed Road Development leads to significant effects on air quality due to road traffic emissions at sensitive receptors. According to EPUK/IAQM Guidance there is a two-stage process to be followed in the assessment:

- Magnitude: a qualitative or quantitative description of the impacts on local air quality arising from the Proposed Road Development; and
- Significance: a judgement on the overall significance of the effects of any impacts.

The EPUK/IAQM states that a meaningful description to the degree of an impact is to express the magnitude of incremental change as a proportion of a relevant assessment level, and then to examine this change in the context of the new total concentration and its relationship with the assessment criterion. The matrix used to determine the impact descriptors is provided in Table 10-4. The matrix was applied to the operational phase assessment as the assessment of potential effects from vehicle emissions during the construction phase was scoped out of the assessment (Section 10.3.2.1).

Table 10-4 Impact Descriptors for Individual Receptors

Long Term Average Concentration at Receptor in Assessment Year	% Change in Concentration Relative to Air Quality Assessment Level (AQAL) - EULV			
	1	2-5	6-10	>10
75% or less of AQAL	Negligible	Negligible	Slight	Moderate
76% – 94% of AQAL	Negligible	Slight	Moderate	Moderate
95% – 102% of AQAL	Slight	Moderate	Moderate	Substantial
103%- 109% of AQAL	Moderate	Moderate	Substantial	Substantial
110% or more of AQAL	Moderate	Substantial	Substantial	Substantial

Source: Land-Use Planning & Development Control: Planning for Air Quality, EPUK/IAQM, 2017

An air quality effect can be described as ‘significant’ or ‘not significant’. The impact descriptors in Table 10-4, are intended for application at the modelled sensitive receptors and whilst there may be a ‘slight’, ‘moderate’ or ‘substantial’ impact at one or more receptors, the overall effect may not necessarily be judged as being significant in some circumstances. Any judgement on the overall significance of the effects of a development will need to take into account such factors as:

- The existing and future air quality in the absence of the Proposed Road Development;
- The extent of current and future population exposure to the impacts; and
- The influence and validity of any assumptions adopted when undertaking the prediction of impacts.

The evaluation of significance of air quality effects for the Proposed Road Development incorporates the different descriptors of effects set out in Table 3.3 of the EPA draft guidelines (EPA, 2017). In particular the following five main descriptors are considered:

- **Quality of Effects**: Within the context of the EPUK/IAQM Guidance only small changes in pollutant concentrations at low pollutant concentrations are so imperceptible that a Neutral effect could be assigned, all other changes are considered to be positive or negative/adverse. Under the EPUK/IAQM approach a neutral change will be described as negligible, all other changes are described as slight, moderate or substantial, and these terms combined with the descriptor positive or adverse identify the quality of the change. This is consistent with the EPA draft guidelines (EPA 2017) and the approach to significance.
- **Significance of Effects**: The terms used in IAQM of slight, moderate and substantial are significance descriptors used for individual receptors (e.g. residential dwellings). These descriptors are used as part of an overall evaluation of significance to determine if a Proposed Road Development is significant or not significant overall. The terms significant and not significant used in the air quality assessment are consistent with the descriptions of significant and not significant set out in Table 3.1 of the EPA draft guidelines (EPA 2017). However, there are no different degrees of overall significance included within the IAQM/EPUK Guidance, such as those set out in EPA draft guidelines (EPA 2017) e.g. Very Significant. These additional terms are not considered to be required within this air quality assessment, as an effect which is significant requires the identification of suitable mitigation measures.
- **Extent and Context of Effects**: The extent of an effect is considered within the overall evaluation step in the determination of whether an effect is considered to significant under the IAQM/EPUK approach. The Context of an effect for air quality will focus on the duration of an effect as described below.
- **Probability of Effects**: The air quality assessment considers a realistic worst case and utilises the most up to date information and tools available to minimise the uncertainty in our air quality assessments. Therefore, where a significant effect is predicted this is considered a ‘likely effect’ and similarly where we evaluate an effect to be not significant, such as following the implementation of mitigation, it is considered to be ‘unlikely’ that an effect could be significant.
- **Duration and Frequency of Effects**: The focus of an evaluation of the significance of an air quality effect, for ambient air quality, is on the potential effect of changes in air quality on pollutant limit values. These limit values are defined as concentration limits or exceedances averaged over annual timescales. Therefore, only durations of time that impact on annual averages are considered to be potentially significant. Durations such as momentary (seconds to minutes) or brief (less than a day) as set out in EPA draft guidelines (EPA 2017) are not considered herein, but durations of temporary (less than a year) to permanent effects (over sixty years) are considered. For a construction phase the effects described herein are considered to align with the duration of works and any associated changes in traffic and these effects are considered reversable once works cease. Whilst for the operation of the Proposed Road Development the air quality assessment focuses on the worst case year of operation, which is the opening year as described in Section 10.3.2.2. Thereafter, as air quality improves effects are considered to reduce over time, with more improvements in air quality, that then reduce air quality effects up to 15 years (long-term) and further improvements beyond to 60 years, albeit at reduced rates of improvement, will further reduce air quality effects (permanent effects).

The other types of effect described by the EPA draft guidelines (EPA 2017) relevant to air quality assessment are listed below:

- **Cumulative effects**: The air quality assessment is an inherently cumulative assessment as where relevant other committed developments and general traffic growth are accounted for in the assessment.
- **Do-Nothing**: The situation without the Proposed Road Development is considered within air quality assessments (or a Do-Minimum) situation to allow the evaluation of changes in air quality to be established.
- **Worst Case**: In air quality a worst or worse case effect is used to describe the range of realistic, but precautionary, assumptions and approaches used to derive a scenario which provides an assessor with pollutant concentrations and changes in pollutant concentrations to evaluate the significance of an effect.
- **Residual Effect**: Residual effects after proposed mitigation are sometimes considered, but often where it is best practice for some industry standard mitigation to be implemented then a scenario with embedded control only is considered.
- **Synergistic Effects**: The overall evaluation of significance considers whether there are significant changes in more than one pollutant e.g. NO_2 and PM_{10}, and where this is the case this is increases the potential for air quality effects to be significant overall.

10.4.2 Ecological Receptors

If the Proposed Road Development is predicted to cause an increase in NO_X concentrations greater than 2 $\mu g/m^3$ and the concentration is predicted to be very close to or exceed the standard (i.e. above 90% of the standard) at an ecological receptor, then the significance of the effect will be determined by the project ecologists considering the sensitivity of the relevant species. If these criteria are not exceeded, then the significance of the air quality effect is considered negligible.

The change in nitrogen deposition due to the Proposed Road Development will be compared with the relevant critical loads for the selected habitat. The significance of the change in nitrogen deposition with respect to the critical load due to the Proposed Road Development will be assessed by the project Ecologist.

10.4.3 Construction Impacts

Construction dust can include particles that contribute to ambient PM_{10} concentrations and also far coarser particles. There are no statutory criteria for dust deposition rates, however, dust from wet or dry deposition on receptor surfaces can result in a loss of amenity and as such is considered a statutory nuisance under the Air Pollution Act 1987.

The impact of both dust and vehicle emissions during the construction phase were considered using Table 10-5, in accordance with the TII Guidance. A semi-quantitative approach was undertaken to determine the likelihood of a significant effect.

Table 10-5 Assessment Criteria for the Impact of Dust Emissions from Construction Activities, with Standard Mitigation in Place

Source		Potential Distance for Significant Effects (Distance from Source)		
Scale	Description	Soiling	PM_{10}	Vegetation Effects
Major	Large construction sites, with high use of haul routes	100 m	25 m	25 m
Moderate	Moderate sized construction site, with moderate use of haul routes	50 m	15 m	15 m
Minor	Minor construction sites, with limited use of haul routes	25 m	10 m	10 m

Source: Guidelines for the Treatment of Air Quality during Planning and Construction of National Roads, TII, 2011

The significance of effects due to vehicle emissions during the construction phase will be dependent on the number of additional vehicle movements, the proportion of Heavy Goods Vehicles (HGVs) and the proximity of sensitive receptors to site access routes. According to the TII Guidance, a change in AADT flow of more than 10% near to sensitive receptors is considered significant and as such concentrations of NO_2, PM_{10} and $PM_{2.5}$ should be undertaken following the methodology described above using the DMRB screening methodology. As discussed in Section 10.3.2.1, assessment of the potential effects from vehicle emissions during the construction phase was scoped out of the assessment.

In terms of designated habitats located within 200 m of any construction works, additional mitigation measures should be considered.

10.5 Limitations and Assumptions

The air quality modelling uses a traffic dataset prepared for the Proposed Road Development. Details regarding the traffic modelling undertaken to support the Proposed Road Development are detailed in the Chapter 05 'Traffic Analysis'.

Background pollutant (NO_2, PM_{10} and $PM_{2.5}$) concentrations have been obtained from EPA monitoring. Background concentrations represent the non-road traffic contribution to total pollutant concentrations away from roads. It has been assumed that rural Zone D monitoring locations adequately represent background pollutant concentrations in the study area, with the highest available monitored concentrations used in the assessment as a cautious approach. A review of the concentrations at these rural Zone D sites between 2016 and 2019 indicated that concentrations remained fairly stable with no clear downward trend. Therefore, the 2019 background pollutant concentrations applied to the air quality assessment have not been projected forward to 2023 (assumed opening year), given the short timescale between the base and assumed opening year. This is a cautious approach and conservatively assumes no improvements in background concentrations between the baseline year and the assumed opening year.

There are uncertainties associated with vehicle emissions data, especially when projected into the future. These uncertainties have been minimised by using the most up to date version of the DMRB Screening Model (V8_EFTV10), which is based on version 10.0 of Defra's Emissions Factors Toolkit (EFT). These tools are based upon Defra's emissions projections for the UK, which have been assumed to also apply to Ireland as both vehicle fleets adhere to Euro standards.

One aspect of potential difference between the vehicle emissions data within the EFT and that of the Irish fleet is the uptake of electric vehicles (EVs). The Irish Government's has stated its ambition of having 1 million EVs on Irish roads by 2030 as set out in their Climate Action Plan (Government of Ireland, 2019b). It is estimated that approximately 2% of vehicles on Irish roads were electric in the base year of 2019 (CSO, 2020), which is in line with the rates used in the EFT for rural areas for that year. In the assumed opening year of 2023, the EFT estimates the uptake of EVs will have increased, constituting approximately 8% of the rural fleet. Interpolating between the base year situation and an assumed 1 million vehicles in 2030 provides a figure of approximately 26% of the 2023 fleet being EVs for the target in Ireland to be reached. Therefore, the use of the EFT in the assessment can be considered conservative compared to the Irish Government's EV uptake aspirations with 18% fewer EVs in the EFT which will result in greater emissions than would be expected with the achievement of Irish Government EV ambitions.

The forecasting method used to predict future NO_2 concentrations is the Highways England 'Gap Analysis' methodology which involves the application of adjustment factors which take into consideration the assumed roadside rates of reduction in NO_x to NO_2 by Defra's modelling tools compared to observed roadside trends. This disparity is due to the 'gap' between NO_2 emissions improvements predicted by the EFT due emissions standards and those that have been realised. Therefore, at roadside receptors (within 50 m of a modelled road) the Highways England gap analysis calculator LTTv1 (as described in IAN 170/12 (Highways England, 2012)) has been applied to modelled NO_2 concentrations, which assumes a smaller degree of improvement in emissions between the base year and the assumed opening year than the predictions using the EFT. The process has not been applied to receptors beyond 50 m from modelled roads as at this distance, as stated in TII Guidance (TII, 2011), road-contributed NO_2 makes up only a small proportion of the total concentration and therefore is not appropriate. Version 1 of the LTT tool has been used in preference to the more recent Version 1.1 on account of its more conservative assumptions of improvement. The selection of Version 1 of the LTT tool is supported by the observed stability in background pollutant concentrations between 2016 and 2019 and as there is no roadside monitoring data within the local area to establish if greater improvements are being observed. If local data with increased rates of roadside pollutant reductions year to year was available this could have resulted in the use of the more recent LTT_{E6} Version 1.1 tool with its greater rates of year to year improvements.

A local roadside monitoring survey has not been conducted for this Proposed Road Development as discussed in Section 10.3.3 due to the Covid-19 pandemic and its associated effects on traffic. In the absence of local monitoring data, the verification of the air quality model has been based on professional judgement. This approach is associated with greater uncertainty in modelled results, because they cannot be compared to monitored concentrations. Therefore, a sensitivity test has been prepared using a higher verification factor of 2 (compared to the factor of 1 used in the primary assessment) to investigate the effects of this on the reported results.

As discussed in Chapter 05 (Traffic Analysis), a permanent traffic counter (TMU N63 080.0 W) is located near to the Proposed Road Development which indicated that during Covid-19 pandemic traffic flows in the area significantly decreased during lockdown periods but returned to normal levels during periods when these lockdown restrictions were lifted. The base year for the air quality assessment was 2019 and therefore the traffic data is not influenced by the Covid-19 restrictions. As traffic flows returned to normal outside of lockdown periods, the transportation consultants have confirmed that it was not necessary to adjust the traffic data in the opening and design years due to the Covid-19 pandemic.

10.6 Baseline Environment

10.6.1 Air Quality Monitoring

The EPA manages the national ambient air quality network in Ireland, which consists of 30 monitoring stations located across the country that monitor a range of pollutants. EU legislation on air quality (the Ambient Air Quality and Cleaner Air for Europe Directive (2008/50/EC) and Daughter Directives) requires that Member States divide their territory into zones for the purpose of monitoring, assessment and management of air quality. The EPA has designated the following four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs;
- Zone B: Cork City and environs;
- Zone C: 16 urban areas with population greater than 15,000; and
- Zone D: Remainder of the country (rural Ireland).

The study area lies within Zone D. The most recent EPA Air Quality in Ireland Report available was published in 2020 and is based on information gathered in 2019 and earlier. The report is supported by the Summary Data Tables 2019. The findings of this report, with respect to air quality in Zone D are described below.

NO_2 was measured at 21 monitoring stations in Ireland in 2019, of which three were in Zone D. There was one exceedance of the EU legislative limit value for annual mean NO_2, at an urban traffic monitoring station in Dublin (Zone A). No monitoring sites in Zone D exceeded the EU legislative limit value for annual mean NO_2 in 2019. The nearest Zone D monitoring site to the study area which measured NO_2 is Castlebar, which is an urban site approximately 60 km northwest of the study area, which measured an annual mean concentration of NO_2 of 8 $\mu g/m^3$ in 2019, with an hourly maximum of 86 $\mu g/m^3$. These are well below the limit values for annual mean NO_2 (40 $\mu g/m^3$) and hourly mean NO_2 (200 $\mu g/m^3$). Due to the smaller population and fewer roads within the study area of Abbeyknockmoy, local air quality is likely to be better represented by the two rural monitoring stations in Zone D, Emo Court (annual mean NO_2 concentration of 4 $\mu g/m^3$) and Kilkitt (annual mean NO_2 concentration of 5 $\mu g/m^3$). As shown in Figure 10-1 annual mean NO_2 concentrations were relatively stable between 2016 and 2019 at all monitors.

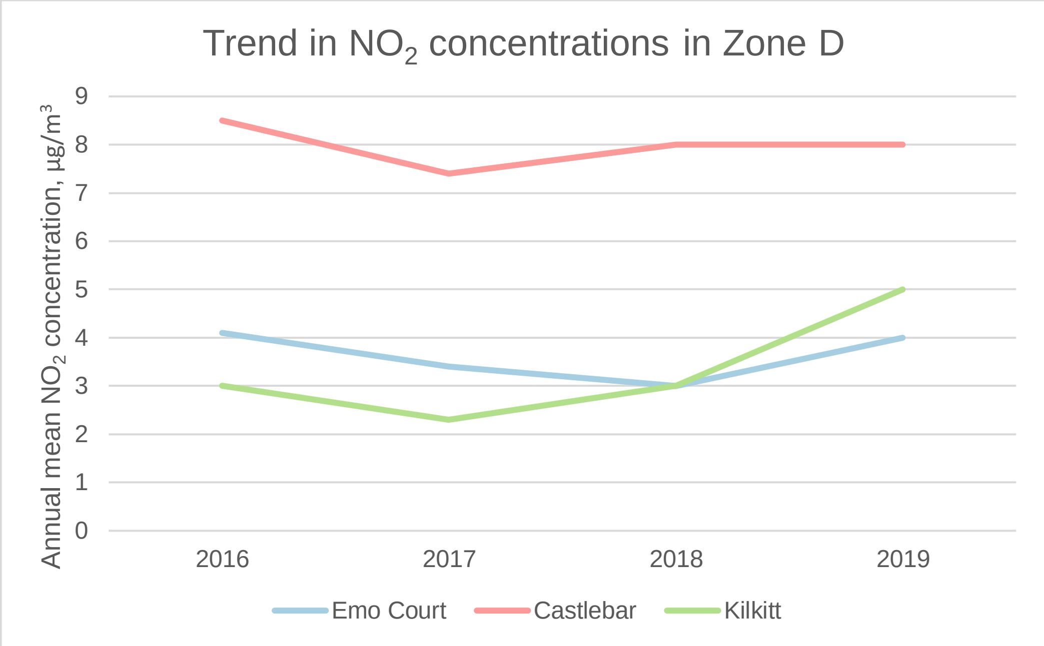

Figure 10-1 Trend in NO_2 Concentrations in Zone D

Source: Air Quality Report – supplemental information, EPA, 2016-2019

There were no exceedances of the EU legislative limit values for any other monitored pollutant in any zone in 2019.

PM_{10} was measured at 35 monitoring stations in Ireland in 2019, of which eight were in Zone D. Within Zone D, there were no exceedances of the EU legislative limit value for annual mean PM_{10}. The nearest Zone D monitoring site to the study area which measured PM_{10} is Claremorris, which is a rural site approximately 36 km to the north of the study area, which measured an annual mean concentration of PM_{10} of 11 μg/m³ in 2019, with a daily maximum of 44 μg/m³. These are well below the limit values for annual mean PM_{10} (40 μg/m³) and daily mean PM_{10} (50 μg/m³). Local air quality is likely to be well represented by Claremorris. Historic data are available (four years 2016 to 2019) for three PM_{10} monitoring sites within Zone D, including Claremorris. At these sites PM_{10} concentrations remained relatively stable between 2016 and 2019, apart from a slight increase at Castlebar between 2018 and 2019, as shown in Figure 10-2.

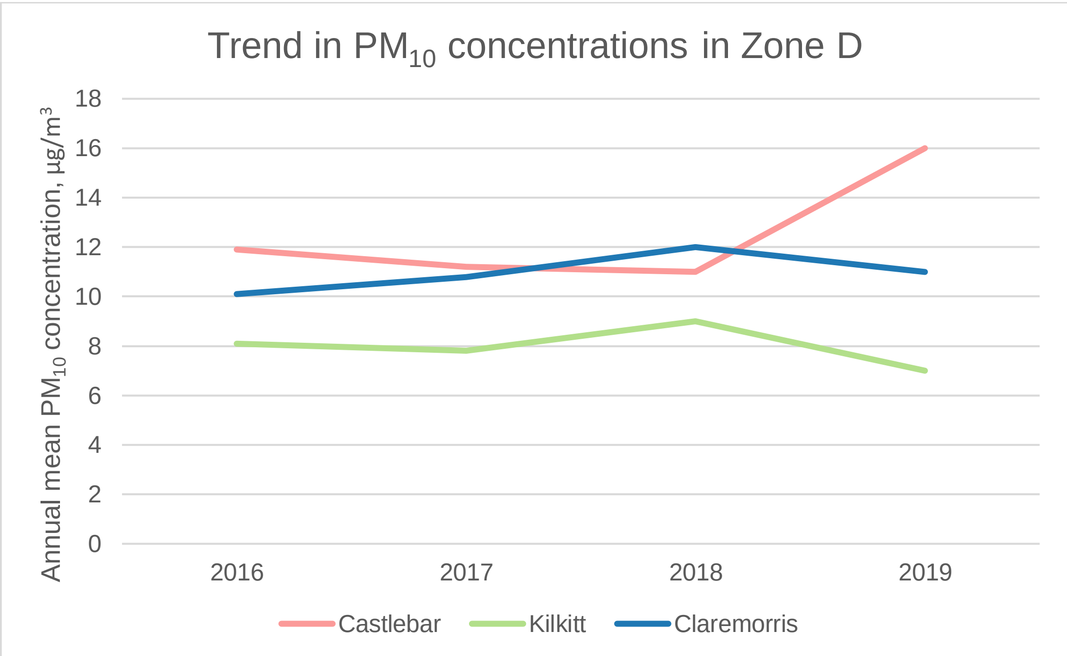

Figure 10-2 Trend in PM_{10} Concentrations in Zone D

Source: Air Quality Report – supplemental information, EPA, 2016-2019

$PM_{2.5}$ was measured at 28 monitoring stations in Ireland in 2019, of which seven were in Zone D. Within Zone D, there were no exceedances of the EU legislative limit value for annual mean $PM_{2.5}$. The nearest Zone D monitoring site to the study area which measured $PM_{2.5}$ is Claremorris, which measured an annual mean concentration of $PM_{2.5}$ of 4 µg/m^3 in 2019, with a daily maximum of 16 µg/m^3. These are well below the limit value for annual mean $PM_{2.5}$ (25 µg/m^3). Local air quality is likely to be well represented by Claremorris. Historic data are available (four years 2016 to 2019) for two $PM_{2.5}$ monitoring sites within Zone D, including Claremorris. As shown in Figure 10-3, annual mean $PM_{2.5}$ concentrations remained relatively stable between 2016 and 2019 at these sites.

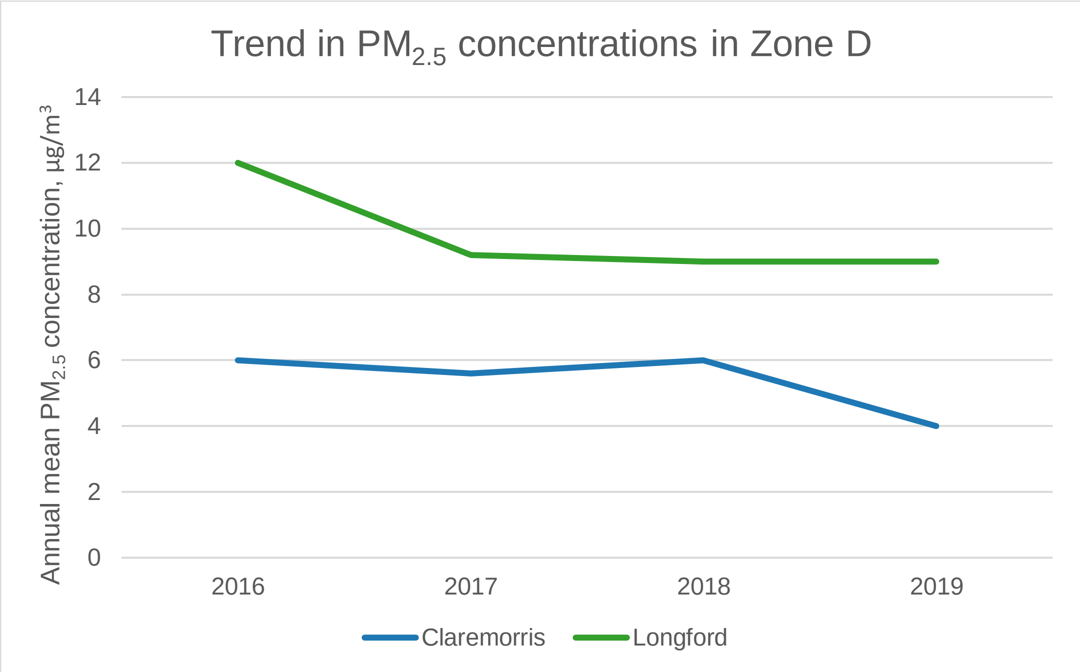

Figure 10-3 Trend in $PM_{2.5}$ Concentrations in Zone D

Source: Air Quality Report – supplemental information, EPA, 2016-2019

VOCs (including benzene) and CO are not monitored in Zone D and are not expected to be at risk of exceedance in rural areas.

The most recent air quality assessment located close to the study area was conducted in Galway city between 13th March 2001 and 23rd October 2001. The assessment included the measurement of CO, sulphur dioxide, NO_2, benzene, particulate matter, and lead. The results concluded that no limit values were exceeded during the measurement period. It is important to note that this monitoring station is located in Zone C, which comprises urban areas with populations greater than 15,000. The area is a mixed residential/commercial district of Galway City.

10.6.2 Background Air Pollution

Background concentrations were determined from EPA monitoring data. For NO_2, the annual mean concentration recorded in 2019 at Kilkitt was applied to the air quality assessment as it was the higher of the two representative rural Zone D monitoring stations. Similarly, for PM_{10} and $PM_{2.5}$, the respective annual mean concentrations at the representative rural Zone D monitoring station Claremorris were used, which had the highest (or only) concentrations of these pollutants for a rural monitor in Zone D. These data were taken from the supplemental information (Summary data tables 2019) of the 2019 EPA Air Quality in Ireland Report. These background concentrations are shown in Table 10-6.

Table 10-6 Representative Background Concentrations

2019 Concentrations (µg/m³)		
NO_2	PM_{10}	$PM_{2.5}$
5.0	11.0	4.0

Source: Air Quality Report – supplemental information, EPA, 2019

Background pollutant concentrations are widely predicted to fall, due to the improvement in emissions standards over time. However, over the past four years at representative sites, as illustrated in Figures 10-1 to 10-3, there has not been a marked fall in pollutant concentrations. To reflect this, and to ensure a conservative approach to the air quality assessment, no improvement in background pollutant concentration was assumed and these 2019 concentrations were assumed to also represent 2023.

An alternative method for identifying background concentrations is by using the Northern Irish local authority 'Armagh, Banbridge and Craigavon' as a proxy for the study area, as was the case for the NO_X to NO_2 calculations as described in Section 10.3.8.2. Background data for this local authority was obtained from Defra and average NO_2 concentrations were found to be 4.7 µg/m^3 in 2019, predicted to decrease to 4.1 µg/m^3 in 2023. This is a very similar concentration to the zoned EPA monitoring method described above, however, reflects slightly better, and improving, background air quality for which there is little evidence from the EPA monitoring. Therefore, it is considered that the EPA monitoring is more representative and conservative.

10.6.3 Sensitive Receptors

According to the TII (2011) Guidance document, a sensitive receptor location may include *"residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present".* The study area varies depending on the type of air quality assessment being conducted, with the largest study area of 200 m from all affected roads. Within this study area, the following air quality-sensitive receptors have been identified:

- Approximately 130 one- and two-storey private dwellings that are located along existing roads within the air quality study area;
- Abbeyknockmoy Community Centre;
- St Bernard's Church;
- Abbeyknockmoy GAA Club;
- Newtown National Primary School;
- Shopping facilities and public-facing businesses in Abbeyknockmoy; and
- Lough Corrib SAC.

Not all air quality standards apply at all sensitive receptors. For example, an annual mean LV would ordinarily be considered to apply at receptors where a member of the public might expect to spend a large proportion of the year, for example, at residences and schools. At other locations, only the short-term LV (hourly, daily etc.), might be expected to apply, as this more closely aligns with the time a member of the public might spend at church, or shopping, for example. Reference should be made to Table 10-1 for LV for NO_2, PM_{10} and $PM_{2.5}$ pollutants.

The selection of receptors for each strand of air quality assessment are discussed in the relevant sections.

10.7 Assessment of Impacts

10.7.1 Construction Phase

10.7.1.1 Construction Dust Assessment

The scale of the construction of the Proposed Road Development is identified as ‘moderate’. Construction is expected to take between 15 and 18 months. Approximately 95,000 m^3 of earthworks and pavement material will be moved, which is a moderate quantity of potentially dusty material. Construction will require the use of haul routes with the new road itself forming the major haul route. The imported fill materials will be brought to the Proposed Road Development site on the public road network, prior to being distributed along the path of the Proposed Road Development via the haul routes. There is therefore potential for effects from the generation of dust up to 50 m from construction activities for dust-soiling. The Proposed Road Development site boundary is considered a proxy for the area in which construction activities will take place.

As described in Section 10.4.3, the scale of the works is considered ‘moderate’ and therefore the distance over which potential PM_{10} and vegetation effects may occur is 15 m and up to 50 m for dust soiling effects.

There will be 19 receptors sensitive to the human health effects of PM_{10} within 15 m of construction activity. These receptors will be residential properties, a school, and a community centre adjacent to the existing N63. There are low baseline levels of PM_{10} within the study area (background PM_{10} is 11.0 µg/m^3 against the EULV of 40 µg/m^3). Therefore, any negative PM_{10} effects will be considered **not significant** and will be of short term duration (only during the construction period).

There will be one designated ecological site (Lough Corrib SAC) within 15 m of construction activity, and 48 dust sensitive receptors (residential properties and businesses) within 50 m of construction activity. There is potential for effects from the generation of dust at these locations during the construction phase.

10.7.1.2 Construction Phase HGVs

To transport the quantity of material required to and from the Proposed Road Development site (95,000 m^3) is estimated to require approximately 15,200 HGV movements (assuming 12.5 m^3 tipper and one full load and one empty movements). Although the total duration of construction is estimated to be 15 to 18 months, the majority of the traffic movement to move material to/from site will be limited to a short term, with an indicative duration of 9 to 12 months. Assuming then, that the HGV movements are equally distributed over a 9-month period with a five-day work week, this results in 196 working days each with 78 HGV movements per day.

As described in Section 10.3.2.1 a 10% change in AADT during the construction phase is required for an air quality assessment to be undertaken. A 10% change in AADT in the assumed opening year on the N63 will equate to between 390 and 540 additional vehicles per day (or 550 to 760 per week-day) over the year. Compared to the indicative daily HGV movements calculated above, this is considered very unlikely. Therefore, the effects associated with vehicle emissions during the construction phase was scoped out of the assessment and is considered to be **not significant**.

10.7.2 Operational Phase

10.7.2.1 Index of Overall Change of Exposure

A calculation of the Index of Overall Change in Exposure has been undertaken to provide a quantification of the change in exposure in the assumed opening year (2023) at sensitive receptor locations, arising from changes in road traffic as a result of the Proposed Road Development. This road network corresponds to the road network identified in the local assessment. The calculations for NO_2 and PM_{10} are provided in Table 10-7 and Table 10-8.

Table 10-7 Index of Overall Change of Exposure to NO_X

Link ID	Description	Properties within 50 m	Link Length (km)	DM NO_X Emissions (kg/yr)	DS NO_X Emissions (kg/yr)	Change in NO_X Emissions (kg/yr)	% Change in Emissions	Change in NO_X Emission Rate (kg/km/yr)	NO_X Index
1	Existing N63 between the eastern end of Abbeyknockmoy and L7138	33	1.2	586	0	-586	-	-488	-16,106
2	Existing N63 between L7138 and L3110	2	0.14	77	20	-57	-291%	-410	-821
3	Existing N63 between L3110 and L6159 (at Liss Bridge)	0	0.19	87	0	-87	-	-457	0
4	Existing N63 between L6159 and L6234	2	0.75	264	0	-264	-	-352	-703
5	Proposed N63 between the eastern end of Abbeyknockmoy and proposed roundabout	14	0.17	0	74	74	100%	438	6,132
6	Proposed N63 between proposed roundabout and L6159 (at proposed river crossing)	5	1.25	0	385	385	100%	308	1,540
7	Proposed N63 between L6159 and L6234	2	0.86	0	302	302	100%	352	703
8	Existing N63 between proposed roundabout and L7138	18	1.1	0	176	176	100%	160	2,885
9	Proposed local link between L3110 and N63/L6159 junction	0	0.34	0	14	14	100%	40	0
TOTAL				1,013	971				-6,370

Note: Links 1, 3 and 4 are replaced in the DS scenario by links 5, 7, 8 and 9.

Table 10-8 Index of Overall Change of Exposure to PM_{10}

Link ID	Description	Properties within 50 m	Link Length (km)	DM PM_{10} Emissions (kg/yr)	DS PM_{10} Emissions (kg/yr)	Change in PM_{10} Emissions (kg/yr)	% change in PM_{10} Emissions	Change in PM_{10} Emission Rate (kg/km/yr)	PM_{10} Index
1	Existing N63 between the eastern end of Abbeyknockmoy and L7138	33	1.2	65	0	-65	-	-54	-1,782
2	Existing N63 between L7138 and L3110	2	0.14	7	2	-5	-212%	-36	-72
3	Existing N63 between L3110 and L6159 (at Liss Bridge)	0	0.19	8	0	-8	-	-44	0
4	Existing N63 between L6159 and L6234	2	0.75	30	0	-30	-	-40	-80
5	Proposed N63 between the eastern end of Abbeyknockmoy and proposed roundabout	14	0.17	0	9	9	100%	54	754
6	Proposed N63 between proposed roundabout and L6159 (at proposed river crossing)	5	1.25	0	43	43	100%	35	174
7	Proposed N63 between L6159 and L6234	2	0.86	0	34	34	100%	40	80
8	Existing N63 between proposed roundabout and L7138	18	1.1	0	21	21	100%	19	347
9	Proposed local link between L3110 and N63/L6159 junction	0	0.34	0	2	2	100%	5	0
TOTAL				111	112				-580

Note: Links 1, 3 and 4 are replaced in the DS scenario by links 5, 7, 8 and 9.

The assessment indicates that a larger number of properties will experience a decrease in exposure to PM_{10} and NO_x than will experience an increase within the study area. This is due to the re-routing of approximately 60% of vehicles from the existing N63 to the Proposed Road Development and thus effectively increasing the distance between the majority of receptors and the source of the emissions as the Proposed Road Development is further away.

The Index of Overall Change in exposure calculations concludes that there will be an overall reduction in exposure to NO_x and PM_{10} as a result of the operation of the Proposed Road Development, with a NO_X index of -6,370 and PM_{10} index of -580.

10.7.2.2 Calculation of Local Scale Pollutant Concentrations

The local air quality assessment study area was determined using the DMRB LA 105 screening criteria and was found to encompass both the existing N63 and the Proposed Road Development. The western extent of the study area is the point at which the proposed road diverges from the existing N63 on the eastern edge of Abbeyknockmoy. The eastern extent of the study area is the junction of the N63 with the L6234.

Five receptors were chosen to represent likely worst-case exposure around the affected roads (within 200 m). These receptors are described in Table 10-9 and illustrated in Volume 03; Figure A10-1.

Table 10-9 Modelled Air Quality Sensitive Receptors

ID	Description	Distance to Affected Road (m)	X (ITM)	Y (ITM)
R1	Residential receptor on the south side of the existing N63	7	550797	743274
R2	Residential receptor on the north side of the existing N63	36	551039	743412
R3	School on the north side of the existing N63	7	551565	743534
R4	Residential receptor on the on the north side of the Proposed Road Development	84	551499	743902
R5	Residential receptor on the north side of the existing N63	39	552276	744138

The predicted annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ at the selected sensitive receptors in the base year, assumed opening year do-minimum (DM, without the Proposed Road Development) and assumed opening year do-something (DS, with the Proposed Road Development) scenarios are listed in Table 10-10, Table 10-11, and Table 10-12 respectively. The tables also provide the predicted change in concentration at the modelled sensitive receptors, and the significance of the effect as determined by the IAQM guidance.

Table 10-10 Modelled Annual Mean NO_2 Concentrations in μg/m³ at Sensitive Receptors

ID	Base	DM	DS	DS Concentration as a Percentage of the EULV	Change	% Change in Concentration Relative to the EULV	Significance
R1	7.1	7.1	6.3	<75%	-0.8	-2.0%	Negligible
R2	5.7	5.5	5.4	<75%	-0.1	-0.3%	Negligible
R3	7.6	7.6	6.1	<75%	-1.5	-3.8%	Negligible
R4*	5.0	5.0	5.2	<75%	+0.2	+0.4%	Negligible
R5	5.5	5.3	5.3	<75%	+<0.1	+<0.1%	Negligible

*LTT gap analysis has not been applied to this (non-roadside) receptor

Table 10-11 Modelled Annual Mean PM_{10} Concentrations in µg/m^3 at Sensitive Receptors

ID	Base	DM	DS	DS Concentration as a Percentage of AQ LV	Change	% Change in Concentration Relative to the EULV	Significance
R1	11.4	11.4	11.2	<75%	-0.2	-0.5%	Negligible
R2	11.1	11.1	11.1	<75%	-<0.1	-0.1%	Negligible
R3	11.4	11.4	11.1	<75%	-0.3	-0.8%	Negligible
R4	11.0	11.0	11.0	<75%	+<0.1	+0.1%	Negligible
R5	11.1	11.1	11.1	<75%	+<0.1	+<0.1%	Negligible

The PM_{10} daily limit value is not predicted to be exceeded at any receptor in any scenario.

Table 10-12 Modelled Annual Mean $PM_{2.5}$ Concentrations in µg/m^3 at Sensitive Receptors

ID	Base	DM	DS	DS Concentration as a Percentage of the EULV	Change	% Change in Concentration Relative to the EULV	Significance
R1	4.4	4.4	4.2	<75%	-0.2	-0.7%	Negligible
R2	4.1	4.1	4.1	<75%	-<0.1	-0.1%	Negligible
R3	4.4	4.4	4.1	<75%	-0.3	-1.1%	Negligible
R4	4.0	4.0	4.0	<75%	+<0.1	+0.2%	Negligible
R5	4.1	4.1	4.1	<75%	+<0.1	+<0.1%	Negligible

Receptors 1-3 are located adjacent to the existing N63, which is predicted to experience a reduction in traffic flows with the Proposed Road Development operational. The Proposed Road Development is located further from these receptors and is therefore less influential in terms of the change in pollutant concentrations. These receptors are therefore predicted to experience improvements in air quality with decreases in NO_2 concentration of up to -1.5 µg/m^3, decreases in PM_{10} concentration of up to -0.3 µg/m^3, and decreases in $PM_{2.5}$ concentration of up to -0.3 µg/m^3. The concentrations in all scenarios at these receptors are well under the relevant EULVs.

Receptor 4 is located approximately 84 m from the Proposed Road Development and slightly further from the existing N63 at 230 m. Therefore, this receptor is predicted to experience a worsening in air quality with increases in NO_2 concentration of +0.2 µg/m^3, increases in PM_{10} concentration of +<0.1 µg/m^3, and increases in $PM_{2.5}$ concentration of up to +<0.1 µg/m^3. The concentrations in all scenarios at this receptor are well under the relevant EULVs.

Receptor 5 is located approximately 39 m from the N63 and 400 m to the east of where the Proposed Road Development re-joins the existing N63. The traffic flow on the N63, adjacent to this receptor is not anticipated to change due to the operation of the Proposed Road Development. This receptor is not predicted to experience any noticeable change (<0.1 µg/m^3) in pollutant concentrations as a result of the Proposed Road Development.

With reference to the IAQM significance criteria (Table 10-4), the NO_2, PM_{10} and $PM_{2.5}$ changes associated with the Proposed Road Development will be **negligible** and **not significant** overall.

10.7.2.3 Designated Sites Assessment

Within the local air quality assessment study area, there is one designated ecological site, Lough Corrib SAC. The characteristics of this site with respect to air quality have been identified by the project ecologists. Air quality impacts at this SAC have been assessed at four locations across the site (E1 to E4), to account for variations in expected effect at the SAC across the study area, due to varying habitats in these locations and/or due to expected variations in traffic changes with the Proposed Road Development. These receptors are described in Table 10-13 and illustrated in Volume 03; Figure A10-1.

Background nitrogen deposition was estimated at 12 kg Nitrogen (N)/hectare(ha)/year(yr) by consulting the EPA's 'Research 323: Critical Loads and Soil-Vegetation Modelling'. This research document also identifies that the countrywide average nitrogen deposition rate is 12 kg N/ha/yr.

Table 10-13 Modelled Designated Ecosystem Receptors

ID	Habitat	Critical Load (kg N/ha/yr) Range	X (ITM)	Y (ITM)
E1	Grassland	15-25	550738	743322
E2	River	5-10	551036	743516
E3	River	5-10	551645	743654
E4	Woodland (with petrifying spring with tufa formations)	10-20	551982	743967

The predicted annual mean concentrations of NO_X and nitrogen deposition rates at the selected sensitive receptors in the base year, assumed opening year do-minimum (DM) and assumed opening year do-something (DS) scenarios are listed in Table 10-14 and Table 10-15 respectively. The tables also provide the predicted changes in concentration/deposition rates at the modelled sensitive receptors.

Table 10-14 Modelled Annual Mean NO_X Concentrations in µg/m^3 at Sensitive Receptors

ID	Distance from Road (m)	Base	DM	DS	Change
E1	26 (site edge)	8.5	8.3	8.6	+0.3
E1	30	8.5	8.3	8.5	+0.3
E1	40	8.4	8.2	8.3	+0.2
E1	50	8.3	8.1	8.2	+0.1
E1	60	8.2	8.0	8.1	+0.1
E1	70	8.1	8.0	8.1	+0.1
E1	80	8.1	8.0	8.0	+0.1
E1	90	8.0	7.9	8.0	+<0.1
E1	100	8.0	7.9	7.9	+<0.1
E1	110	8.0	7.9	7.9	+<0.1
E1	120	8.0	7.9	7.9	+<0.1
E1	130	7.9	7.8	7.9	+<0.1
E1	140	7.9	7.8	7.8	+<0.1
E1	150	7.9	7.8	7.8	+<0.1
E1	160	7.9	7.8	7.8	+<0.1
E1	170	7.9	7.8	7.8	+<0.1
E1	180	7.8	7.8	7.8	+<0.1
E1	190	7.8	7.8	7.8	+<0.1
E1	200	7.8	7.8	7.8	+<0.1
E2	6 (road edge)	7.6	7.6	10.5	+2.9

ID	Distance from Road (m)	Base	DM	DS	Change
E2	10	7.6	7.6	9.5	+1.9
E2	20	7.6	7.6	8.6	+1.0
E2	30	7.6	7.6	8.3	+0.7
E2	40	7.6	7.6	8.1	+0.5
E2	50	7.6	7.6	8.0	+0.4
E2	60	7.6	7.6	8.0	+0.4
E2	70	7.6	7.6	7.9	+0.3
E2	80	7.6	7.6	7.9	+0.3
E2	90	7.6	7.6	7.9	+0.3
E2	100	7.6	7.6	7.8	+0.2
E2	110	7.6	7.6	7.8	+0.2
E2	120	7.6	7.6	7.8	+0.2
E2	130	7.6	7.6	7.8	+0.2
E2	140	7.6	7.6	7.8	+0.2
E2	150	7.6	7.6	7.8	+0.2
E2	160	7.6	7.6	7.7	+0.1
E2	170	7.6	7.6	7.7	+0.1
E2	180	7.6	7.6	7.7	+0.1
E2	190	7.6	7.6	7.7	+0.1
E2	200	7.6	7.6	7.7	+0.1
E3	3 (road edge)	14.1	14.3	9.4	-4.9
E3	10	10.8	10.7	8.5	-2.2
E3	20	9.4	9.3	8.0	-1.2
E3	30	8.9	8.7	7.9	-0.9
E3	40	8.6	8.5	7.8	-0.7
E3	50	8.5	8.3	7.7	-0.6
E3	60	8.4	8.2	7.7	-0.5
E3	70	8.3	8.1	7.6	-0.4

ID	Distance from Road (m)	Base	DM	DS	Change
E3	80	8.2	8.0	7.6	-0.4
E3	90	8.1	8.0	7.6	-0.4
E3	100	8.1	7.9	7.6	-0.3
E3	110	8.0	7.9	7.6	-0.3
E3	120	8.0	7.9	7.6	-0.3
E3	130	8.0	7.9	7.6	-0.2
E3	140	8.0	7.8	7.6	-0.2
E3	150	7.9	7.8	7.6	-0.2
E3	160	7.9	7.8	7.6	-0.2
E3	170	7.9	7.8	7.6	-0.2
E3	180	7.9	7.8	7.6	-0.2
E3	190	7.9	7.8	7.6	-0.2
E3	200	7.8	7.8	7.6	-0.2
E4	12 (site edge)	10.1	10.0	10.0	+<0.1
E4	20	9.1	9.0	9.0	+<0.1
E4	30	8.7	8.5	8.5	+<0.1
E4	40	8.4	8.2	8.2	+<0.1
E4	50	8.3	8.1	8.1	+<0.1

Note: At transect points 50 m and closer to the road, LTT has been applied. At transect points > 50 m from the road, LTT has not been applied. At E4, the designated habitat does not extend beyond 50 m from the road.

Transects 1, 2, and 4 are predicted to experience deteriorations in air quality due to the emissions from the Proposed Road Development. Transect 3 is predicted to experience an improvement in air quality due to a reduction in emissions from the existing N63. In all cases the absolute concentration of NO_X is predicted to be well below the limit value of 30 µg/m^3. Additionally, while there is an increase in concentration of NO_X of 2.9 µg/m^3 at the nearest point of transect E2 (6 m) to the road, the total NO_X concentration predicted in the DS scenario at this location is 10.5 µg/m^3, which is 35% of the limit value, well under the 90% which will trigger an assessment of significance. Therefore, the effects of the NO_X concentration are considered **negligible** and **not significant**.

Table 10-15 Modelled Nitrogen Deposition Rates in kg N/ha/yr at Sensitive Receptors

ID	Distance from Road (m)	Base	DM	DS	Change	% Change Relative to the low end of Critical Load Range
E1	26 (site edge)	12.1	12.1	12.1	+<0.1	+0.2%
E1	30	12.1	12.1	12.1	+<0.1	+0.1%
E1	40	12.1	12.0	12.1	+<0.1	+0.1%
E1	50	12.1	12.0	12.0	+<0.1	+0.1%
E1	60	12.0	12.0	12.0	+<0.1	+<0.1%
E1	70	12.0	12.0	12.0	+<0.1	+<0.1%
E1	80	12.0	12.0	12.0	+<0.1	+<0.1%
E1	90	12.0	12.0	12.0	+<0.1	+<0.1%
E1	100	12.0	12.0	12.0	+<0.1	+<0.1%
E1	110	12.0	12.0	12.0	+<0.1	+<0.1%
E1	120	12.0	12.0	12.0	+<0.1	+<0.1%
E1	130	12.0	12.0	12.0	+<0.1	+<0.1%
E1	140	12.0	12.0	12.0	+<0.1	+<0.1%
E1	150	12.0	12.0	12.0	+<0.1	+<0.1%
E1	160	12.0	12.0	12.0	+<0.1	+<0.1%
E1	170	12.0	12.0	12.0	+<0.1	+<0.1%
E1	180	12.0	12.0	12.0	+<0.1	+<0.1%
E1	190	12.0	12.0	12.0	+<0.1	+<0.1%
E1	200	12.0	12.0	12.0	+<0.1	+<0.1%
E2	6 (road edge)	**12.0**	**12.0**	**12.2**	+0.2	+4.5%
E2	10	**12.0**	**12.0**	**12.1**	+0.1	+3.0%
E2	20	**12.0**	**12.0**	**12.1**	+0.1	+1.5%
E2	30	**12.0**	**12.0**	**12.1**	+0.1	+1.0%
E2	40	**12.0**	**12.0**	**12.0**	+<0.1	+0.8%
E2	50	**12.0**	**12.0**	**12.0**	+<0.1	+0.7%
E2	60	**12.0**	**12.0**	**12.0**	+<0.1	+0.6%

ID	Distance from Road (m)	Base	DM	DS	Change	% Change Relative to the low end of Critical Load Range
E2	70	**12.0**	**12.0**	**12.0**	+<0.1	+0.5%
E2	80	**12.0**	**12.0**	**12.0**	+<0.1	+0.4%
E2	90	**12.0**	**12.0**	**12.0**	+<0.1	+0.4%
E2	100	**12.0**	**12.0**	**12.0**	+<0.1	+0.4%
E2	110	**12.0**	**12.0**	**12.0**	+<0.1	+0.3%
E2	120	**12.0**	**12.0**	**12.0**	+<0.1	+0.3%
E2	130	**12.0**	**12.0**	**12.0**	+<0.1	+0.3%
E2	140	**12.0**	**12.0**	**12.0**	+<0.1	+0.3%
E2	150	**12.0**	**12.0**	**12.0**	+<0.1	+0.3%
E2	160	**12.0**	**12.0**	**12.0**	+<0.1	+0.2%
E2	170	**12.0**	**12.0**	**12.0**	+<0.1	+0.2%
E2	180	**12.0**	**12.0**	**12.0**	+<0.1	+0.2%
E2	190	**12.0**	**12.0**	**12.0**	+<0.1	+0.2%
E2	200	**12.0**	**12.0**	**12.0**	+<0.1	+0.2%
E3	3 (road edge)	**12.5**	**12.4**	**12.0**	-0.3	-6.6%
E3	10	**12.3**	**12.2**	**12.0**	-0.2	-3.2%
E3	20	**12.1**	**12.1**	**12.0**	-0.1	-1.8%
E3	30	**12.1**	**12.1**	**12.0**	-0.1	-1.3%
E3	40	**12.1**	**12.1**	**12.0**	-0.1	-1.1%
E3	50	**12.1**	**12.0**	**12.0**	-<0.1	-0.9%
E3	60	**12.1**	**12.0**	**12.0**	-<0.1	-0.8%
E3	70	**12.1**	**12.0**	**12.0**	-<0.1	-0.7%
E3	80	**12.0**	**12.0**	**12.0**	-<0.1	-0.6%
E3	90	**12.0**	**12.0**	**12.0**	-<0.1	-0.6%
E3	100	**12.0**	**12.0**	**12.0**	-<0.1	-0.5%
E3	110	**12.0**	**12.0**	**12.0**	-<0.1	-0.4%

ID	Distance from Road (m)	Base	DM	DS	Change	% Change Relative to the low end of Critical Load Range
E3	120	**12.0**	**12.0**	**12.0**	-<0.1	-0.4%
E3	130	**12.0**	**12.0**	**12.0**	-<0.1	-0.4%
E3	140	**12.0**	**12.0**	**12.0**	-<0.1	-0.4%
E3	150	**12.0**	**12.0**	**12.0**	-<0.1	-0.3%
E3	160	**12.0**	**12.0**	**12.0**	-<0.1	-0.3%
E3	170	**12.0**	**12.0**	**12.0**	-<0.1	-0.3%
E3	180	**12.0**	**12.0**	**12.0**	-<0.1	-0.3%
E3	190	**12.0**	**12.0**	**12.0**	-<0.1	-0.3%
E3	200	**12.0**	**12.0**	**12.0**	-<0.1	-0.3%
E4	12	**12.4**	**12.4**	**12.4**	+<0.1	+<0.1%
E4	20	**12.2**	**12.2**	**12.2**	+<0.1	+<0.1%
E4	30	**12.2**	**12.1**	**12.1**	+<0.1	+<0.1%
E4	40	**12.1**	**12.1**	**12.1**	+<0.1	+<0.1%
E4	50	**12.1**	**12.1**	**12.1**	+<0.1	+<0.1%

*Note: At transect points 50 m and closer to the road, LTT has been applied. At transect points > 50 m from the road, LTT has not been applied. At E4, the designated habitat does not extend beyond 50 m from the road. Nitrogen deposition rates in **bold** exceed the relevant critical load (low end of the critical load range).*

Transect 1 is predicted to remain under its critical load with the Proposed Road Development operational. Transects 2, 3 and 4 are predicted to be above their respective critical loads both with and without the Proposed Road Development operational. Transects 2 and 4 are predicted to experience increases in nitrogen deposition due to the emissions from the Proposed Road Development. Transect 3 is predicted to experience a decrease in nitrogen deposition due to a reduction in emissions from the existing N63. The project ecologist has been consulted regarding the significance of the effect, which has been found to be **negligible** and **not significant** overall (see Chapter 07 Biodiversity, Section 7.6.4.3).

10.7.2.4 Local and Designated Sites Sensitivity Test

The results of the sensitivity test to investigate the effects of using a more conservative verification factor of 2 are presented in Volume 04; Appendix A10-1. In summary, the outcome of the assessments did not differ using this approach and the results were considered to be **negligible** and **not significant** overall.

10.7.2.5 Regional Air Quality Assessment

The regional air quality emission levels for the base year and the Do-Minimum and Do-Something scenarios for both the opening and design years have been predicted and are presented in Table 10-16.

Table 10-16 Regional Emissions Summary

	NO_X (kg/year)	PM_{10} (kg/year)	CO_2 (tonnes/year)
Base 2019	1,410	106	664
DM 2023	1,013	111	728
DS 2023	971	112	706
DM 2039	625	147	952
DS 2039	598	149	924
Change in 2023	-42	2	-22
Change in 2039	-27	2	-28
% change in 2023	-4.1%	1.4%	-3.0%
% change in 2039	-4.4%	1.6%	-2.9%

A decrease in regional emissions of NO_X and CO_2 has been predicted in the assumed opening year and design year with the Proposed Road Development operational (DS), compared to without (DM), while a decrease in regional emissions of PM_{10} is predicted. While there is an increase in the total vehicle-kilometres travelled as a result of the Proposed Road Development (approximately 10,900 vehicle-kilometres per day in the DM scenario compared to approximately 11,100 vehicle-kilometres per day in the DS scenario, in the assumed opening year), the primary cause of the reductions in emissions of NO_X and CO_2 is the alleviation of congestion. The change in NO_x emissions is predicted to be less in the design year (27 kg/year) compared to the assumed opening year (42 kg/year), due to continuing vehicle emission improvements with respect to NO_X between these years. However, for CO_2 there is anticipated to be a slightly larger change in emissions in the design year (28 tonnes/year) compared to the assumed opening year (22 tonnes/year). In the context of national emissions, these changes are very small and considered to be **negligible** and **not significant** overall for NOx and PM_{10}.

Further details regarding the effect of the change in CO_2 emissions is discussed in Chapter 11 Climate Change.

10.8 Do-Nothing Scenario

In the Do-Nothing Scenario, the Proposed Road Development would not be constructed and is represented by the 'Do-Minimum' Scenario. The local air quality predictions for the DM scenario are presented in Section 10.7.2.2. In summary, the maximum predicted NO_2 concentration at a sensitive receptor in the Do-Nothing Scenario is 7.6 $\mu g/m^3$, the maximum predicted PM_{10} concentration in the Do-Nothing Scenario is 11.4 $\mu g/m^3$, and the maximum predicted $PM_{2.5}$ concentration in the Do-Nothing Scenario is 4.4 $\mu g/m^3$. These are well below the relevant EULVs.

10.9 Mitigation and Monitoring Measures

10.9.1 Construction Phase

It is recommended that standard industry good practice mitigation measures should be applied to the Proposed Road Development site, such as that described in 'Control of dust from construction and demolition activities' (Kukadia et al., 2003), 'Best Practice Guidance: The control of dust and emissions from demolition and construction' (GLA, 2006), and 'Guidance on the assessment of dust from demolition and construction' (IAQM, 2014). Standard dust mitigation measures will manage any associated contaminates in soils such as fungal spores, although in this location no specific sources of spores are known.

Some example mitigation measures from the TII guidance (TII, 2011), are wind breaks and barriers, frequent cleaning and watering of the construction site and associated access roads, control of vehicle access, vehicle speed restrictions, covering of piles, use of gravel at site exit points to remove caked on dirt from tyres and tracks, washing of equipment at the end of each work day and prevention of onsite burning. Where appropriate and practicable, hard surface roads should be wet swept to remove any deposited materials; un-surfaced roads should be restricted to essential site traffic only; and wheel-washing facilities should be located at all exits from the construction site. Air quality mitigation measures will be incorporated into a Dust Management Plan that will form part of the Contractor's Construction Environmental management Plan (CEMP).

10.9.2 Operational Phase

No operational phase mitigation measures are recommended as the effects were considered to be negligible.

10.10 Residual Impacts and Effects

Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines (EPA 2017), the effects from the impacts that remain after all assessment and mitigation are referred to as 'Residual Effects'.

10.10.1 Construction Phase

The implementation of standard industry good practice mitigation measures as outlined in Section 10.9 and within the Contractors CEMP will mitigate potential significant adverse effects from residual dust and vehicle emission impacts during the construction phase will not occur, so the residual effect will be **negligible** and **not significant**.

10.10.2 Operational Phase

As no mitigation measures are required, residual effects from residual vehicle emission impacts remain as presented in Section 10.7.2.

10.11 Cumulative Impacts and Effects

Cumulative impacts and associated effects have been assessed within the local assessment by the inclusion of background concentrations, derived from monitoring data, which account for non-localised sources of the pollutants of concern.

If the construction stage of the Proposed Road Development overlaps with the construction of any other proposed developments within 100 m, there is the potential for cumulative dust impacts.

Possible overlapping proposed developments include the construction of a playground in Abbeyknockmoy (application reference number 15374). Further details are available in Volume 04; Appendix A1-1. In the event that there was a cumulative construction project, the implementation of industry standard mitigation measures will ensure that there will be a **negligible** and **not significant** cumulative dust effect.

Cumulative impacts associated with the operational phase of the Proposed Road Development will be as a result of increased traffic emissions associated with other permitted and proposed developments in the area. No permitted developments are known that will affect the traffic flow on the Proposed Road Development. Therefore, there will be no cumulative effects during the operational phase.

10.12 Summary

In summary:

- The air quality impacts and effects of the Proposed Road Development have been assessed at a local and regional level;
- At a local level, the index of overall change of exposure has shown that the Proposed Road Development will result in a reduction in overall exposure to PM_{10} and NO_x. This is due to the redistribution of vehicles using the Proposed Road Development resulting in a reduction in traffic flows on the N63. The majority of receptors are located adjacent to the N63 and therefore will experience a reduction in concentrations of both PM_{10} and NO_X;
- This is supported by the 'calculation of local scale pollutant concentrations' assessment which predicted the effect of the Proposed Road Development at five receptors. The assessment predicted reductions in NO_2, PM_{10}, and $PM_{2.5}$ at properties along the existing N63, with slight increases seen at a single property located closer to the Proposed Road Development. However, overall air quality is very good within the study area (well below the relevant EULVs), so these impacts will result in negligible effects which overall will be not significant;
- The Proposed Road Development helps meet Policy Objective 64 of Project Ireland 2040 by reducing the overall exposure to road-contributed pollutants in the study area;
- At Lough Corrib SAC, there are both increases and decreases in NO_X concentration and nitrogen deposition at locations across the study area. These impacts will result in negligible effects which overall will be not significant;
- Regionally, increases in PM_{10}, will be expected with the Proposed Road Development due to the greater number of vehicle-kilometres travelled with the Proposed Road Development, while decreases in NO_2 and CO_2 will be expected with the Proposed Road Development due to the alleviation of congestion;
- During construction, dust impacts will be mitigated by the use of standard industry good practice mitigation measures as set out in the Contractors CEMP, resulting in a not significant effect. Additionally, the effect of additional construction traffic on the road network due to the Proposed Road Development is considered to be not significant; and
- Overall, the Proposed Road Development is **not significant** and considered **neutral** with respect to air quality.

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 11: Climate

Galway County Council

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Table of Contents

Figures

No figures.

Tables

11. Climate

11.1 Introduction

This chapter presents an assessment of the impacts of the Proposed Road Development on the climate. It defines the study area; the methodology used for developing the baseline and impact assessment; provides a description of the baseline environment in relation to climate change; and presents the findings of the impact assessment. It also considers the resilience of the Proposed Road Development to the physical impacts of future climate change.

In line with Institute of Environmental Management and Assessment (IEMA) guidance (IEMA, 2015; IEMA, 2017), consideration has been given within this Environmental Impact Assessment Report (EIAR) to the following aspects of climate change assessment:

- Lifecycle Greenhouse Gas (GHG) impact assessment – the impact of GHG emissions arising from the Proposed Road Development on the climate during the lifecycle stages within the scope of the assessment (see Section 11.2.5);
- Climate Change Resilience (CCR) review – the resilience of the Proposed Road Development to projected climate change impacts; and
- In-Combination Climate Change Impact (ICCI) assessment – the combined impact of the Proposed Road Development and future climate change on receptors in the surrounding environment.

The ICCI assessment has not been included in the climate chapter. The rationale for scoping out this assessment, is summarised in Table 11-1.

Table 11-1 Rationale for Scoping Out Climate Parameters for the ICCI Assessment

Parameter	Rationale for Scoping Out
Extreme weather	The impacts of extreme weather events on the water environment discipline are considered as part of the climate change allowances within the Flood Risk Assessment (FRA) (see Volume 04; Appendix A9-1) and it would not be proportionate or appropriate to assess such effects within the EIAR solely for the purpose of the ICCI assessment. These impacts have therefore not been included in this chapter.
Sea level rise	The Proposed Road Development site is not located in an area that is susceptible to sea level rise.
Temperature	The Proposed Road Development site is within a rural area, and as such will have a negligible urban heat island effect.
Precipitation	The impact of increased rainfall due to climate change is considered as part of the FRA (see Volume 04; Appendix A9-1). It is therefore not considered proportionate or appropriate to assess precipitation within this chapter solely for the purposes of the ICCI assessment.
Wind	It is not proportionate to assess wind solely for the purposes of the ICCI assessment due to a lack of wind climate projections.

11.2 Legislation, Policy and Guidance

11.2.1 Climate Agreements

For Ireland, climate change mitigation and adaptation actions are framed and informed by United Nations (UN), European Union (EU) and national policy. These include the United Nations Framework Convention on Climate Change (UNFCC), the Kyoto Protocol, the UN Paris Agreement, the EU Strategy on Adaptation to Climate Change, the EU Climate and Energy Package and the Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021a).

Mitigation of GHG emissions is the primary response to the threat of climate change and each country will need to play its part in taking effective actions. The aim of holding the increase in the global average temperature to well below 2°C, relative to pre-industrial temperature, frames mitigation actions from global to local levels.

To achieve this objective, global emissions of carbon dioxide and other GHGs must be brought to near or below zero by the end of this century. The Government published the 'Climate Action and Low Carbon Development National Policy Position' in April 2014 (Government of Ireland, 2014), committing Ireland to an 80% reduction in carbon emissions in the energy sector compared to 1990 levels by 2050. However, a more ambitious target has now been committed to in law through the Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021a), which establishes a 2050 net zero emissions target and a 51% emissions reduction target by 2030, compared to a 2018 baseline. The Act also introduces a system of successive 5-year carbon budgets starting in 2021. The following three carbon budgets have been developed by the Climate Change Advisory Council (2021) and are expected to be written into law on February 25th 2022:

- **2021-2025**: 295 Mt CO2e[1];
- **2026-2030**: 200 Mt CO2e; and
- **2031-2035**: 151 Mt CO2e.

11.2.2 National Planning Policy

National Spatial Strategy for Ireland 2002-2020

The National Spatial Strategy for Ireland 2002-2020 (Government of Ireland, 2002) highlights the importance of limiting energy demand and Carbon dioxide (CO_2) emissions as a result of the development of Ireland's transport networks and encourages promotion of forestry and initiatives to address the impact of transport on the environment.

Project Ireland 2040: National Planning Framework

The National Planning Framework (Government of Ireland, 2019) highlights the importance of reducing GHG emissions to accelerate action on climate change, adopting principles of the circular economy and managing waste in a more sustainable manner.

The Framework also describes the importance of progressively electrifying mobility systems, moving away from "*polluting and carbon intensive propulsion systems to new technologies*".

Project Ireland 2040: National Development Plan 2018-2027

The National Development Plan 2018-2027 (Government of Ireland, 2018) sets out the investment priorities that will underpin the implementation of the National Planning Framework (above). This Development Plan emphasises the need for "*investment to support the achievement of climate action objectives and discourage investment in high-carbon technologies*".

[1] Mt CO2e = Million tonnes of carbon dioxide equivalent

National Energy & Climate Plan 2021-2030

This Plan (Government of Ireland, 2020) builds upon existing national strategies and policies, and outlines objectives and planned policies to make sure national emissions reduction targets are achieved. Key objectives include, but are not limited to:

- Decarbonisation – Reducing emissions from sectors outside the EU's Emissions Trading System by 30% (relative to 2005 levels) by 2030;
- Renewable energy – Including increasing electricity generated from renewable sources to 70%. Electricity generated from renewable sources to 70%; and
- Energy efficiency – Contributing towards the EU wide target of achieving at least 32.5% improvement in energy efficiency by 2030.

The Plan includes the latest assessment of Ireland's total projected greenhouse gas emissions out to 2040, including emissions projections by sector. The GHG emissions associated with the Proposed Road Development will be contextualised against these emissions projections.

There is a long-term projected decrease in greenhouse gas emissions as a result of inclusion of new climate mitigation policies and measures that formed part of the National Development Plan (NDP) which was published in 2018. A decrease in transport sector emissions is also projected over the longer term, which is largely attributed to assumed uptake of electric vehicles and the impact of greater biofuel uptake.

The projections reflect plans to bring Ireland onto a lower carbon trajectory in the longer term. However, Ireland still faces significant challenges in meeting EU 2030 reduction targets in the non-Emissions Trading System (ETS) sector and national 2050 reduction targets in the electricity generation, built environment and transport sectors. Progress in achieving targets is dependent on the level of implementation of current and future plans.

Climate Action Plan (2021)

The objective of the Climate Action Plan (Government of Ireland, 2021b) follows the Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021a), which commits Ireland to a legally binding target of net zero GHG emissions by no later than 2050, and a reduction of 51% (compared to 2018 levels) by 2030. The Climate Action Plan outlines 475 actions that need to be taken across all the key sectors.

Specifically in relation to the transport sector, key actions include encouraging the uptake of biofuels, providing additional public transport and active travel options and accelerating the uptake of Electric Vehicles (EVs) to achieve a target of 950,000 EVs on the road by 2030.

Targets also include developing coherent reduction strategies for waste and resource use, and increasing the level and quantity of recycling to develop a more circular economy.

In addition to reducing GHG emissions, the Climate Action Plan also highlights the importance of considering future climate change, such as increases in severe weather events and increased incidence of flooding, and building climate change resilience into new development.

Smarter Travel – A Sustainable Transport Future (A New Transport Policy for Ireland 2009-2020)

The Department of Transport's 'Smarter Travel – A Sustainable Transport Future' (Department of Transport, 2009) sets out a series of initiatives to reduce GHG emissions. These include actions to reduce travel demand, increase alternatives to the private car and improve the efficiency of motorised transport. Enhanced incentives to encourage vehicle owners to switch to electric options should also be encouraged.

There are five key goals which form the basis of the new transport policy. Those pertinent to the Proposed Road Development from an air quality and climate perspective are:

- Improving economic competitiveness through maximising the efficiency of the transport system and alleviating congestion and infrastructural bottlenecks; and
- Minimising the negative impacts of transport on the local and global environment through reducing localised air pollutants and greenhouse gas emissions.

A Waste Action Plan for a Circular Economy: Ireland's National Waste Policy 2020-2025

The objective of this Waste Action Plan (Government of Ireland, 2021c) is to transition to a circular economy in Ireland, in line with the '*European Green Deal'* and the '*EU 2020 Circular Economy Action Plan*'.

Within this Plan, construction and demolition (C&D) waste is reported to be the largest waste stream in the EU, representing approximately one third of all waste produced. Effective management of C&D waste, of which approximately 80% is excavated soil and stone, is therefore essential to the success of this Plan.

The Plan outlines the following key actions the sector must take over the coming years to overcome the challenges associated with the transition to a circular economy:

- Promote waste prevention in the first instance;
- Follow best available techniques;
- Expand the range and use of recycled products;
- Create a market demand for recycled products and segregating more material onsite to allow for recycling; and
- Meet the target of preparing for reuse, recycling and other material recovery (incl. beneficial backfilling operations using waste as a substitute) of 70% by weight of C&D non-hazardous waste (excluding natural soils & stone).

11.2.3 Local Planning Policy

Galway County Development Plan 2022-2028

Section 14 - Climate Change, Energy and Renewable Resource of the Development Plan (GCC, 2021) outlines aims to "*reduce the carbon footprint by integrating climate action into the planning system in support of national targets […] and move to a competitive low carbon economy*". The development plan seeks to protect, mitigate and adapt to the impacts of climate change. The council is committed to addressing climate change in a proactive manner, and so climate action is integrated into every section of the plan, from cultural heritage to education and community development.

Galway County Council (GCC) is committed to making the transition to becoming a low carbon and climate resilient County, promoting the economic, social and environmental benefits of low carbon development, with an emphasis on the reduction in energy demand and greenhouse gas emissions. This includes a combination of effective mitigation and adaptation responses to climate change across multiple sectors, including buildings, transport, energy production, minerals/waste, agriculture, water management, infrastructure, wildlife and biodiversity, economy and tourism, human health, risk and insurance, and land management and forestry.

Galway County Council Draft Climate Adaptation Strategy 2019-2024

The Adaptation Strategy (GCC, 2019) describes historic, observed climate change patterns as well as projected future climate change impacts. The projected impacts include:

- Maximum and minimum average temperatures are projected to rise;
- Increase in temperatures reached on hottest days, and an increase in frequency of hot days;
- A decrease in the frequency of frost risk; and
- High variability in rainfall, with the intensity of heavy rainfall events likely to increase.

The Adaptation Strategy identifies key climate change risks and opportunities to critical infrastructure and buildings. These include increased flooding due to heavy rainfall events; increased costs and resource demands for maintenance and repairs due to climate events; damage to transport networks due to increased temperatures; potentially streamlined construction timelines in the summer due to drier conditions; and reduced cold and frost damage due to increased winter temperatures.

In response to these projected impacts, Goal 1 of the Adaptation Strategy states the county must "*Increase the Resilience of Critical Infrastructure & Buildings to Climate Change by Planning and Implementing Appropriate Adaptation Measures*". This includes promoting climate resilient and sustainable design and construction; making sure new developments are not at risk from coastal, fluvial, pluvial or ground water flooding as per the Flood Risk

Planning Guidelines; and developing sustainable land use planning policies which facilitates transportation efficiency and a general shift towards the use of low carbon public transportation.

While the focus of the Adaptation Strategy is on climate change adaptation, it also recognises that climate change mitigation through reducing GHG emissions is key to reducing the impact of climate change, and therefore the level of adaptation required.

11.3 Methodology

This section of this EIAR chapter presents the following:

- Information sources, guidelines and policies that have been consulted throughout the preparation of this chapter;
- The methodology used for the assessment of effects of GHG emissions, including the criteria for the determination of sensitivity of receptor and magnitude of change from the existing 'baseline' condition;
- An explanation as to how the identification and assessment of potential effects of GHG emissions has been reached;
- The significance criteria and terminology for the assessment of residual effects of GHG emissions; and
- The approach adopted for the CCR review.

11.3.1 Study Area

11.3.1.1 Lifecycle GHG Impact Assessment

The GHG assessment study area considers all GHG emissions arising over the lifecycle of the Proposed Road Development. This includes direct GHG emissions arising from activities within the Proposed Road Development site boundary and indirect emissions from activities outside the Proposed Road Development site boundary (for example, the transportation of materials to the Proposed Road Development site, embodied carbon within construction materials and the impact on vehicle journeys within the wider road network).

11.3.1.2 Climate Change Resilience Review

The study area for the climate change resilience review is the area within the boundary of the Proposed Road Development.

11.3.2 Determination of the Baseline Environment

11.3.2.1 Lifecycle GHG Impact Assessment

The baseline for the GHG emissions assessment is a 'business-as-usual' scenario whereby the Proposed Road Development does not go ahead. The baseline scenario includes existing GHG emissions sources associated with the Proposed Road Development site.

11.3.2.2 Climate Change Resilience Review

The baseline for the climate change resilience assessment is the historic climate in the location of the Proposed Road Development. Historic climate data available on the Met Eireann website for the period of 1981-2000 has been used to determine the baseline, in line with the baseline period for the climate change projections used for the 'future baseline' scenario.

An Environmental Protection Agency (EPA) funded report (EPA, 2015) on the regional climate model projections for Ireland, presenting climate change projections for mid-century (2041-2060) against a baseline period of 1981-2000, has been used to determine the 'future baseline' scenario. The resilience of the Proposed Road Development to climate change has been reviewed in the context of these climate projections.

11.3.3 Determination of Sensitive Receptors

11.3.3.1 Lifecycle GHG Impact Assessment

The global climate has been identified as the receptor for the purposes of the lifecycle GHG impact assessment.

11.3.3.2 Climate Change Resilience Review

The receptor for the CCR review is the Proposed Road Development itself, including workers, users and associated infrastructure.

11.3.4 Describing Potential Effects

11.3.4.1 Lifecycle GHG Impact Assessment

Construction Effects

GHG emissions resulting from the construction of the Proposed Road Development that will impact on the climate are calculated in line with the GHG Protocol (WBCSD & WRI, 2012). GHG 'hot spots' (i.e. sources and activities likely to generate the largest amount of GHG emissions) have been identified to enable priority areas for mitigation to be targeted. This approach is consistent with the principles set out in IEMA guidance (IEMA, 2017).

This lifecycle approach considers emissions from different lifecycle stages of the Proposed Road Development as a whole including product stage, construction process stage and the operational stage.

Where activity data has allowed, expected GHG emissions arising from the construction and operational activities, and embodied carbon in materials of the Proposed Road Development, have been quantified using the Transport Infrastructure Ireland (TII) Carbon Assessment Tool v2.1. Where it was not possible to use this tool, a calculation-based methodology was used, as per the following equation presented in the UK Defra 2021 emissions factors guidance (Defra, 2021):

Activity data x GHG emissions factor = GHG emissions value

Where a calculation-based approach was required, Sustainable Energy Authority of Ireland (SEAI) emissions factors (SEAI, 2021) have been used to calculate emissions where available. However, where SEAI emissions factors are not available, UK Defra 2021 emissions factors (Defra, 2021) have been used.

In line with the GHG Protocol, when defining potential impacts (or 'hot spots'), the seven Kyoto Protocol GHGs have been considered, specifically:

1. Carbon dioxide (CO_2);
2. Methane (CH_4);
3. Nitrous oxide (N_2O);
4. Sulphur hexafluoride (SF_6);
5. Hydrofluorocarbons (HFCs);
6. Perfluorocarbons (PFCs); and
7. Nitrogen trifluoride (NF_3).

These GHGs are broadly referred to in this chapter under an encompassing definition of 'GHG emissions', with the unit of tCO_2e (tonnes CO_2 equivalent).

Where data is not available, a qualitative approach to addressing GHG impacts has been followed, in line with the IEMA guidance (IEMA, 2017).

Table 11-2 summarises the key anticipated GHG emissions sources associated with the construction phase of the Proposed Road Development and whether they have been scoped into the assessment.

Table 11-2 Scope of Potential GHG Emissions Sources from the Construction Stages

Lifecycle Stage	Activity	Primary Emission Sources	Scoped In/Out
Pre-construction stage	Onsite construction activity. Disposal and transportation of earthworks/waste.	GHG emissions from fuel consumption by construction plant and vehicles, generators onsite, and worker commuting. GHG emissions from disposal and transportation of earthworks/pre-construction waste.	In
	Land clearance.	Loss of carbon sink.	In
Product stage	Raw material extraction and manufacturing of products/materials. Transport of products/materials to site.	Embodied GHG emissions. GHG emissions from fuel consumption for transportation of construction materials.	In
Construction process stage	Onsite construction activity. Transport of construction workers.	Energy (electricity, fuel, etc.) consumption from plant, vehicles and generators onsite. GHG emissions from fuel consumption for transportation of construction workers.	In
	Disposal and transportation of construction waste.	GHG emissions from energy use and from fuel consumption for transportation of waste.	In
	Provision and treatment of water.	GHG emissions from the supply of potable water, and the disposal and treatment of wastewater.	Out

Emissions from provision and treatment of water during construction have been scoped out of this assessment as they are likely to be minimal in proportion to the overall construction GHG emissions footprint of the Proposed Road Development. As such, emissions from the provision and treatment of water are not considered material.

Operation Effects

The methodology for determining operational GHG emissions is the same as for construction phase emissions, with the addition of a scenario-based assessment to account for baseline operational vehicle use emissions. The following two scenarios are quantified to calculate the anticipated additional GHG emissions as a result of the Proposed Road Development. These scenarios include:

- A ‘Do-Minimum’ (DM) scenario whereby the Proposed Road Development is not implemented; and
- A ‘Do-Something’ (DS) scenario whereby the Proposed Road Development goes ahead and the GHG emissions reductions from embedded control measures are taken into account.

Table 11-3 summarises the key anticipated operational emissions sources and whether they have been scoped into the assessment.

Table 11-3 Scope of Potential GHG Emissions Sources from the Operation Stage

Lifecycle Stage	Activity	Primary Emissions Sources	Scoped In/Out
Operation stage	Use of vehicles	GHG emissions from vehicle use from additional journeys due to the Proposed Road Development.	In
	Energy use	GHG emissions from operational energy use (e.g. road lighting, traffic lights etc.)	In
	Infrastructure maintenance	GHG emissions from maintenance of infrastructure/assets in operation stage (including embodied carbon in materials, maintenance activities, transportation of materials, worker commuting and waste disposal)	In
	Provision and treatment of water	GHG emissions from the supply of potable water, and the disposal and treatment of wastewater	Out
Decommissioning	Decommissioning of the Proposed Road Development	GHG emissions from decommissioning	Out

Emissions from provision and treatment of water during operation have been scoped out of this assessment as they are likely to be minimal in proportion to the overall operational GHG emissions footprint of the Proposed Road Development. As such, emissions from the provision and treatment of water are not considered material.

Decommissioning has been scoped out of the assessment as it is anticipated that as part of the road network, the Proposed Road Development will be in use beyond the design life of the development. Also, it is not possible to assess the GHG impact of decommissioning activities with any certainty as the decommissioning landscape (e.g. methods and fuels used) is anticipated to change considerably. Any future decommissioning will require a separate planning submission, at which point any likely significant effects will be assessed.

11.3.4.2 Climate Change Resilience Review

In line with IEMA guidance, the vulnerability of the Proposed Road Development to climate change has been considered. A review of climate change resilience for the Proposed Road Development has been conducted which identifies potential climate change impacts.

The review has included all infrastructure and assets associated with the Proposed Road Development. It covers resilience against both gradual climate change, and the risks associated with an increased frequency of extreme weather events.

Climate change resilience measures that have been designed into the Proposed Road Development are outlined in Section 11.6.

11.3.5 Significance of Effect

There are no specific criteria for determining the significance of GHG emissions for EIAR. The IEMA guidance on GHG in EIAR (IEMA, 2017) states that *"any GHG emissions or reductions from a project might be considered to be significant"*. The guidance also states it is down to the professional judgment of the practitioner to determine how best to contextualise a project's GHG impact and assign the level of significance. It is suggested that sectoral, local, or national carbon budgets can be used, as available and appropriate, to contextualise a project's GHG impact and determine the level of significance. The approach adopted for the purposes of this assessment is outlined below.

The national carbon reduction targets, as set out in the Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021a), have been used to determine the impact of the additional GHG emissions as a result of the Proposed Road Development on Ireland's ability to meet its reduction targets. Consideration has also been given to the first three carbon budgets, produced by the Climate Change Advisory Council (2021), to further contextualise the impact of the Proposed Road Development on Ireland's carbon reduction goals.

In GHG accounting, it is common practice to consider exclusion of emission sources that are <1% of a given emissions inventory on the basis of a 'de minimis' contribution. The Publicly Available Specification (PAS) 2050 (2011) Specification (BSI, 2011) allows emissions sources of <1% contribution to be excluded from emission inventories, and these inventories to still be considered complete for verification purposes. This would therefore suggest that a development with emissions of <1% of Ireland's permitted emissions will have a minimal impact on Ireland's ability to meet its carbon reduction targets.

Therefore, for the purposes of this assessment, where total annual emissions from the operation of the Proposed Road Development are determined to be equal to or more than 1% of Ireland's permitted annual emissions, they will be considered to be of major significance. Where total annual emissions from the operation of the Proposed Road Development are determined to be less than 1% of Ireland's permitted annual emissions, they will be considered to be of minor significance.

11.4 Limitations and Assumptions

The current Proposed Road Development site is responsible for minor levels of direct GHG emissions associated with agricultural practices. For the purposes of this assessment, it is assumed baseline emissions associated with existing agricultural energy and fuel use will be negligible in the context of the Proposed Road Development. Therefore, the agricultural energy and fuel use baseline is assumed to be zero.

GHG emissions from current vehicle use on the existing N63 scheme and wider affected road network are factored into the baseline of the operational vehicle use emissions calculations.

Carbon sequestration impacts as a result of land use change have also been considered within the GHG assessment. Changes to land use have been estimated based on the design of the Proposed Road Development and proposed planting. Carbon sequestration values for each land use type were based on figure reported by the EU commission (EU Commission, 2010).

As a detailed breakdown of plant and machinery use onsite is not available at this stage, fuel use onsite during construction has been estimated based on data from a similar scheme assessed previously (the ‘benchmark scheme’), for which such data was available. The construction fuel use figure from the benchmark scheme has been updated using the SEAI emissions factor for diesel (SEAI, 2021) and prorated based on the comparative road lengths of the benchmark scheme and the Proposed Road Development.

The same approach has been taken for the construction worker travel calculations due to insufficient data - The construction worker travel emissions figure from the benchmark scheme has been updated using the UK Defra 2021 emissions factor for an average sized car (‘unknown fuel’) and prorated based on the comparative road lengths of the benchmark scheme and the Proposed Road Development.

The UK Defra 2021 emissions factor for ‘Rigid Heavy Goods Vehicles (HGV) – 7.5-17 t, 100% laden’ has been used to estimate GHG emissions associated with HGV transportation during construction, calculated on a tonne/km basis based on the total material requirements and an assumed transportation distance of 50 km to site. This distance is considered to be a conservative estimate.

A wastage rate of 5% was applied to all construction materials. It has been assumed that 15% of construction waste will be sent to landfill and 85% will be recovered, in line with standard permit requirements for an 85% recovery rate for C&D wastes, as described within the TII guidance document on 'The Management of Waste from National Road Construction Projects (TII, 2017).

The air quality modelling undertaken to calculate GHG emissions from additional vehicle journeys during operation also only accounts for CO_2, rather than CO_2e. However, the EV uptake factored into the modelling reflects a conservative estimate compared to the Irish Government’s 2030 EV uptake aspirations of 950,000 EVs on the road by 2030, as set out in their Climate Action Plan. Therefore, presenting operational vehicle use emissions in CO_2 is not anticipated to have a material impact on the outcome of the assessment.

CO_2 emissions from additional vehicle use have been modelled for the opening year (2023) and design year (2039) and are assumed to increase incrementally between these two years. As road user emissions have not been modelled beyond 2039, the 2039 figure has been assumed each year for the remainder of the design lifetime.

Maintenance activities during the lifetime of the Proposed Road Development are assumed to consist of resurfacing of the road and replacement of road restraint systems, safety barriers and fencing on one occasion. As the design life of the bridge is 120 years, bridge replacement is not considered within the maintenance calculations. The embodied carbon within the materials required for maintenance has been estimated using the relevant construction-stage product calculations.

11.5 Baseline Environment

11.5.1 Lifecycle GHG Impact Assessment

The land within the boundary of the Proposed Road Development consists mainly of arable land, hedgerows and trees. Existing vegetation on the Proposed Road Development site currently acts as a carbon sink. Also, current use of the agricultural land on the Proposed Road Development site has minor levels of associated GHG emissions (e.g. tractor and machinery use for farming). Baseline agricultural GHG emissions are dependent on soil and vegetation types present, and fuel use for the operation of vehicles and machinery. The existing N63 within the boundary of the Proposed Road Development also has associated transport emissions.

The baseline for the GHG emissions assessment is a 'business-as-usual' scenario whereby the Proposed Road Development does not go ahead.

11.5.2 Climate Change Resilience Review

Current Baseline

The current baseline for the climate change resilience assessment is the current climate in the location of the Proposed Road Development. Historic climate data obtained from the Met Eireann website (Met Eireann, 2021) recorded at the Shannon Airport meteorological station (the closest station to the site for which sufficient historic data was available) for the 20-year period of 1981-2000, is summarised in Table 11-4. This 20-year period aligns with the baseline period of the climate projections below.

Table 11-4 Historic Climate - Current Baseline

Climatic Factor	Month	Figure
Average annual maximum daily temperature (°C)	-	13.9
Warmest month on average (°C)	July	20.0
Coldest month on average (°C)	January	3.3
Mean annual rainfall levels (mm)	-	985
Wettest month on average (mm)	December	110
Driest month on average (mm)	April	59

Future Baseline

The future baseline will be used to determine the resilience of the Proposed Road Development to climate change and to identify potential climate adaption measures. An EPA-funded report (EPA, 2015) on the regional climate model projections for Ireland presents the following climate change projections for mid-century (2041-2060), against a baseline period of 1981-2000:

- Temperature projections suggest an increase in mean annual temperatures of 1.2-1.6°C under the high-emissions scenario, with the largest increases expected in the east of the country;
- Mean winter temperature projections indicate an increase of 1.2°C in the southwest and to 1.7°C in the north, while mean summer temperature projections indicate an increase of 1.1°C in the southwest and to 1.7°C in the north;
- Rainfall projections indicate a significant decrease in average precipitation levels for summer. "Likely" (where over 66% off the ensembles agree) reductions in summer rainfall of 3% to 20% are anticipated for the high emissions scenario;
- While the projections for average winter precipitation are less certain (no "likely" projections are defined due to large variations in projections), robust increases in the number of wet days are reported, which is of particular relevance to flooding impacts. "Likely" increases in the number of 'wet days' and 'very wet days'[2] for winter of 24% and 30%, respectively, are reported under the high emissions scenario;

[2] A "wet day" is defined as one on which the daily precipitation amount is greater than 20 mm. A "very wet day" is defined as one on which the daily precipitation is greater than 30 mm.

- Average annual rainfall is projected to decrease over the assessment period;
- The number of extended dry periods (defined as at least 5 consecutive days for which the daily precipitation is less than 1 mm) is also expected to increase over the year, particularly in summer and autumn, with "likely" values ranging from a 12% to 40% increase;
- Storms affecting Ireland are anticipated to decrease in frequency, but increase in severity, increasing the risk of damage to infrastructure; and
- Wind energy is projected to decrease in spring summer and autumn, while projected increases in wind energy in the winter were found to be statistically insignificant.

11.6 Assessment of Impacts

11.7 Embedded Control Measures

As outlined in Chapter 01 Introduction, the assessment of impacts takes into account any embedded control measures that form an inherent part of the Proposed Road Development. Those relevant to the climate assessment are described in the following sections.

11.7.1.1 Climate Change Resilience

The following climate change resilience measures were included in the design of the Proposed Road Development.

- The attenuation systems including Sustainable Urban Drainage Systems (SUDS) have been designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. This design will ensure that there is no increase in the risk of flooding in the receiving watercourse due to construction of the road up to the 100-year return period.
- The Abbert River bridge layout and heights have been developed following assessment of potential 1 in 100-year flooding event plus climate change.

11.7.1.2 Lifecycle GHG Impact Assessment

The following mitigation measures have been built into the design to reduce the GHG impact of the Proposed Road Development:

- Steel quantities on the bridge have been reduced through the design to reduce associated embodied carbon emissions;
- Concrete components will be pre-cast offsite where possible to reduce waste and associated GHG emissions, as well as streamlining the construction process and therefore reducing GHG emissions associated with construction activities;
- Plastic pipes have been specified where possible rather than concrete to reduce associated embodied carbon emissions; and
- Dedicated pedestrian and cycle facilities have been incorporated into the design of the Proposed Road Development to improve connectivity between the community facilities and residential properties and encourage more sustainable modes of transport.

11.7.2 Lifecycle GHG Impact Assessment

11.7.2.1 Construction Phase

The total GHG emissions from construction are estimated to be approximately 9,495 tCO_2e. The primary GHG emissions sources and the breakdown of the calculated GHG emissions are shown in Table 11-5.

The greatest contribution to construction emissions is the embodied carbon within construction products, accounting for 37% of construction emissions.

Table 11-5 Construction GHG Emissions

Project Activity/Emissions Source	Total GHG Emissions (tCO_2e)	% of Construction Emissions[3]
Land use change	2,172	22.9%
Products	3,471	36.6%
Construction activities	2,161	22.8%
Transport of materials	1,485	15.6%
Worker travel	159	1.7%
Waste disposal	48	0.5%
Total	9,495	

GHG emissions from construction activities will be limited to the anticipated duration of the construction programme where all enabling, construction and landscaping will be taking place (that is, workers are onsite and plant is running). The average annual construction emissions equate to 6,330 tCO_2e overall, assuming a 1.5-year construction programme.

11.7.2.2 Operational Phase

A comparison of operational road user GHG emissions between the DM and DS scenarios for the opening year (2023) and the design year (2039) are presented in Table 11-6.

Table 11-6 Comparison of Operation Vehicle use Emissions – DM vs DS Scenarios

Reporting Category	Year	
	GHG Emissions - 2023 (tCO_2)	GHG Emissions - 2039 (tCO_2)
Do-Minimum (DM) scenario	728	952
Do-Something (DS) scenario	706	924
Variation (DS-DM)[4]	-22	-28

Total operational GHG emissions over the design life of the Proposed Road Development are summarised in Table 11-7.

Table 11-7 Operational GHG Emissions

Project Activity/Emissions Source	Total GHG Emissions (tCO_2e[5]) (over 60-year design life)	% Contribution to Operational Emissions Impact
Operational energy use	1,453	30%
Maintenance activities	1,729	36%
Additional vehicle use	-1,629	34%
Total	1,553	

[3] Percentages reported may not add up to 100% due to rounding.
[4] Variation figures may not equate to the difference between the DM and DS scenario figures reported due to rounding.
[5] As outlined in Section 11.3, emissions associated with operational energy use and additional vehicle use only account for CO_2 emissions. However, the difference between CO_2 and CO_2e is considered to be minimal and is not anticipated to have a material impact on the outcome of the assessment.

Annually, the average operational GHG emissions from operational energy use, maintenance activities and additional vehicle use equate to approximately 26 tCO_2e, however this figure varies depending on the year of operation (from 25 to 31 tCO_2e[3]) due to the variation in modelled operational vehicle use emissions.

Additional GHG emissions associated with operational vehicle use have been modelled for the opening year (2023; -22 tCO_2e[3]) and the design year (2039; -28 tCO_2e[3]). For the purposes of this assessment, an incremental increase has been assumed between 2023 and 2039, and the 2039 figure has been assumed for the rest of the design lifetime. A negative GHG emissions value here represents a beneficial carbon impact in relation to operational vehicle use.

The GHG footprint is considered to reflect a robust worst-case as the calculations have been carried out using current emissions factors. Embodied carbon and emissions associated with energy and fuel use are anticipated to be lower in the future as a result of grid decarbonisation and machinery and vehicle electrification in line with Ireland's net zero carbon emissions target for 2050.

It is also anticipated that additional GHG reductions could be made through implementation of further mitigation measures through further design and during construction of the Proposed Road Development, such as specification of low carbon concrete, utilisation of recycled materials for the cycleway aspect, and utilisation of hybrid or electric plant.

11.7.2.3 Significance of Effect

GHG emissions arising as a result of the Proposed Road Development are considered to have a direct, negative effect on the receptor. The effects of GHG emissions are also considered to be long term, irreversible and have the potential to be cumulative with other projects. In terms of effect significance, IEMA (2017) suggests that "*GHG emissions have a combined environmental effect that is approaching a scientifically defined environmental limit, as such any GHG emissions or reduction from a project might be considered significant.*"

To determine the level of significance, the impact of the Proposed Road Development has been compared with Ireland's carbon reduction targets for 2030 and 2050, as outlined in the Climate Action and Low Carbon Development (Amendment) Act 2021 (Government of Ireland, 2021a). The impact of the Proposed Road Development has also been further contextualised by comparing the GHG emissions with the projected Transport Emissions Inventories for 2022 and 2040 (under the 'With Additional Measures' scenario)

Table 11-8 GHG Emissions Against Ireland's 2030 and 2050 targets

Year	Lifecycle Stage	GHG Emissions Target (tCO_2e)	Emissions from Proposed Road Development (tCO_2e)	Emissions as a % of National Target
2030	Operation	30,121,520	28	0.0001%
2050	Operation	Net 0	25	100%

Table 11-9 GHG Emissions Against Ireland's first three carbon budgets

Carbon Budget Period	Lifecycle stage	Emissions Budget (tCO_2e)	Emissions from Proposed Road Development (tCO_2e)	Emissions as a % of GHG Emissions Target
2021-2025	Construction & Operation	295,000,000	9,587	0.0032%
2026-2030	Operation	200,000,000	146	0.0001%
2031-2035	Operation	151,000,000	136	0.0001%

When compared to Ireland's 2030 GHG target, GHG emissions from the Proposed Road Development account for only 0.0001%. However, compared to Ireland's net zero 2050 target, any amount of emissions would push Ireland over a zero emissions threshold. It is important to note though, that Ireland's target is not for absolute zero emissions, but for **net** zero emissions, and therefore Ireland's permitted emissions are not zero. The Climate Action Plan 2021 recognises that there will inevitably be some residual emissions in 2050, but that "*any remaining emissions [will be] balanced by the removal of GHG emissions from the atmosphere*".

Any residual emissions associated with the Proposed Road Development in 2050 are likely to be from operational vehicle use, plant or generator fuel use (for maintenance activities) and grid electricity use. Therefore, it is anticipated that these residual emissions will decrease over time in line with existing government policies encouraging uptake of EVs, more sustainable construction practices, and decarbonisation of the national grid (see Section 11.2.1).

As achieving the required reductions across Ireland's national emissions inventory, including emissions from Ireland's entire transport network, also relies on the success of such policies, it is not anticipated that the residual impacts associated with the Proposed Road Development will have a material impact on the ability of the Irish Government to meet its carbon reduction targets.

To put the annual operational emissions from the Proposed Road Development into context (28 tCO_2e and 25 tCO_2e, for 2030 and 2050 respectively), transport emissions per person in Ireland in 2018 equated to 2.5 tCO_2e, according to the Climate Action Plan 2021. With the impact of the Proposed Road Development equating to the emissions associated with only 10-11 road users, the impact of the Proposed Road Development is considered to be negligible in the context of Ireland's entire road network. The operational emissions presented here are also considered to represent a robust worst case as they do not account for decarbonisation of the grid and future uptake of low carbon transport options (e.g. EVs).

As the GHG emissions associated with the Proposed Road Development are not considered to have a material impact on Ireland's ability to meet its carbon reduction targets (i.e. >1% of permitted residual emissions), the impact GHG emissions from the Proposed Road Development are considered to be of **minor significance.**

When further contextualised against the first three carbon budgets for Ireland, GHG emissions as a result of the Proposed Road Development, during both construction and operation, equate to well below 1% of permitted emissions.

11.7.3 Climate Change Resilience Review

11.7.3.1 Construction Phase

During the construction process, receptors may be vulnerable to a range of climate risks. These could include:

- Inaccessible construction site due to severe weather event (flooding, snow and ice, storms) restricting working hours and delaying construction;
- Health and safety risks to the workforce during severe weather events;
- Unsuitable conditions (due to very hot weather or very wet weather, for example) for certain construction activities; and
- Damage to construction materials, plant and equipment, including damage to temporary facilities/assets within the site boundary, such as offices, compounds, material storage areas and worksites, for example from stormy weather.

11.7.3.2 Operational Phase

During the operational phase, the Proposed Road Development may be vulnerable to a range of climate risks. These could include:

- Increased frequency and severity of extreme weather events (such as heavy and/or prolonged precipitation, storm events and heatwaves) leading to:
  - Damage to utilities due to stormy periods and intense rainfall;
  - Damage to drainage systems due to flooding from intense rainfall; and
  - Flooding from drainage systems during intense or prolonged rainfall.
- Increased winter precipitation leading to surface water flooding and standing waters; and
- Increased summer and winter temperatures leading to increased heat stress on infrastructure and assets.

See Section 11.6.1 for a list of adaptation measures built into the design of the Proposed Road Development to increase its resilience to climate change during operation.

11.8 Mitigation and Monitoring Measures

11.8.1 Lifecycle GHG Impact Assessment

11.8.1.1 Additional Mitigation Measures

The following GHG mitigation measures will be implemented during the construction stage of the Proposed Road Development:

- Proposed planting of trees, hedgerows and other vegetation onsite, as described in Chapter 07 Biodiversity and Chapter 13 Landscape and Visual, will reduce the impact of land use change on GHG emissions;
- A Construction Traffic Management Plan (CTMP) will be produced prior to construction and implemented in full, minimising congestion and encouraging car sharing and the use of public transport; and
- It is a requirement that a Construction Environmental Management Plan (CEMP) will be prepared by the appointed Contractor prior to construction and will include various measures to reduce GHG emissions, including:
  - Specification of locally-sourced construction materials where possible, including re-use of site-won materials in line with circular economy principles;
  - Handling materials efficiently onsite to minimise the waiting time for loading and unloading, thereby reducing potential emissions;
  - Turning off machinery engines when not in use;
  - Ensuring regular maintenance of plant and machinery;
  - Specification of materials with lower embodied carbon where possible, such as recycled steel and concrete with cement replacements (e.g. Ground Granulated Blast Furnace Slag (GGBS) and Pulverised Fly Ash (PFA)); and
  - A requirement for the contractor to implement an Energy Management System for the duration of the works.

No additional mitigation and monitoring beyond the measures already described above are required during the construction and operation of the Proposed Road Development.

11.8.2 Climate Change Resilience Review

11.8.2.1 Additional Mitigation and Monitoring

Climate change impacts will be considered within maintenance plans and final detailed drainage system design.

The construction stage CEMP will include a requirement to plan for additional mitigation measures to avoid wind-blown dust issues during potential extended periods of dry weather during construction.

Climate change projections will be considered when determining appropriate materials (e.g. consideration of materials with increased tolerance to high temperatures).

No additional mitigation or monitoring beyond the measures already described above are required during the construction and operation of the Proposed Road Development.

11.9 Do-Nothing Scenario

Under the Do-Nothing scenario, no development of the N63 route from Liss to Abbey will occur.

11.9.1 Lifecycle GHG Impact Assessment

Under a Do-Nothing scenario, none of the additional GHG emissions associated with the construction phase (see Table 11-5) will be emitted. Operational emissions associated with additional road lighting, and for the maintenance of additional road aspects, will also not be emitted.

Road user emissions are anticipated to increase under the Do-Nothing scenario, as modelled for the Do-Minimum scenario.

11.9.2 Climate Change Resilience Review

Under a Do-Nothing scenario, climate change is expected to continue as projected under the baseline scenario (see section 11.5). The resilience of the Proposed Road Development under a Do-Nothing scenario cannot be commented on as the Do-Nothing scenario assumes no development occurs.

11.10 Residual Impacts and Effects

'Residual impacts' are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (hereafter referred to as the 'EPA draft guidelines'), the effects from the impacts that remain after all assessment and mitigation are referred to as 'Residual Effects' (EPA, 2017). This section identifies the residual impacts and associated effects, following the implementation of mitigation and monitoring measures.

There will be unavoidable GHG emissions resulting from both the construction phase and the operational phase of the Proposed Road Development as materials, energy use, fuel use, and transport will be required. However, as none of the associated effects are major and of high significance, it is not appropriate to define any mitigation measures further to the ones detailed in Section 11.6.

Table 11-10 provides a summary of residual impacts and associated effects on climate.

Table 11-10 Climate Summary of Potential Effects

Description of Residual Impact	Sensitivity of Receptor	Nature of Effect/Geographic Scale	Magnitude of Effect	Initial Classification of Effect (with embedded control)	Additional Mitigation	Residual Effect Significance
Construction						
GHG emissions	High	Long term/Global	Low	Minor	None	**Minor (Low significance)**
Complete and Occupied						
GHG emissions	High	Long term/Global	Low	Minor	None	**Minor (Low significance)**

11.11 Cumulative Impacts

11.11.1 Lifecycle GHG impact assessment

Most development results in GHG emissions and consequently all development therefore has the potential to result in a cumulative effect on GHG emissions. The identified receptor is the global climate and effects are therefore not geographically constrained. As such, it is not possible to define a study area for the assessment of cumulative effects on of GHG emissions nor to undertake a cumulative effects assessment. Moreover, as the assessment methodology uses Ireland's carbon reduction targets as a proxy for the global climate, this wider perspective is already covered by default. Consequently, consideration of the effects of the Proposed Road Development together with other developments on GHG emissions has been scoped out of this assessment.

11.11.2 Climate Change Resilience Review

As the CCR review is only concerned with the assets of the Proposed Road Development and a broader consideration of existing interdependent infrastructure, a cumulative assessment is not appropriate.

11.12 Summary

11.12.1 Lifecycle GHG Impact Assessment

In summary:

- The construction phase has been quantitatively assessed in terms of expected GHG emissions arising from onsite construction activities, loss of carbon sink through land use change, embodied carbon in the construction materials, transportation of construction materials and workers, and waste disposal;
- In relation to the impact on Ireland's ability to meet its carbon reduction targets, the effect from GHG emissions during the construction phase of the Proposed Road Development have been found to be minor (low significance);
- The operational phase has been quantitatively assessed in terms of expected GHG emissions arising from operational energy use, additional vehicle journeys and maintenance activities;
- In relation to the impact on Ireland's ability to meet its carbon reduction targets, the effect from GHG emissions during the operation of the Proposed Road Development have been found to be minor (low significance); and
- There will be unavoidable GHG emissions resulting from both the construction phase and the operational phase of the Proposed Road Development. However, as none of the effects are major and of high significance, it is not appropriate to define any mitigation measures further to the ones detailed in Section 11.6.1.

11.12.2 Climate Change Resilience Review

In summary:

- During the construction process, receptors may be vulnerable to a range of climate risks. These could include:
  - Inaccessible construction site due to severe weather event (flooding, snow and ice, storms) restricting working hours and delaying construction;
  - Health and safety risks to the workforce during severe weather events;
  - Unsuitable conditions (due to very hot weather or very wet weather, for example) for certain construction activities; and
  - Damage to construction materials, plant and equipment, including damage to temporary buildings/facilities within the site boundary, such as offices, compounds, material storage areas and worksites, for example from stormy weather.
- During the operational phase, the Proposed Road Development may be vulnerable to a range of climate risks. These could include:
  - Increased frequency and severity of extreme weather events (such as heavy and/or prolonged precipitation, storm events and heatwaves) leading to:
    - Damage to utilities due to stormy periods and intense rainfall;
    - Damage to drainage systems due to flooding from intense rainfall; and
    - Flooding from drainage systems during intense or prolonged rainfall.
  - Increased winter precipitation leading to surface water flooding and standing waters; and
  - Increased summer and winter temperatures leading to increased heat stress on infrastructure and assets.
- The climate change resilience measures built into the design of the Proposed Road Development (outlined in Section 11.6.2) are considered to be appropriate in the context of the climate change projections outlined in Section 11.4.2. It is therefore not appropriate to define any additional mitigation measures.

11.13 References

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 12: Noise and Vibration

Galway County Council

February 2022

Table of Contents

Figures

Tables

Volume 04 Appendices

12. Noise and Vibration

12.1 Introduction

This chapter presents an assessment of the impacts of the Proposed Road Development on noise and vibration. It defines the study area; the methodology used for developing the baseline and impact assessment; provides a description of the baseline environment in relation to noise and vibration; and presents the findings of the impact assessment.

This chapter should be read in conjunction with Chapter 04 'Description of the Proposed Road Development' and Chapter 05 'Traffic Analysis'.

12.2 Legislation, Policy and Guidance

There are no statutory standards in Ireland relating to noise and vibration limit values for construction works or for environmental noise relating to road traffic noise. In the absence of specific statutory Irish guidelines, the assessment has made reference to non-statutory national guidelines, in addition to international standards and guidelines relating to noise and/or vibration impact for environmental sources. These are summarised below:

- British Standard Institute (BSI) British Standard (BS) 5228 (2009 +A1 2014) Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (hereafter referred to as BS 5228 – 1) (BSI 2009 + A1 2014a);
- BS 5228 (2009 +A1 2014) Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (hereafter referred to as BS 5228 – 2) (BSI 2009 + A1 2014b);
- BS 7385 (1993) Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration (hereafter referred to as BS 7385 – 2). (BSI, 1993);
- Highways England Design Manual for Roads and Bridges (DMRB) 'LA 111 Sustainability & Environmental Appraisal. Noise and Vibration Rev 2', (hereafter referred to as DMRB Noise and Vibration) (Highways England, 2020);
- Galway County Council (GCC), Galway County Noise Action Plan December 2018 – November 2023 (hereafter referred to as the Galway County NAP 2018 – 2023) (GCC, 2018);
- European Communities (Environmental Noise) Regulations 2018 (S.I. No. 549/2018);
- European Communities Noise Emission by Equipment for Use Outdoors (Amendment Regulations) (S.I. No. 241 / 2006);
- International Organization for Standarization (ISO) 9613-2:1996 Acoustics – Attenuation of sound during propagation outdoors - Part 2: General method of calculation (hereafter referred to as ISO 9613 – 2) (ISO, 1996);
- International Organisation for Standardisation (ISO) 1996-1:2016 Acoustics - Description, measurement and assessment of environmental noise. Part 1: Basic quantities and assessment procedures (hereafter referred to as ISO 1996 – 1) (ISO, 2016);
- ISO 1996-2:2017 - Description, measurement and assessment of environmental noise - Part 2: Determination of sound pressure levels (hereafter referred to as ISO 1996 – 2) (ISO, 2017);
- Transport Infrastructure Irelands (TII) (formerly National Roads Authority (NRA)) 'Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1' (hereafter referred to as the TII Noise Guidelines 2004) (TII, 2004);
- TII's 'Good Practice Guide for the Treatment of Noise during the Planning of National Road Schemes (hereafter referred to as the TII Noise Guidelines 2014' (TII, 2014);
- The UK Department of Transport Calculation of Road Traffic Noise (hereafter referred to as CRTN) (UK DoT 1988); and
- National Policy Objective 65 within 'Project Ireland 2040, National Planning Framework' (Government of Ireland, 2018).

In addition to specific noise and vibration guidance documents, the following guidelines were considered and consulted in the preparation of this chapter:

- EPA's draft 'Guidelines on the Information to be contained in Environmental Impact Assessment Reports' (EPA, 2017); and
- EPA's draft 'Advice Notes for Preparing Environmental Impact Statements (hereafter referred to as the Draft EPA Advice 2015)' (EPA, 2015).

12.2.1 Construction Phase Assessment Guidelines

Guidelines relating to construction noise and vibration limits are set out within the TII guidance documents and other relevant national and international documentation for the control of noise and vibration from construction sites. These are discussed in the following sections.

Construction Noise

The TII Noise Guidelines 2004 (TII, 2004) and TII Noise Guidelines 2014 (TII, 2014) guidance documents specify noise levels that are typically deemed acceptable in terms of construction noise for new national roads. These design goals are set out in Table 12-1.

Table 12-1 Maximum Permissible Noise Levels at the Façade of Dwellings during Construction Phase

	Noise Levels (dB re 2 x 10^{-5} Pa)	
Period	**dB $L_{Aeq,1hr}$**	**dB $L_{AS, Max ,1hr}$**
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75
Sundays and Bank Holidays 08:00 to 16:30hrs	60*	65*

*Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the local authority.*

Source: TII 2004

Construction Vibration

Vibration standards are generally split into two categories, those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. For construction phase vibration effects, it is appropriate to consider the magnitude of vibration in terms of Peak Particle Velocity (PPV) for both.

With regards to building response, the TII guidelines outline the following vibration limit values with respect of ensuring that no cosmetic or structural damage occurs to buildings in the vicinity of construction works.

Table 12-2: Allowable Vibration during Road Construction in order to Minimise the Risk of Building Damage

Allowable Vibration Velocity (Peak Particle Velocity) at the Closest Part of Any Sensitive Property to the Source of Vibration, at a Frequency of		
Less than 10 Hz	10 to 50 Hz	50 to 100 Hz
8 mm/s	12.5 mm/s	20 mm/s

Source: TII Noise Guidelines 2004

Humans are particularly sensitive to vibration stimuli and perception of vibration at very low levels may lead to concern. Vibration typically becomes perceptible at around 0.15 to 0.3 mm/s and may become disturbing or annoying at higher magnitudes. However, higher levels of vibration are typically tolerated for single events or events occurring frequently over a short-term period, particularly during construction projects and when the origin of vibration is known. For example, piling can typically be tolerated at vibration levels up to 2.5 mm/s during the daytime and the evening if those affected are aware of the time-frame and origin of the vibration, and if they have been informed about the limit values relating to the structural integrity of neighbouring properties.

12.2.2 Operational Phase Assessment Guidelines

12.2.2.1 TII Noise Guidance Documents

There are no statutory guidelines relating to noise from road schemes in Ireland. In the absence of statutory guidance, the most commonly applied standards are the TII 'Guidelines for the Treatment of Noise and Vibration in National Road Schemes 2004' (TII, 2004) and TII 'Good Practice Guidelines for the Treatment of Noise during the Planning of National Road Schemes', referred to as the TII 2004 Guidelines and the 2014 Noise guidelines respectively within this chapter. Both documents specify that the following absolute noise design for new national road schemes in Ireland is appropriate:

Day-evening-night value of: 60 dB Lden.

This is a free field façade criterion, i.e. does not take account of reflections from building facades.

L_{den} is the 24-hour noise rating level determined by the averaging of the L_{day} with the $L_{evening}$ (plus a 5 dB penalty) and the L_{night} (plus a 10 dB penalty). L_{den} is calculated using the following formula:

$$L_{den} = 10\log\left(\frac{1}{24}\right)\left(12*\left(10^{\frac{L_{day}}{10}}\right)+4*\left(10^{\frac{L_{evening}+5}{10}}\right)+8*\left(10^{\frac{L_{night}+10}{10}}\right)\right)$$

Where:

L_{day} is the A-weighted long-term average sound level as defined in ISO 1996 (2017) Description, measurement and assessment of environmental noise. Part 2: Determination of sound pressure levels, determined over all of the day periods of a year. This is defined as the period between 07:00hrs and 19:00hrs;

$L_{evening}$ is the A-weighted long-term average sound level as defined in ISO 1996-2, determined over all the evening periods of a year. This is defined as the period between 19:00hrs and 23:00hrs; and

L_{night} is the A-weighted long-term average sound level as defined in ISO 1996-2:2017, determined over all the night periods of a year. This is defined as the period between 23:00hrs and 07:00 hrs.

The average sound levels are based on the $L_{Aeq,T}$ parameter. This is the equivalent continuous sound level. It is a type of average and is used to describe a fluctuating noise in terms of a single noise level over the sample period (T).

The following three conditions must be satisfied under the TII guidelines for noise mitigation to be provided:

(a) the combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal of 60 dB L_{den};

(b) the relevant noise level is at least 1 dB more than the predicted traffic noise level without the proposed road scheme in place; and

(c) the contribution to the increase in the relevant noise level from the proposed road scheme is at least 1 dB.

The TII Noise Guidelines 2014 (TII, 2014) recognise that "*in some cases the attainment of the design goal may not be possible by sustainable means*". The guidance also notes that the benefit gained by the insertion of an environmental noise barrier is limited and notes that caution should be exercised specifying substantial screening where small benefits (<3 dB) are only achieved, given a change of 3 dB(A) "*is the smallest change that would give a reliable difference in public response*".

The Proposed Road Development under consideration is a partial realignment of national secondary road and hence the design goal and assessment methodology set out in the TII 2004 and 2014 guidelines for the assessment of potential noise impacts are directly applicable.

The noise design goal is applied to existing receptors and those included in permitted planning projects in respect of both the assumed Year of Opening and the Design Year, typically 15 years after the projected year of opening. In the case of this Proposed Road Development, a commencement year of 2023 and a future Design Year of 2039 have been assessed.

12.2.2.2 Galway County Council Noise Action Plan (2018 - 2023)

The Galway County Council Noise Action Plan (NAP) relates to the management of environmental noise in accordance with the Environmental Noise Directive (END) (2002/49/EC). The purpose of the Action Plan is to manage and reduce, where necessary, environmental noise through the adoption of the action plans. The NAP includes the following onset noise levels for assessment of noise management measures, based on Guidance from the EPA:

- 70 dB $L_{den;}$ and
- 57 dB $L_{night.}$

Where locations are identified to be exposed to traffic noise levels above these thresholds during the noise mapping process, they would form part of a priority decision support matrix which takes into account factors such as the noise exposure level, type of noise receptor, the type of noise source and the number of people affected. It enables a number of different factors to be examined and facilitates the assessment of the relative importance of each. Noise mitigation or management is then considered where necessary, feasible and cost effective.

With respect to road traffic noise for new national road schemes, the NAP refers to the TII guidelines for noise with respect to setting operational noise design goals.

In the case of GCC, noise due to road traffic sources from sections of roads with a traffic flow threshold above 3 million vehicle trips per annum were mapped in terms of the L_{den} and the L_{night} parameter in accordance with the third round of noise mapping studies within Europe. This relates to traffic flows for the year 2016 in line with the third mapping round. There are no sections of the N63 within GCC that exceeded this traffic volume and hence, the N63 has not been mapped as part of third round of GCC's NAP.

12.3 Methodology

12.3.1 Study Area

The study area for the noise and vibration impact assessment is focused on the areas likely to be affected by the operation of the Proposed Road Development. This includes noise/vibration sensitive locations along the proposed alignment in addition to those in proximity to existing roads in the vicinity of the Proposed Road Development.

12.3.2 Determination of the Baseline Environment

A baseline noise study has been undertaken within the study area in order to provide a context of the typical noise environment and to determine the main contributors to the existing environment. The surveying was completed in accordance with relevant guidance and standards including:

- Guidelines for the Treatment of Noise and Vibration in National Road Schemes (TII, 2004);
- Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes (TII, 2014);
- Calculation of Road Traffic Noise Shortened Measurement Procedure (CRTN, 1988); and
- ISO 1996-2: 2017 Acoustics – Description, Measurement and Assessment of Environmental Noise – Part 2 Determination of sound pressure levels.

12.3.2.1 Survey Locations

Survey locations were chosen to represent noise levels at the closest noise sensitive locations to the Proposed Road Development. The survey comprised two unattended monitoring stations and five attended monitoring locations along the length of the Proposed Road Development and at properties along existing roads in the vicinity. The monitoring positions are described in Table 12-3 and illustrated in Figure 12-1.The two unattended locations were selected on the basis that they are closest houses to the Proposed Road Development and at a distance from existing road noise.

Table 12-3 Noise Survey Locations

Location	Survey Type	Description of Survey Location
UN1	Unattended	To the rear of a house on the north side of the existing N63
UN2	Unattended	To the side of a house along the L6159 which lies to the north of the Proposed Road Development
AT1	Attended	In a car parking area to the front of houses in Abbeyknockmoy at the west end of the Proposed Road Development
AT2	Attended	Near the road edge by a house close to the proposed tie-in by the proposed roundabout.
AT2a	Attended	Alternate position near AT2 used for the 2nd and 3rd measurements
AT3	Attended	At a gate entrance opposite a house along the exiting N63.
AT4	Attended	To the front of the house where unattended measurement location UN1
AT5	Attended	In a car parking area next to Abbeyknockmoy Community Centre at a distance representative of the rear façade of a house to the east.
AT6	Attended	At the front boundary of a house to the north of the Proposed Road Development along the L6234

Figure 12-1 Noise Survey Locations

12.3.2.2 Survey Periods

Attended surveys were undertaken during the following periods:

- AT1 to AT5 on 21 January 2021 between 08:50 to 14:51 hrs.

Unattended surveys were undertaken during the following periods:

- UN1 between 10:25 hrs on 21 January to 10:25 hrs on 22 January 2021; and
- UN2 between 09:50 hrs on 21 January to 10:15 hrs on 22 January 2021.

The weather during the attended survey period was dry with varying cloud cover and temperatures in the range 2 to 6 degrees Celsius. Wind speeds were 0 to 2 m/s and as such they were not considered to have had a detrimental effect on the noise measurements.

12.3.2.2.1 Unattended Noise Surveys

The unattended noise surveys (UN1 & UN2) were conducted using Rion NL52 Sound Level Meters with Environmental Outdoor Kits. The measurement apparatus was calibrated before and after the survey using a Brüel & Kjær Type 4231 Sound Level Calibrator. The results were saved to the instrument memory for later analysis.

The L_{den} value from this monitoring data set is derived directly from the measured L_{Aeq} values using the formula presented in Section 12.2.2.1.

The timing of the unattended noise survey was selected to avoid weather conditions unsuitable for noise surveys, (i.e. wind and rain).

12.3.2.2.2 Attended Noise Surveys

Attended measurements were performed using a Rion NL52 Sound Level Meter. Measurements were conducted at five survey locations on a cyclical basis. Sample periods were 15 minutes. The results were noted onto a Survey Record Sheet immediately following each sample and were also saved to the instrument memory for later analysis where appropriate. Survey personnel noted all primary noise sources contributing to noise build-up.

The survey work was conducted in accordance with the short-term measurement procedure as specified in the TII noise guidance documents. When surveying traffic noise, the acoustical parameters of interest are the $L_{Aeq(T)}$, $L_{A10(T)}$ and $L_{A10(18hour)}$, expressed in terms of decibels (dB) relative to 2×10^{-5} Pa.

The value of $L_{A10(T)}$ is the noise level exceeded for just 10% of the time over a representative time period within a sample hour period. $L_{A10(18hour)}$ is the arithmetic average of the values of $L_{A10(T)}$ for each of the one-hour periods between 06:00 and 24:00hrs. $_{LA10(18hour)}$ is the parameter typically used for the purposes of assessing traffic noise.

The shortened measurement procedure involves a method whereby $L_{A10(18hour)}$ and L_{den} values are obtained through a combination of measurement and calculation as follows:

- Noise level measurements are undertaken at the chosen location over three consecutive hours between 10:00 and 17:00hrs;
- The duration of the sample period during each hour is selected to encompass sufficient traffic flows to ensure reliable results; and
- The $L_{A10(18hour)}$ for the location is derived by subtracting 1 dB from the arithmetic average of the three hourly sample L_{A10} values, i.e.
  - $L_{A10(18hour)} = ((\sum L_{A10(15\ minutes)}) \div 3) - 1$ dB; and
  - The derived L_{den} value is calculated from the $L_{A10(18hour)}$ value, i.e.
  - $L_{den} = 0.86 \times L_{A10(18hr)} + 9.86$ dB.

12.3.2.3 Survey Parameters

The survey results are presented in terms of the following parameters.

$L_{Aeq,T}$ is the A-weighted equivalent continuous steady sound level during the sample period and effectively represents an average value. T relates to the sample duration.

$L_{A10,T}$ is the A-weighted sound level that is exceeded for 10% of the sample period; this parameter gives an indication of the upper limit of fluctuating noise such as that from road traffic. T relates to the sample duration.

12.3.3 Determination of Sensitive Receptors

The study area was examined to identify the distribution of noise and/or vibration sensitive receptors and to determine the location of noise-sensitive locations. In this context, noise-sensitive locations are defined as:

- Private residential houses;
- Education establishments (primary schools, secondary schools, college and university buildings);
- Hospitals/Medical facilities;
- Amenity areas with noise sensitivity (camping areas, golf clubs, parks, fishing areas etc.); and
- Religious buildings.

12.3.4 Describing Potential Effects

Effects on the noise environment are described using terms provided in the EPA 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (hereafter referred to as the 'EPA draft guidelines') (EPA, 2017). The process to describe potential effects is presented in Chapter 01 Introduction. As almost all of the 37 noise-sensitive locations considered in this noise assessment are residential dwellings, and along with Abbeyknockmoy School (ref. H32 and H33), they belong to the 'high' sensitivity category as described in the EPA draft guidance (EPA 2017). There are two locations of 'medium' sensitivity H30 and H31 representing Abbeyknockmoy Community Centre.

In the absence of any Irish guidelines or standards relating to describing the effects associated with changes in noise levels as a result of the Proposed Road Development, reference has been made to the DMRB Noise and Vibration document (Highways England, 2020).

Specific assessment criteria on the magnitude of effects and requirements for mitigation are outlined in the following sections.

12.3.4.1 Construction Phase

The construction phase of the Proposed Road Development will involve predominately ground-breaking, earthworks and earthworks haulage, drainage works, construction of drainage ponds and surfacing works, as well as the movement of machinery and materials within and to and from the construction compounds and along local roads.

A variety of items of plant will be in use during these construction works, all of which have the potential to generate high levels of noise and potential levels of perceptible vibration. These will include breakers, excavators, dump trucks, and generators in addition to general road surfacing and levelling equipment.

Chapter 04 'Description of the Proposed Road Development' provides a full description of the proposed construction phasing and works for the Proposed Road Development.

In general, road building works by their nature are transient in nature as the works progress along the length of the route of the Proposed Road Development. This includes excavation and fill works, structures, and road completion works. Site compounds will be set up typically at the commencement of the works and remain in place until all construction in the area is completed.

The potential noise and vibration impacts associated with this phase are set out within Section 12.6.1.

12.3.4.2 Operational Phase

The operational phase will involve a partial realignment of national secondary road and junctions as part of the Proposed Road Development. The Proposed Road Development will introduce traffic noise to areas which are not currently exposed to any significant level of road traffic, particularly at properties set back from existing local roads. The character of the noise environment will be altered at properties where intermittent traffic forms part of the noise environment to a more continual source of noise as a result of the operational phase. In addition to the above, the Proposed Road Development will divert traffic flows from sections of the existing roads and hence will result in a reduction in traffic noise along sections of these roads once operational.

The operational phase will be of long-term duration and will alter the existing noise environment at properties in proximity to the Proposed Road Development and along existing roads to different extents.

The potential impacts associated with this phase are set out within Section 12.6.2.

12.3.5 Significance of Effect

As outlined in Chapter 01 Introduction, once the description of the effect, including quality, probability, magnitude, character and duration has been identified, this can, with the use of professional judgement, be cross-referenced with the importance of the sensitivity of the receptor to conclude the overall significance of effect as per the EPA draft guidelines (EPA, 2017). However, as outlined earlier, in the absence of any Irish guidelines or standards relating to describing the significance of effects associated with changes in noise levels as a result of the Proposed Road Development, reference has been made to the DMRB Noise and Vibration document (UKHA, 2020).

As mentioned above, all but two of the 37 noise-sensitive locations belong to the ‘high’ sensitivity category.

12.3.5.1 Construction Phase

Construction Traffic

In the absence of any Irish guidelines or standards relating to describing the effects associated with changes in road traffic noise levels, reference has been made to the DMRB Noise and Vibration document (UKHA, 2020). This document provides magnitude rating tables relating to changes in road traffic noise. The document suggests that for construction traffic, the magnitude of impacts is assessed over the ‘short term[1]’ using the magnitude of impact ratings in Table 12-4.

Table 12-4 Magnitude of Impact Relating to Changes in Road Traffic Noise Level – Construction Phase

Magnitude of Impact – Short Term	Increase in Traffic Noise Level (dB)
Major	Greater than or equal to 5
Moderate	Greater than or equal to 3.0 and less than 5.0
Minor	Greater than or equal to 1.0 and less than 3.0
Negligible	Less than 1.0

Source: DMRB Noise and Vibration (Highways England, 2020)

Vibration

Table 12-5 presents the significance relating to potential impacts to building occupants during construction based on guidance from BS 5228 – 2 (BSI 2009 + A1 2014b) and the related significance ratings from the EPA draft guidelines (EPA, 2017).

[1] Short term has been defined as “Noise change based on parallel assessment year (for example DMOY against Do-Something Opening year scenario (DSOY)) (UKHA, 2020).

Table 12-5 Human Response Vibration Significance Ratings

Criteria	Impact Magnitude	Significance Rating
>10 mm/s PPV	Very High	Very Significant
>1 mm/s PPV	High	Moderate to Significant
>0.3 mm/s PPV	Medium	Slight to Moderate
>0.14 mm/s PPV	Low	Not Significant to Slight
Less than 0.14 mm/s PPV	Very Low	Imperceptible to Not Significant

Source: BS 5228-2 (BSI 2009 +A1 2014b) & Draft EPA Guidelines (EPA 2017)

12.3.5.2 Operational Phase

Evaluation of Potential Noise Impacts

There are no guidelines in Ireland for assigning significance criteria for new road developments. The TII Guidance for noise does not prescribe a methodology for evaluating the magnitude or significance of road traffic noise from a new road development. A criterion based on the absolute noise levels is used as a threshold value above which noise mitigation measures are to be provided, assuming the 3 conditions for noise mitigation are met. The 60 dB L_{den} design goal takes into consideration the alignment of the majority of new national roads in Ireland across a range of different environments including rural, semi-rural, suburban and urban locations.

In order, therefore, to evaluate the potential significance of the noise levels associated with the operation of the Proposed Road Development, professional judgement needs to give consideration to issues such as the absolute level of noise, the magnitude of change in noise levels at a given location and the receptor sensitivity.

Magnitude of Change

In the absence of any Irish guidelines or standards relating to describing the effects associated with changes in road traffic noise levels, reference has been made to the DMRB Noise and Vibration document (UKHA, 2020). This document provides magnitude rating tables relating to changes in road traffic noise. The document suggests that during the year of opening (the short-term period), the magnitude of impacts between the Do-Minimum and the Do-Something scenarios are likely to be greater compared to the longer-term period when people become more habituated to the change. The document suggests that during the year of opening, the magnitude of impacts between the Do-Minimum and the Do-Something scenarios are likely to be greater compared to the longer-term period when people become more habituated to the source.

This document suggests that changes in noise levels between the Do-Minimum and Do-Something scenarios for the year of Opening are compared and categorised in line with the ‘short term’ table reproduced in Table 12-6. Longer term impacts are assessed by comparing the Do-Minimum noise level calculated for the assumed Opening year against the Do-Something scenario for the Design year (typically 15 years after opening) as reproduced in Table 12-7.

It should be noted the tables below relates to the $L_{A10,18hr}$ parameter as opposed to the L_{den} which is the assessment parameter for road traffic noise in Ireland.

Table 12-6 DMRB Magnitude of Impact Relating to Changes in Road Traffic Noise Level – Operational Phase Short Term

Increase in Traffic Noise Level dB(A)	Magnitude of Impact – Short Term	Significance Rating
Greater than or equal to 5	Major	Significant
Greater than or equal to 3.0 and less than 5.0	Moderate	Significant
Greater than or equal to 1.0 and less than 3.0	Minor	Not Significant
Less than 1	Negligible	Not Significant

Source: DMRB Noise and Vibration (Highways England, 2020)

Table 12-7 DMRB Magnitude of Impact Relating to Changes in Road Traffic Noise Level – Operational Phase Long Term

Increase in Traffic Noise Level, dB(A)	Magnitude of Impact – Long Term	Significance Rating
Greater than or equal to 10	Major	Significant
Greater than or equal to 5.0 and less than 9.9	Moderate	Significant
Greater than or equal to 3.0 and less than 4.9	Minor	Not Significant
Less than 3	Negligible	Not Significant

Source: DMRB Noise and Vibration (Highways England, 2020)

Receptor Sensitivity

Other considerations relating to the evaluation of impacts is the sensitivity of the receptor under consideration. The following sensitivity (Table 12-8) is proposed for the property types along the route of the Proposed Road Development.

Table 12-8 Classification of Receptor Sensitivity to Noise

Sensitivity of Receptor	Description
High	Residential properties, hospitals, nursing homes, educational buildings (daytime)
Medium	Places of worship, community facilities, amenity areas
Low	Commercial and industrial premises

The noise sensitive receptors assessed along the route of the Proposed Road Development are predominately residential properties. Assessment locations H30 & H31 and H32 & H33 represent the Abbeyknockmoy Community Centre (medium sensitivity) and the Abbeyknockmoy School (high sensitivity) (See Volume 04; Appendix A12-2).

The above information will be used as a basis for evaluating potential noise impacts from the Proposed Road Development.

12.3.6 Operational Phase Noise Model

A computer-based prediction model has been prepared in order to quantify the traffic noise level associated with the operational phase of the Proposed Road Development. This section discusses the methodology behind the noise modelling process and presents the results of the modelling exercise.

12.3.6.1 DGMR Predictor

Proprietary noise calculation software was used for the purposes of this impact assessment. The selected software, DGMR Predictor Version V2021, calculates traffic noise levels in accordance with CRTN and TII guidance.

12.3.6.2 Prediction of Traffic Noise

Noise emissions during the operational phase of the project have been modelled using Predictor in accordance with CRTN and with the application of the relevant conversion factors as detailed in the TII Guidance. The CRTN method of predicting noise from a road scheme consists of the following five elements:

- Divide the road scheme into segments so that the variation of noise within this segment is small;
- Calculate the basic noise level at a reference distance of 10 metres from the nearside carriageway edge for each segment;
- Assess for each segment the noise level at the reception point taking into account distance attenuation and Screening of the source line;
- Correct the noise level at the reception point to take account of site layout features including reflections from buildings and facades, and the size of source segment; and
- Combine the contributions from all segments to give the predicted noise level at the receiver location for the whole road scheme.

12.3.6.3 Input to the Noise Model

The noise model was prepared using 3D road alignment drawings, topographical data, Ordnance Survey mapping and traffic flow data. Traffic flow information in terms of Annual Average Daily Traffic (AADT) and %HGV (Heavy Goods Vehicle) is given in Table 5-6 in Chapter 05 Traffic Analysis for the following scenarios:

- Year 2019 – Do-Minimum Scenario;
- Year 2023 – Do-Minimum Scenario – Proposed Road Development not built;
- Year 2023 – Do-Something with Proposed Road Development;
- Year 2039 – Do-Minimum Scenario – Proposed Road Development not built; and
- Year 2039 – Do-Something with Proposed Road Development.

The speed limit along the length of the Proposed Road Development is modelled at 100 km/h. The AADT values have been broken into 24 hourly periods using the TII standard diurnal profiles. The hourly noise predictions were conducted in accordance with Method A of the TII guidelines.

12.3.6.4 Model Calibration

A road model for the existing adjacent roads was developed using the AADT values provided for the year 2019. Road traffic noise levels were calculated at the baseline unattended noise monitoring positions. The results of the model were used to compare the modelled noise levels against the baseline noise survey data.

The calculated L_{den} results for each of the survey locations are summarised in Table 12-9.

Table 12-9 Calculated versus Baseline noise levels

Baseline Location	Measured Noise Level, dB Lden	Calculated Noise Level, dB Lden	Difference
UN1	55	57	+2 dB
UN2	48	53	+5 dB, See text

The results of the calibration exercise indicate a strong correlation (difference of just 2 dB) between noise levels measured during the baseline survey and those calculated using the 2019 traffic flows at UN1. At UN2, the modelled L_{den} is 5 dB higher than the measured L_{den}. In this instance the location is at a distance of over 200 m from the nearest modelled road in the Baseline Model. The CRTN calculation is conservative at distances of this order of magnitude and therefore the predicted noise levels are similarly conservative.

Variations will always occur between results recorded during a baseline survey and those calculated due to other sources in the environment in addition to the short period over which the surveys are undertaken compared to the calculated noise level which represents a long-term average.

12.4 Limitations and Assumptions

A survey of vibration levels along the corridor of the Proposed Road Development was not undertaken, as levels associated with existing roads would not be expected to be of a magnitude sufficient to cause disturbance to people or structural damage to property. Furthermore, vibration was not perceptible at any of the noise survey locations.

It is noted that the noise survey was undertaken during Covid-19 lockdown conditions and that the primary noise source, i.e. traffic noise, was not at “normal” levels due to reduced traffic flows and activity in the immediate area of the survey locations. Based on a review of traffic count information, it is assumed that traffic noise levels may have been up to 2dB(A) lower than normal conditions.

12.5 Baseline Environment

A baseline noise study has been undertaken within the study area in order to provide a context of the typical noise environment and to determine the main contributors to the existing environment. The surveying was completed in accordance with relevant guidance and standards discussed in Section 12.2.

12.5.1 Results of Noise Surveys

Table 12-10 and Table 12-11 summarise the results of the baseline noise survey. Full survey results for the unattended surveys conducted at Locations UN1 and UN2 are graphed in Volume 04; Appendix A12-1.

The results of the survey have indicated the existing noise environment at locations in the vicinity of the Proposed Road Development and set back from the existing N63 road were measured in the range 48 to 55 dB $L_{den,}$ the higher value being recorded at UN1 located to the rear of a house on the north side of the existing N63.

Noise levels at monitoring locations along the existing N63 road were measured in the range of 60 to 71 dB L_{den}.

Road traffic, local activities and general suburban ambient sources all contributed to the ambient noise levels. The range of noise levels measured is considered typical of the environment under assessment.

Table 12-10 Baseline Attended Noise Survey Results

Survey Reference	Location	Start Time	Measured Noise Levels (dB re.2×10-5Pa)		Calculated $L_{A10,18hr}$ dB	Calculated L_{den}, dB	Description of Noise Environment
			LAeq	LA10			
AT1		08:52	66	70	68	68	Local Traffic, distant traffic. Birdsong, dogs barking in distance.
		10:44	64	69			
		13:05	64	68			
AT2		09:09	68	70	71	71	Local Traffic, distant traffic. Birdsong, dogs barking in distance.
		11:32	70	72			
		13:26	72	75			
AT3		09:27	71	70	71	71	Local traffic, distant traffic audible in lulls. Birdsong, dogs barking in distance.
		12:08	73	75			
		13:43	69	71			
AT4		09:46	69	67	71	71	Local traffic, distant traffic audible in lulls. Birdsong, dogs barking in distance.
		11:51	71	74			
		14:00	72	75			
AT5		10:04	54	58	58	60	Local traffic, distant traffic audible in lulls. Birdsong, dogs barking in distance. Running water in stream audible in lulls in traffic noise.
		12:26	57	60			
		14:18	54	58			
AT6		10:30	60	51	49	52	Occasional local traffic, distant traffic audible in lulls. Birdsong, dogs barking in distance.
		12:45	58	49			
		14:36	57	49			

Table 12-11: Baseline Unattended Noise Survey Results

Survey Reference	Location	Date	Measured Noise Levels			Measured Lden, dB	Description of Noise Environment
			L_{day}	$L_{evening}$	L_{night}		
UN1		21 - 22 January 2021	51	48	45	55	Road traffic along existing N63
UN2		21 - 22 January 2021	45	43	40	48	Distant road traffic along N63, light traffic on L6159

12.6 Assessment of Impacts

12.6.1 Construction Phase

A variety of items of plant will be in use, such as excavators, loaders, dumper trucks, generators in addition to vehicular movements to and from the Proposed Road Development site that will make use of existing roads. Due to the nature of the activities undertaken on a road construction site, there is potential for generation of high levels of noise in proximity to the works.

Noise levels associated with construction may be calculated in accordance with methodology set out in BS 5228 – 1 (BSI 2009 + A1 2014a). This standard sets out sound power levels for plant items normally encountered on construction sites, which in turn enables the prediction of noise levels at selected locations. It is often not possible, however, to conduct detailed prediction calculations for the construction phase of a project. This is due to the fact that the programme for construction works has not been established in detail. Under such circumstances, best practice involves the consideration of appropriate mitigation measures to ensure construction activities do not exceed the recommended noise criteria as set out in Table 12-1.

Table 12-12 lists the sound power levels of the plant used for calculation of the expected noise level at various distances from the roadway. Construction noise calculations have been conducted at distances of 10 to 80 m from the works for the main work phases, presented in Table 12-13 to Table 12-15. The calculations assume that plant items are operating for 66% of the time and that all plant items associated with the individual phases are operating simultaneously and at the same distance for any one scenario. A screening correction of 5 dB has been included in the calculations, assuming partial screening from site hoarding along the site works (see Figure F3 in BS 5228 – 1 (BSI 2009 + A1 2014a)).

Table 12-12 Typical Construction Plant Sound Power Noise Levels

Plant Item (BS5228 Ref.)	Sound Power Level, dB(A) re 10^{-12} W
Wheeled loader C2.26	107 OK
Tracked excavator (loading dump truck) (C1.10)	113 OK
Dozer C.2.10	108 OK
Dump Truck Tipping fill (C2.30)	107 OK
Articulated dump truck (dumping rubble) C1-11	108 OK
Tracked excavator (C2.21)	99 OK
vibration rollers (C5.20)	103 OK
Asphalt Paver & Tipping Lorry (C.5.31)	105 OK
Diesel Generator (C4.76)	89 OK
Road Rollers (C5.19)	108 OK
Angle Grinder (C4.93)	108

Source: BS 5228 – 1 (BSI 2009 + A1 2014a)

Table 12-13 Indicative Construction Noise Calculations during Site Clearance and Preparation

Site Clearance & Preparation	Calculated LAeq, T at Distance from Road (m)			
	10 m	25 m	50 m	80 m
Wheeled loader (C2.26)	72	64	58	54
Tracked excavator (loading dump truck) (C1.10)	78	70	64	60
Dozer (C.2.10)	73	65	59	55
Dump Truck (C2.30)	72	64	58	54
Combined L_{Aeq}	81OK	73	67	63

Table 12-14 Indicative Construction Noise Calculations during Excavation and Fill Works

Site Clearance & Preparation	Calculated $L_{Aeq,T}$ at Distance from Road (m)			
	10 m	25 m	50 m	80 m
Tracked excavator (loading dump truck) (C1.10)	78	70	64	60
Articulated dump truck (dumping rubble) (C1.11)	73	65	59	55
Wheeled loader (C2.26)	72	64	58	54
Dozer C.2.10	73	65	59	55
Dump Truck Tipping fill (C2.30)	72	64	58	54
Combined L_{Aeq}	81	73	67	63

Table 12-15 Indicative Construction Noise Calculations During Road Works

Site Clearance & Preparation	Calculated $L_{Aeq,T}$ at distance from road (m)			
	10 m	25 m	50 m	80 m
Tracked excavator (C2.21)	64	56	50	48
Dump Truck (C2.30)	72	64	58	54
vibration rollers (C5.20)	68	60	54	50
Asphalt Paver & Tipping Lorry (C.5.31)	70	62	56	52
Diesel Generator (C4.76)	54	46	40	36
Road Rollers (C5.19)	73	65	59	55
Combined LAeq	77	69	63	59

Table 12-16 Indicative Construction Noise Calculations for Construction Compounds

Site Clearance & Preparation	Calculated $L_{Aeq,T}$ at distance from road (m)			
	10 m	25 m	50 m	80 m
Tracked excavator (C2.21)	64	56	50	46
Dump Truck (C2.30)	72	64	58	54
Angle Grinder (C4.93)	73	65	59	55
Diesel Generator (C4.76)	54	46	40	36
Wheeled Loader Lorry (C2 26)	72	64	58	54
Combined LAeq	77	69	63	59

The results of the assessment have indicated that at distances of beyond 50 m from the works, the construction daytime noise limit of 70 dB L_{Aeq} can typically be complied with for the scenarios assessed. At distances of up to 25 m from the works, there is potential for the noise criterion to be exceeded in the absence of noise mitigation over and above the use of site hoarding. A small number of properties at the eastern and western ends of the Proposed Road Development are within 25 m of the proposed works, and in particular the construction compound at the western end, hence the use of localised screening and the range of best practice mitigation measures set out in Section 12.7 will be employed to ensure the construction noise limits are not exceeded at noise-sensitive locations along the length of the Proposed Road Development.

It should be noted that the calculations set out in the above tables are indicative and are used for the purposes of comparison only with the adopted criteria. Where exceedance of the recommended criteria is expected, the use of noise mitigation measures will be used as part of the construction works.

In conclusion, although the noise from construction will be clearly audible, considering that the predicted noise levels are within the criteria for construction noise for the majority of locations, it is considered that the likely effects on the noise environment will be **negative**, **moderate**, **local**, and **short-term**. As per the EPA draft guidelines (EPA 2017), a moderate effect is "*an effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends*". When construction works are within 25 m of a noise-sensitive location, worst-case noise levels are such that there is the potential for a significant effect.

12.6.1.1 Construction Traffic

Table 5-5 within the Traffic Analysis Chapter presents the expected increase in traffic flows during the construction period as 2.4 to 3.3% of AADT. Considering that in order to increase traffic noise levels by 1 dB, traffic volumes would need to increase by the order of 25%, it is considered that, with reference to Table 12-4, the additional traffic introduced onto the local road network during the construction phase of the Proposed Road Development will not result in a significant noise impact. The resultant noise impact **is neutral, imperceptible** and **short-term**.

12.6.1.2 Construction Vibration

The potential for elevated levels of vibration at neighbouring sensitive locations during construction is typically limited to excavation works, rock-breaking, piling, blasting operations and lorry movements on uneven road surfaces. The more significant of these is the vibration from excavation and rock-breaking operations.

In terms of piling, low vibration methods involving bored or augured piles will be selected over and above percussive type piling, where ground conditions permit. This piling method significantly minimises the levels of both noise and vibration generated as it is a non-percussive piling technique.

For the purposes of this assessment the expected vibration levels during piling have been determined through reference to published empirical data, assuming an augered pile. BS 5228 – 2 (BSI 2009 + A1 2014b), publishes the measured magnitude of vibration of rotary bored piling using a 600 mm pile diameter for bored piling into soft ground over rock, (Table D.6, Ref. No. 106):

- 0.54 mm/s at a distance of 5 m, for auguring;
- 0.22 mm/s at a distance of 5 m, for twisting in casing;
- 0.42 mm/s at a distance of 5 m, for spinning off; and
- 0.43 mm/s at a distance of 5 m, for boring with rock auger.

Considering the low vibration levels at very close distances to the piling rigs, vibration levels at the nearby sensitive buildings are not expected to pose any significance in terms of cosmetic or structural damage in proximity to the development works. In addition, the range of vibration levels is typically below a level which would cause any disturbance to occupants of adjacent buildings.

During rock breaking, there is also potential for vibration to be generated through the ground. Empirical data for this activity is not provided in the BS 5228-2 standard, however the likely levels of vibration from this activity is expected to be significantly below the vibration criteria for building damage on experience from other sites. AWN Consulting have previously conducted vibration measurements under controlled conditions, during trial construction works, on a sample site where concrete slab breaking was carried out. The trial construction works consisted of the use of the following plant and equipment when measured at various distances:

- 3 tonne hydraulic breaker on small CAT tracked excavator; and
- 6 tonne hydraulic breaker on large Liebherr tracked excavator.

Vibration measurements were conducted during various staged activities and at various distances.

Peak vibration levels during staged activities using the 3 Tonne Breaker ranged from 0.25 to 0.48 PPV (mm/s) at distances of 10 to 50 m respectively from the breaking activities. Using a 6 Tonne Breaker, measured vibration levels ranged between 0.24 to 1.49 PPV (mm/s) at distances of 10 to 50 m respectively.

Whilst these measurements relate to a solid concrete slab, the range of values recorded provides some context in relation typical ranges of vibration generated by construction breaking activity.

Notwithstanding the above, any construction activities undertaken on the site will be required to operate below the recommended vibration criteria set out in Table 12-2.

12.6.2 Operational Phase

Free-field traffic noise levels have been predicted at 37 assessment locations in the vicinity of the Proposed Road improvement. The noise assessment locations are displayed in Volume 04; Appendix A12-2.

12.6.2.1 Model Results

The results of the traffic noise predictions are presented in Table 12-17 for the assumed Opening year (2023) and the Design year (2039). The results are compared against the three TII criteria for determining the requirement for noise mitigation discussed in Section 12.2.2. These are re-iterated below for clarity:

a. The combined expected maximum traffic noise level, i.e. the relevant noise level, from the proposed road scheme together with other traffic in the vicinity is greater than the design goal of 60 dB L_{den};

b. The relevant noise level is at least 1 dB more than the expected traffic noise level without the proposed road scheme in place; and

c. The contribution to the increase in the relevant noise level from the proposed road scheme is at least 1 dB.

The associated magnitude of change in road traffic between the Do-Minimum and Do-Something scenarios are presented for the short-term period for the assumed year of Opening and for the long-term period for the design year.

Table 12-17: Assessment of Traffic Noise Levels for Opening and Design Years

Location Ref.	Design Year 2023 Predicted Noise Level Do Minimum L_{den} (dB)	Design Year 2023 Predicted Noise Level Do Something L_{den} (dB)	TII Condition for Noise Mitigation Satisfied? (a)	(b)	(c)	Mitigation Required?	Magnitude of Change Short-term	Design Year 2039 Predicted Noise Level Do Minimum L_{den} (dB)	Design Year 2039 Predicted Noise Level Do Something L_{den} (dB)	TII Condition for Noise Mitigation Satisfied? (a)	(b)	(c)	Mitigation Required?	Magnitude of Change Long-term
H01	64	60	No	No	Yes	No	Moderate Positive	66	62	Yes	No	Yes	No	Minor Positive
H02	65	61	Yes	No	Yes	No	Moderate Positive	66	62	Yes	No	Yes	No	Minor Positive
H03	64	60	No	No	Yes	No	Moderate Positive	65	61	Yes	No	Yes	No	Minor Positive
H04	66	63	Yes	No	Yes	No	Moderate Positive	68	64	Yes	No	Yes	No	Minor Positive
H05	66	63	Yes	No	Yes	No	Moderate Positive	68	64	Yes	No	Yes	No	Minor Positive
H06	66	62	Yes	No	Yes	No	Moderate Positive	67	63	Yes	No	Yes	No	Minor Positive
H07	67	60	No	No	Yes	No	Major Positive	69	61	Yes	No	Yes	No	Moderate Positive
H08	66	58	No	No	Yes	No	Major Positive	67	60	No	No	Yes	No	Moderate Positive
H09	68	61	Yes	No	Yes	No	Major Positive	69	63	Yes	No	Yes	No	Moderate Positive
H10	66	61	Yes	No	Yes	No	Major Positive	67	62	Yes	No	Yes	No	Moderate Positive
H11	58	57	No	No	Yes	No	Minor Positive	60	58	No	No	Yes	No	Negligible
H12	67	63	Yes	No	Yes	No	Moderate Positive	69	65	Yes	No	Yes	No	Minor Positive
H13	65	63	Yes	No	Yes	No	Minor Positive	67	64	Yes	No	Yes	No	Minor Positive
H14	69	65	Yes	No	Yes	No	Moderate Positive	71	66	Yes	No	Yes	No	Moderate Positive
H15	69	65	Yes	No	Yes	No	Moderate Positive	71	66	Yes	No	Yes	No	Moderate Positive

Location Ref.	Design Year 2023 Predicted Noise Level		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Short-term	Design Year 2039 Predicted Noise Level		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Long-term
	Do Minimum L_{den} (dB)	Do Something L_{den} (dB)	(a)	(b)	(c)			Do Minimum L_{den} (dB)	Do Something L_{den} (dB)	(a)	(b)	(c)		
H16	69	64	Yes	No	Yes	No	Major Positive	71	66	Yes	No	Yes	No	Moderate Positive
H17	69	64	Yes	No	Yes	No	Major Positive	71	65	Yes	No	Yes	No	Moderate Positive
H18	66	61	Yes	No	Yes	No	Major Positive	68	63	Yes	No	Yes	No	Moderate Positive
H19	69	62	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H20	69	61	Yes	No	Yes	No	Major Positive	71	63	Yes	No	Yes	No	Moderate Positive
H21	65	58	No	No	Yes	No	Major Positive	66	59	No	No	Yes	No	Moderate Positive
H22	55	60	No	Yes	Yes	No	Major Negative	57	61	Yes	Yes	Yes	Yes	Minor Negative
H23	65	59	No	No	Yes	No	Major Positive	66	60	No	No	Yes	No	Moderate Positive
H24	65	59	No	No	Yes	No	Major Positive	67	60	No	No	Yes	No	Moderate Positive
H25	67	60	No	No	Yes	No	Major Positive	69	61	Yes	No	Yes	No	Moderate Positive
H26	69	61	Yes	No	Yes	No	Major Positive	71	62	Yes	No	Yes	No	Moderate Positive
H27	68	60	No	No	Yes	No	Major Positive	70	61	Yes	No	Yes	No	Moderate Positive
H28	68	60	No	No	Yes	No	Major Positive	70	61	Yes	No	Yes	No	Moderate Positive
H29	71	61	Yes	No	Yes	No	Major Positive	73	63	Yes	No	Yes	No	Major Positive

Location Ref.	Design Year 2023 Predicted Noise Level		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Short-term	Design Year 2039 Predicted Noise Level		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Long-term
	Do Minimum L_{den} (dB)	Do Something L_{den} (dB)	(a)	(b)	(c)			Do Minimum L_{den} (dB)	Do Something L_{den} (dB)	(a)	(b)	(c)		
H30	70	60	No	No	Yes	No	Major Positive	72	62	Yes	No	Yes	No	Major Positive
H31	55	52	No	No	Yes	No	Moderate Positive	56	54	No	No	Yes	No	Negligible
H32	70	59	No	No	Yes	No	Major Positive	72	61	Yes	No	Yes	No	Major Positive
H33	56	52	No	No	Yes	No	Moderate Positive	58	54	No	No	Yes	No	Minor Positive
H34	53	58	No	Yes	Yes	No	Major Negative	54	59	No	Yes	Yes	No	Moderate Negative
H35	51	54	No	Yes	Yes	No	Moderate Negative	52	55	No	Yes	Yes	No	Minor Negative
H36	59	61	Yes	Yes	Yes	Yes	Minor Negative	61	62	Yes	Yes	Yes	Yes	Negligible
H37	60	61	Yes	Yes	Yes	Yes	Minor Negative	61	62	Yes	Yes	Yes	Yes	Negligible

The results of the assessment indicate that during the assumed Opening year, two locations H36 and H37 satisfy the TII requirement for noise mitigation. The same assessment locations are likely to experience a minor change in noise level during the short-term period (≥3 dB). One location, H35, is likely to experience a moderate change (3 to 5 dB) in noise levels. Two locations, H22 and H34 are likely to experience a major change in noise level in the short term (≥5 dB), but as the predicted noise level remains within 60 dB L_{den}, the criteria for mitigation are not met.

During the Design year, three assessment locations (H22, H36 and H37) satisfy the TII requirement for noise mitigation. Two locations, H22 and H35 are likely to experience a minor change in noise levels (3 to 5 dB). One location, H34 is calculated to experience a moderate change in noise level during the long-term period (5 to 9 dB) but the operational noise level of 55dB L_{den} is below the operational design goal of 60 dB L_{den}.

Nine locations (H01, H02, H03, H04, H05, H06, H12, H13 and H33) are likely to experience a minor reduction in road noise levels. Eighteen locations (H07, H08, H09, H10, H14, H15, H16, H17, H18, H19, H20, H21, H23, H24, H25, H26, H27 and H28) are likely to experience a moderate reduction in road noise levels and three locations are likely to experience a major reduction in road noise: H29, H30 and H32.

The mitigation measures proposed to reduce operational noise levels at the three locations discussed above, i.e. H22, H36 and H37 are set out in Section 12.7.2.

The description of the significance of effect for the Proposed Road Development as a whole is assigned using professional judgement, taking a number of factors into account in this instance: the number of locations where noise levels increase, the number of locations where noise levels decrease and the practicality of the mitigation measures. In the Proposed Road Development, with just three locations requiring noise mitigation measures, the majority of locations assessed are predicted to have road traffic noise levels reduced, and the mitigation being relatively straightforward to implement, it is considered that the overall significance of effect is 'slight'. The definition of a 'slight' effect is from the EPA draft guidance (EPA 2017): "*an effect which causes changes in the character of the environment without affecting its sensitivities*".

In conclusion, it is considered that the likely effects on the noise environment will be **negative**, **slight**, **local**, and **long-term.**

12.6.2.2 Operational Vibration

As a vehicle travels along a road, vibration can be generated in the road and subsequently propagate towards nearby buildings. Such vibration is generated by the interaction of a vehicle's wheels and the road surface and by direct transmission through the air of energy waves. Some of these waves arise as a function of the size, shape and speed of the vehicle, and others from pressure fluctuations due to engine, exhaust and other noises generated by the vehicle.

The TII 2004 document notes that ground vibrations produced by road traffic are unlikely to cause perceptible structural vibration in properties located near to well-maintained and smooth road surfaces. Perceptible road traffic vibration can therefore be largely avoided by maintenance of the road surface.

12.7 Mitigation and Monitoring Measures

12.7.1 Construction Phase

The contract documents will clearly specify the construction noise criteria included in this chapter which the construction works must operate within. The Contractor undertaking the construction of the works will be obliged to take specific noise abatement measures and comply with the recommendations of BS 5228 – 1 (BSI 2009 + A1 2014a) and BS 5228 – 2 (BSI 2009 + A1 2014b) and the Noise and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures will ensure that:

- No plant used onsite will be permitted to cause an ongoing public nuisance due to noise;
- The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by onsite operations;
- All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract;

- Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers; and
- Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.

During the course of the construction programme, the contractor will be required to manage the works to comply with the limits detailed in Section 12.2.1 of this chapter. The following sections provide outline guidance on measures to control construction noise, in accordance with BS 5228 – 1 (BSI 2009 + A1 2014a) and BS 5228 – 2 (BSI 2009 + A1 2014b).

12.7.1.1 Selection of Quiet Plant

The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the Proposed Road Development site. The least noisy item of plant will be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative.

For static plant such as compressors and generators used at work areas such as construction compounds etc., the units will be supplied with manufacturers' proprietary acoustic enclosures where possible.

The contractor will evaluate the choice of excavation, breaking or other working method taking into account various ground conditions and site constraints. Where possible, where alternative lower noise generating equipment that will economically achieve, in the given ground conditions, equivalent structural/excavation/breaking results, these will be selected to minimise potential disturbance.

12.7.1.2 General Comments on Noise Control at Source

If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control 'at source'. This refers to the modification of an item of plant, or the application of improved sound reduction methods in consultation with the supplier or the best practice use of equipment and materials handling to reduce noise.

Proposed techniques will also be evaluated in light of their potential effect on occupational health and safety. The following outline guidance relates to practical noise control at source techniques which relate to specific site considerations:

- For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB. Mobile plant will be switched off when not in use and not left idling;
- For percussive tools such as pneumatic concrete breakers or tools a number of noise control measures include fitting a muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed and erection of localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries are other suitable forms of noise reduction;
- For all materials handling, the contractor will ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights;
- Where compressors, generators and pumps are located in areas in close proximity to noise sensitive properties/areas and have potential to exceed noise criterion, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation;
- Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can be controlled by fixing resilient materials in between the surfaces in contact;
- Demountable enclosures could also be used to screen operatives using hand tools and could be moved around site as necessary; and
- All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.

12.7.1.3 Screening

Typically, screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to other forms of noise control. The effectiveness of a noise screen will depend on the height and length of the screen, its mass, and its position relative to both the source and receiver.

The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen will be wrapped around the source.

BS 5228 – 1 (BSI 2009 + A1 2014a) states that on level sites, the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier will be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 10 kg/m^2 will give adequate sound insulation performance. As an example, the use of a standard 2.4 m high construction site hoarding would provide a sufficient level of noise screening once it is installed at a suitable position between the source and receiver.

12.7.1.4 Working Hours

Normal working times will be 07:00 to 19:00 hrs Monday to Friday and 08:00 to 13:00 hrs Saturday. Works other than the pumping out of excavations, security and emergency works will not be undertaken outside these working hours without the written permission of the Contracting Authority.

Works other than the pumping out of excavations, security and emergency works will not be undertaken at night and on Sundays without the written permission of the GCC.

12.7.2 Operational Phase

In order to reduce operational noise levels along the length of the Proposed Road Development mitigation measures through the use of a low-noise road surface have been included. The mitigation measures detailed here are based on the current scheme design. Low-noise road surface in the context of the guidance under which this assessment is prepared refers to a road surface which provides a reduction in noise levels of 2.5 dB(A) when compared to hot rolled asphalt.

The low-noise road surface should extend from the roundabout at the western end of the Proposed Road Development to its eastern end (in both directions). The extent of noise mitigation proposed is illustrated in Figure 12-2. Predicted Noise levels with this low-noise road surface in place are presented in Section 12.8.2.

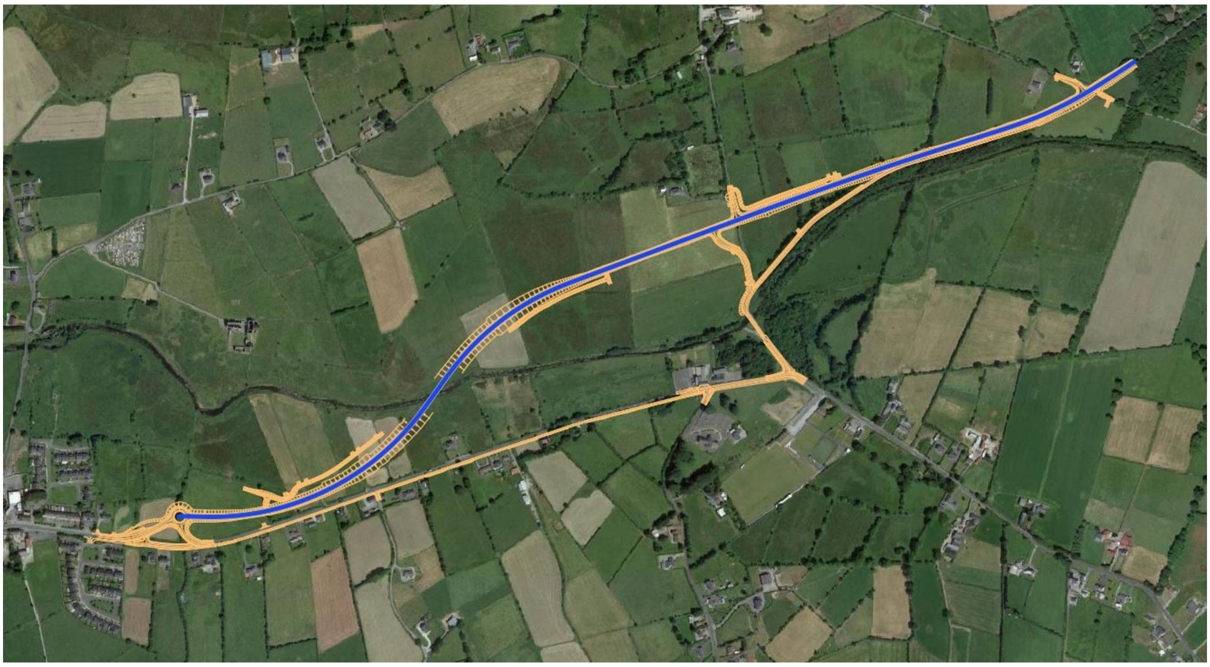

Figure 12-2: Mitigation Measures – Proposed Extent of Low-Noise Road Surface

12.8 Residual Impacts and Effects

12.8.1 Construction Phase

During the construction phase of the Proposed Road Development, there will be **short-term moderate to significant impacts** on nearby residential properties due to noise emissions from site traffic and other activities. The application of noise limits, restricted hours of operation, along with implementation of appropriate noise control measures, will be designed in order to control noise emissions to within the noise limits for this phase.

In conclusion, it is considered that the likely residual effects on the noise environment will be **negative, moderate, local,** and **short-term** for the majority of locations. However, where construction works are taking place within 25 m of a noise-sensitive location, worst-case noise effects have the potential to be **negative, significant, local a**nd **short-term.**

12.8.2 Operational Phase

The residual impacts of the Proposed Road Development have been assessed taking into account the recommended noise mitigation measures set out in Section 12.7.2. Table 12-18 presents the residual noise impacts taking into account the proposed mitigation measures for noise.

Table 12-18: Assessment of Traffic Noise Levels for Opening and Design Years, With Mitigation

Location Ref.	Design Year 2023 Predicted Noise Level Do Minimum L_{den} (dB)	Do Something L_{den} (dB)	TII Condition for Noise Mitigation Satisfied? (a)	(b)	(c)	Mitigation Required?	Magnitude of Change Short-term	Design Year 2039 Predicted Noise Level Do Minimum L_{den} (dB)	Do Something L_{den} (dB)	TII Condition for Noise Mitigation Satisfied? (a)	(b)	(c)	Mitigation Required?	Magnitude of Change Long-term
H01	64	60	No	No	Yes	No	Moderate Positive	66	62	Yes	No	Yes	No	Minor Positive
H02	65	61	Yes	No	Yes	No	Moderate Positive	66	62	Yes	No	Yes	No	Minor Positive
H03	64	60	No	No	Yes	No	Moderate Positive	65	61	Yes	No	Yes	No	Minor Positive
H04	66	63	Yes	No	Yes	No	Moderate Positive	68	64	Yes	No	Yes	No	Minor Positive
H05	66	63	Yes	No	Yes	No	Moderate Positive	68	64	Yes	No	Yes	No	Minor Positive
H06	66	61	Yes	No	Yes	No	Major Positive	67	63	Yes	No	Yes	No	Minor Positive
H07	67	59	No	No	Yes	No	Major Positive	69	61	Yes	No	Yes	No	Moderate Positive
H08	66	58	No	No	Yes	No	Major Positive	67	59	No	No	Yes	No	Moderate Positive
H09	68	60	No	No	Yes	No	Major Positive	69	62	Yes	No	Yes	No	Moderate Positive
H10	66	60	No	No	Yes	No	Major Positive	67	61	Yes	No	Yes	No	Moderate Positive
H11	58	55	No	No	Yes	No	Moderate Positive	60	57	No	No	Yes	No	Minor Positive
H12	67	62	Yes	No	Yes	No	Major Positive	69	63	Yes	No	Yes	No	Moderate Positive
H13	65	61	Yes	No	Yes	No	Moderate Positive	67	62	Yes	No	Yes	No	Moderate Positive
H14	69	63	Yes	No	Yes	No	Major Positive	71	65	Yes	No	Yes	No	Moderate Positive
H15	69	63	Yes	No	Yes	No	Major Positive	71	65	Yes	No	Yes	No	Moderate Positive
H16	69	63	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H17	69	62	Yes	No	Yes	No	Major Positive	71	64	Yes	No	Yes	No	Moderate Positive
H18	66	60	No	No	Yes	No	Major Positive	68	61	Yes	No	Yes	No	Moderate Positive

Location Ref.	Design Year 2023 Predicted Noise Level		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Short-term	Design Year 2039 Predicted Noise Level		TII Condition for Noise Mitigation Satisfied?			Mitigation Required?	Magnitude of Change Long-term
	Do Minimum	Do Something						Do Minimum	Do Something					
	L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)			L_{den} (dB)	L_{den} (dB)	(a)	(b)	(c)		
H19	69	61	Yes	No	Yes	No	Major Positive	71	63	Yes	No	Yes	No	Moderate Positive
H20	69	61	Yes	No	Yes	No	Major Positive	71	62	Yes	No	Yes	No	Moderate Positive
H21	65	57	No	No	Yes	No	Major Positive	66	59	No	No	Yes	No	Moderate Positive
H22	55	58	No	Yes	Yes	No	Moderate Negative	57	59	No	Yes	Yes	No	Negligible
H23	65	58	No	No	Yes	No	Major Positive	66	59	No	No	Yes	No	Moderate Positive
H24	65	58	No	No	Yes	No	Major Positive	67	59	No	No	Yes	No	Moderate Positive
H25	67	59	No	No	Yes	No	Major Positive	69	61	Yes	No	Yes	No	Moderate Positive
H26	69	60	No	No	Yes	No	Major Positive	71	62	Yes	No	Yes	No	Moderate Positive
H27	68	59	No	No	Yes	No	Major Positive	70	61	Yes	No	Yes	No	Moderate Positive
H28	68	59	No	No	Yes	No	Major Positive	70	61	Yes	No	Yes	No	Moderate Positive
H29	71	61	Yes	No	Yes	No	Major Positive	73	63	Yes	No	Yes	No	Major Positive
H30	70	60	No	No	Yes	No	Major Positive	72	62	Yes	No	Yes	No	Major Positive
H31	55	50	No	No	Yes	No	Major Positive	56	52	No	No	Yes	No	Minor Positive
H32	70	59	No	No	Yes	No	Major Positive	72	61	Yes	No	Yes	No	Major Positive
H33	56	50	No	No	Yes	No	Major Positive	58	52	No	No	Yes	No	Moderate Positive
H34	53	56	No	Yes	Yes	No	Moderate Negative	54	57	No	Yes	Yes	No	Minor Negative
H35	51	52	No	Yes	Yes	No	Minor Negative	52	53	No	Yes	Yes	No	Negligible
H36	59	58	No	No	Yes	No	Minor Positive	61	60	No	No	Yes	No	Negligible
H37	60	59	No	No	Yes	No	Minor Positive	61	60	No	No	Yes	No	Negligible

The assessment has determined that with the inclusion of the recommended noise mitigation measures, traffic noise levels associated with the Proposed Road Development, combined with traffic along the adjacent surrounding roads, will be sufficiently reduced such that the TII conditions for noise mitigation are not satisfied at the noise assessment locations during both assessment years.

The related potential noise impacts during the two assessment years are summarised in the following sections.

12.8.2.1 Evaluation of Residual Impacts

The previous section presents the residual noise levels once noise mitigation has been included along the length of the Proposed Road Development. With the inclusion of the noise mitigation measures, noise levels are at or below the TII operational noise design goal of 60dB L_{den} at all assessment locations.

In line with the methodology outlined in Section 12.3.5.2, in order to evaluate the significance of noise impacts, the following approach has been undertaken:

- Baseline noise levels (or Calculated Do-Minimum noise levels where road traffic dominates) are compared against the calculated Do-Something noise levels to determine the increase in noise levels;
- The significance of change is assigned to each location based on the magnitude of change ratings from the DMRB short term table (Year of Opening) and long-term table (Design Year); and
- The significance of the Proposed Road Development as a whole is assigned using professional judgement.

Table 12-19 summarises the number of properties categorised within each rating band for the assumed year of Opening and the Design Year, based on the DMRB assessment tables only.

Table 12-19 Change in noise levels with Mitigation Measures

Short-Term Impacts – Year of Opening			Long-Term Impacts - Design Year		
Noise Change, dB	**Magnitude**	**No of Assessment Locations**	**Noise Change, dB**	**Magnitude**	**No of Assessment Locations**
0	No Change/Reduction	34	0	No Change/Reduction	32
0.1 to 0.9	Negligible	None	0.1 to 2.9	Negligible	4
1 to 2.9	Minor	1	3 to 4.9	Minor	1
3 to 4.9	Moderate	2	5 to 9.9	Moderate	None
5 or more	Major	None	10 or more	Major	None
Total		37			37

During the assumed Year of Opening (2023), it is concluded that two assessment locations will experience a ‘Moderate’ short-term noise impact, which relates to any noise increase from 3 to 4.9 dB. One location will experience a ‘Minor’ noise impact as a result of the change in the noise environment. At the remaining locations, the impacts are categorised as ‘No Change/Reduction’.

During the Design Year of 2039, it is concluded that one assessment location will experience a ‘Minor’ long-term noise impact in accordance with the DMRB, which relates to any noise increase from 3 to 4.9 dB. Four locations will experience a ‘Negligible’ noise impact. At the remaining locations, the impacts are categorised as ‘No Change/Reduction’. Assessment locations where a reduction in noise levels is calculated relate to properties along the existing road network where traffic volumes will be reduced as a result of the Proposed Road Development.

Summary of Residual Impacts

Taking into account the proposed noise mitigation measures, the calculated residual noise levels, the increases in noise levels, the impact of the residual noise impacts associated are determined as follows:

- Operational noise levels have been designed to not exceed the TII design goal of 60dB L_{den} at all the noise sensitive locations along the Proposed Road Development;
- No assessment locations are predicted to experience a ‘Major’ change in noise level; and
- Taking into account the residual reduction in predicted noise levels at 32 of the 37 locations assessed and the magnitude of change (negligible to minor in the long term) in noise levels predicted at the 5 locations which are predicted to experience an increase in noise levels, it is considered that the likely effects on the noise environment will be **negative, of slight significance, local, and long-term**.

12.9 Do-Nothing Scenario

In the absence of the Proposed Road Development being constructed, the noise environment at the nearest noise sensitive locations will remain largely unchanged resulting in a neutral and local impact in the long-term. Noise levels will increase gradually in line with traffic growth, as presented in the Do Nothing scenarios in Table 12-16.

12.10 Cumulative Impacts and Effects

Based on the review of Volume 04; Appendix A1-1, there are no other planning applications of scale in the study area that has cumulative construction or operational implications in terms of noise impact. A cumulative assessment is therefore not considered necessary in this instance.

12.11 Summary

In summary:

- Noise and vibration from the Proposed Road Development has been assessed according to the guidance and methodology presented in Section 12.3;
- A baseline noise survey was undertaken to measure existing traffic noise levels at the closest properties within the study area. The results of the baseline survey confirm that properties along the existing road network experience traffic noise levels above 60 dB L_{den}. At properties located along the alignment of the Proposed Road Development, ambient noise levels are below 60 dB L_{den} and are influenced by traffic along surrounding roads and local traffic movements and environmental sources (bird song, foliage rustle etc.);
- Indicative calculations have been made to estimate the range of likely noise levels during the construction phase of the project. The application of noise limits, restricted hours of operation, along with implementation of appropriate noise control measures, have indicated that the construction noise impact will be short-term moderate to major impact. Therefore, it is considered that the likely residual effects on the noise environment will be negative, moderate to significant, local, and short-term;
- Road traffic noise levels were predicted at 37 assessment locations within the study area using the projected traffic flows for the two assessment years. It was determined that mitigation will be required to reduce traffic noise levels at three locations;
- Noise mitigation in the form of a low-noise road surface has been proposed and modelled to reduce traffic noise levels to within the TII design goal of 60 dB L_{den}. With the proposed mitigation measures in place, calculated noise levels are reduced for both assessment years to within the design goal at the relevant assessment locations;
- The assessment has determined that once operational, the noise impact associated with the Proposed Road Development will result in a varying degrees of impact, from negligible to major in the long term. A number of locations will experience a positive noise impact as the Proposed Road Development is at a greater distance than the existing road; and
- Taking into account the residual reduction in predicted noise levels at 32 of the 37 locations assessed and the magnitude of change (negligible to minor in the long term) in noise levels predicted at the 5 locations which are predicted to experience an increase in noise levels. It is considered that the likely effects on the noise environment will be **negative, of slight significance, local, and long-term**.

12.12 References

- British Standard Institute (BSI) British Standard (BS) 5228 (2009 +A1 2014) Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise (hereafter referred to as BS 5228 – 1) (BSI 2009 + A1 2014a);
- BS 5228 (2009 +A1 2014) Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration (hereafter referred to as BS 5228 – 2) (BSI 2009 + A1 2014b);
- BS 5228: Part 1. (2009). and the European Communities Noise Emission by Equipment for Use Outdoors) Regulations, 2001.
- Highways England. (2020). *Design Manual for Roads and Bridges (DMRB) LA 111 Sustainability & Environmental Appraisal. Noise and Vibration Rev 2*;
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- TII. (2014). *Good Practice Guide for the Treatment of Noise during the Planning of National Road Schemes*, Transport Infrastructure Ireland.
- UK`s Department of Transport. (1988). Calculation of Road Traffic Noise (CRTN).
- National Standards Authority of Ireland (2017) I.S. EN 1793-1:2017 *Road Traffic Noise Reducing Devices - Test Method For Determining The Acoustic Performance - Part 1: Intrinsic Characteristics Of Sound Absorption Under Diffuse Sound Field Conditions*
- National Standards Authority of Ireland (2018) I.S. EN 1793-2:2018 *Road traffic noise reducing devices - Test method for determining the acoustic performance - Part 2: Intrinsic characteristics of airborne sound insulation under diffuse sound field conditions*
- National Standards Authority of Ireland (1998) I.S. EN 1793-3:1998 *Road Traffic Noise Reducing Devices - Test Method For Determining The Acoustic Performance - Normalized Traffic Noise Spectrum*
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- National Standards Authority of Ireland (2020) I.S. EN 1794-2:2020 Road traffic noise reducing devices - Non-acoustic performance - Part 2: General safety and environmental requirements
- National Standards Authority of Ireland (2016) I.S. EN 1794-3:2016 *Road Traffic Noise Reducing Devices - Non-Acoustic Performance - Part 3: Reaction To Fire - Burning Behaviour Of Noise Reducing Devices And Classification*

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report

Chapter 13: Landscape and Visual

Galway County Council

February 2022

Table of Contents

Figures

Tables

Plates

Volume 03 Figures

Volume 04 Appendices

13. Landscape and Visual

13.1 Introduction

This chapter presents an assessment of the impacts of the Proposed Road Development on landscape and visual aspects. It defines the study area, the methodology used for developing the baseline and impact assessment. It also provides a description of the baseline environment in relation to landscape and visual aspects and presents the findings of the impact assessment.

13.2 Legislation, Policy, and Guidance

This Landscape and Visual Impact Assessment (LVIA) has been undertaken with regards to best practice as outlined within the following guidelines, planning legislation and information sources:

The Transport Infrastructure Ireland (TII) guidance in particular promotes consistency in the approach to landscape assessment of road projects, including the effects on landscape character and on views from sensitive visual receptors. Defined as a consequential process, the assessment methodology for landscape and visual effects, detailed within the standards documents, has been used to inform this assessment.

The assessment has also been supported by using guidance from the Landscape Institute (LI) and Institute of Environmental Management and Assessment (IEMA) ‘Guidelines for Landscape and Visual Impact Assessment’ (2013), 3rd Edition; hereafter referred to as the GLVIA.

The Galway County Development Plan 2015-2021 was still current at the time of writing this assessment (June/July 2021). The Draft Galway County Development Plan 2022-2028 has been reviewed for information but has not been considered further due to its draft status.

Other sources used to inform the assessment include:

- TII: Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads - Standard, PE-ENV-01102, December 2020;
- TII: Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Specified Infrastructure Projects – Overarching Technical Document, PE-ENV-01101, December 2020;
- TII: Project Management Guidelines, PE-PMG=02041, December 2020;
- TII: The Treatment of Transition Zones to Towns and Villages on National Roads, DN-GEO-03084, July 2021;
- EPA: “Guidelines on the information to be contained in Environmental Impact Assessment Reports”, Draft, August 2017;
- LI/IEMA: Guidelines for Landscape and Visual Impact Assessment (GLVIA), 2013, 3rd Edition;
- Galway County Development Plan 2015-2021;
- Draft Galway County Development Plan 2022-2028;
- National Parks and Wildlife Service (NPWS), http://www.npws.ie/;
- Irishtrails, https://www.sportireland.ie/outdoors/find-your-trails;
- National Monuments Service, Archaeological Survey of Ireland,
- https://webgis.archaeology.ie/NationalMonuments/WebServiceQuery/Lookup.aspx; and
- Ordnance Survey Ireland, 1:50,000 Discovery Mapping.

13.3 Methodology

The Proposed Road Development will involve the modification and realignment of an existing road through an area of open grassland and agricultural fields. The type and duration of the landscape and visual effects fall within two main stages as follows:

- Construction (temporary and of a short duration)
  - Potential physical effects arising from construction of the development on the landscape resource within the development application boundary area;
  - Potential effects to landscape character or visual amenity within the wider study area as a result of visibility of construction activities or the development during construction;
  - Effects of temporary site infrastructure such as – site traffic; construction compounds; and
  - Potential effects of partially built development in various stages of construction.
- Operational
  - Potential effects of the Proposed Road Development on landscape character considers how the introduction of new landscape elements physically alters the landform, landcover, landscape pattern and perceptual attributes of the site or how visibility of the proposals changes the way in which the landscape character is perceived;
  - Potential effects of the Proposed Road Development on views and visual receptors; and
  - Potential cumulative effects of the development in combination with other planned and Proposed Road Developments of a similar type and scale upon the landscape and visual resource of the study area.

The proposed construction of the new road corridor and associated mitigation will become a long-term feature of the landscape along the Abbert River valley and eastern fringes of Abbeyknockmoy village. The assessment takes account of this in the determination of residual visual effects.

Galway County landscape designations have been reviewed as part of this assessment. However, given the nature of the development, its location, scale and setting, it is considered that likely significant effects will occur within the locality of Abbeyknockmoy and will not affect the broader description of the county Landscape Character Assessment (LCA) classification within which the scheme lies.

13.3.1 Study Area

A study area radius of 1.5 km from the boundary of the Proposed Road Development has been selected to identify potential significant landscape and visual effects (refer to Volume 03; Figure 13-1 – Landscape Designations). The extent of the study area has been defined via a combination of a desktop survey including a review of maps and aerial photographs of the development site and a site survey.

The study area was defined to an area where landscape and visual effects could potentially be significant rather than defining the extend of the visibility of the Proposed Road Development. Given the nature of road works, the visual extent in reality is often far less than 1.5 km, and significant effects are mainly confined to the Abbert River valley – which is neither wide nor deep at this location – therefore much of the viewshed is confined to local horizons.

13.3.1.1 Zone of Theoretical Visibility (ZTV)

Mapping the extent of the area from which a development is likely to be visible has many names, which is symptomatic of its limitations. Originally known as a Visual Envelope Map (VEM), then as a Zone of Visual Influence (ZVI) and more recently as a Zone of Theoretical Visibility (ZTV), these changes in terminology reflect attempts to address frequent challenges occasioned by the mapping. Thus, as a theoretical methodology, ZTV prediction does not take into account the effects of seasons, lighting, weather conditions or visibility over distance. Moreover, a ZTV does not take into account the screening effects of vegetation or built structures and can omit topographical variations of up to 10 m. Therefore, in reality, ZTV mapping's principal use is to identify viewing points for further analysis.

Considering the low-lying nature of the study area and resultant limitations to views, the production of a ZTV would not have been useful for the identification of viewpoints. The assessment relied therefore on comprehensive site surveys to establish the nature of visibility within the study area and to identify key viewpoint locations.

13.3.2 Determination of the Baseline Environment

A baseline study has been undertaken through a combination of desk-based research and site appraisal in order to establish the existing conditions of the landscape and visual resources of the study area. Desk-based research has involved a review of mapping and aerial photography, relevant planning, and policy documents, the relevant Galway County Landscape Character Assessments, and other relevant documents and publications.

13.3.3 Determination of Sensitive Receptors

For there to be a visual impact, there is the need for a viewer. Views experienced from locations such as settlements, recognised routes and popular vantage points used by the public have been included in the assessment. Receptors are the viewers at these locations. The degree to which receptors, i.e. people, will be affected by changes as a result of the Proposed Road Development depends on a number of factors, including:

- Receptor activities, such as taking part in leisure, recreational and sporting activities, travelling, or working;
- Whether receptors are likely to be stationary or moving and how long they will be exposed to the change at any one time;
- The importance of the location, as reflected by designations, inclusion in guidebooks or other travel literature, or the facilities provided for visitors;
- The extent of the route or area over which the changes will be visible;
- Whether receptors will be exposed to the change daily, frequently, occasionally, or rarely;
- The orientation of receptors in relation to the Proposed Road Development and whether views are open or intermittent;
- Proportion of the developments that will be visible (full, sections or none);
- Viewing direction, distance (i.e. short-, medium- and long-distance views) and elevation;
- Nature of the viewing experience (for example, static views, views from settlements and views from sequential points along routes);
- Accessibility of viewpoint (public or private, ease of access);
- Nature of changes (for example, changes in the existing skyline profile, creation of a new visual focus in the view, introduction of new man-made objects, changes in visual simplicity or complexity, alteration of visual scale, landform and change to the degree of visual enclosure); and
- Nature of visual receptors (type, potential number and sensitivity of viewers who may be affected).

13.3.4 Describing Potential Effects

For the purposes of assessment, a clear distinction is drawn between landscape and visual effects, as defined in the GLVIA:

Landscape Effect –" *Effects on the landscape as a resource in its own right*".

Visual Effect –" *Effects on specific views and on the general visual amenity experienced by people*".

It should be noted that this chapter refers to landscape and visual 'effects' rather than 'impacts'. As stated in the TII: Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads – Standard, PE-ENV-01102, December 2020; "*… the 'impact' is defined as the action been [sic] taken, whilst the 'effect' is defined as result (change or changes) of that action …*".

The baseline landscape and visual conditions of the study area (approximately 1.5 km radius from the proposed road corridor) were assessed through desktop studies, and site survey in February 2020 and April 2021.

The staged process, classification of magnitude and significance of the LVIA is described in detail in Section 3 of the TII Standard PE-ENV-01102 guidelines. An overview on the approach to the preparation of the landscape and visual impact assessment is provided below.

13.3.4.1 Landscape Effects

The landscape components are also described as landscape receptors and comprise the following:

- Individual landscape elements or features;
- Specific aesthetic or perceptual aspects; and
- Landscape character, or the distinct, recognisable, and consistent pattern of elements (natural and man-made) in the landscape that makes one landscape or settlement different from another.

The assessment will identify the interaction between these components and the Proposed Road Development during construction and operation. The condition of the landscape and any evidence of current pressures causing change in the landscape will also be documented and described.

13.3.4.2 Visual Effects

Visual effects are determined by the extent of visibility and the nature of the visibility (i.e. how a development is seen within the landscape); for example, whether it appears integrated and balanced within the visual composition of a view or whether it creates a focal point.

Negative visual effects may occur through the intrusion of new elements into established views, which are out of keeping with the existing structure, scale, and composition of the view. Visual effects may also be beneficial, where an attractive focus is created in a previously unremarkable view or the influence of previously detracting features is reduced. The significance of effects will vary, depending on the nature and degree of change experienced and the perceived value and composition of the existing view.

13.3.4.3 Determination of Potential Effects

Landscape is not static but rather changes over time in response to various pressures (e.g. changes in agriculture, forestry, infill development, re-development etc.). Many of these changes are gradual and progressive and often accepted without any associated significant landscape or visual effects. By contrast, Specified Infrastructure Projects may bring about accelerated or fast change, which can result in likely significant direct and indirect landscape or visual effects. The significance of these changes or effects is directly related to the significance and sensitivity of the receiving landscape and visual environments.

The significance and sensitivity of the landscape and visual environment is evaluated having regard to the information collated at the Landscape Character Assessment (LCA) stage. In general, significance and sensitivity are applied to landscapes and aspects of the landscape that are important to defining and maintaining the character of landscape areas identified in the LCA, as well as to designated and notable features of the landscape.

Visual significance and sensitivity address the views available to people (i.e. visual receptors), living, working, and visiting a landscape and their visual amenity.

Level ratings for the landscape and visual significance/sensitivity as well as the magnitude and significance of landscape and visual effects is provided in the TII: Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads - Standard, PE-ENV-01102, December 2020, pp. 33-39.

The staged process for assessing landscape and visual effects is outlined below:

- Define the study area;
- Collect and collate information on the landscape by means of desk top study and site visit;
- Assess the character and value of the landscape through consultation, desk top study and site assessment;
- Identify the effects throughout the project's life cycle;
- Identify the nature of the effects: direct (because of the development, including lighting), indirect or secondary (because of an associated development secondary to the main development), and cumulative (because of the addition of many small effects, including cumulative effects of other projects, to create larger, more significant effects);
- Identify the landscape effects in relation to the sensitivity of the landscape; determine the scale and magnitude of change;
- Identify the visual effects in relation to the sensitivity of views and the visual receptors; determine the scale and magnitude of change;
- Identify the significance of landscape and visual effects; and
- Separately assess landscape and visual effects, noting the interaction/closely related aspects of each.

All or some of project characteristics will have a corresponding effect on the receiving landscape and visual environment and the resulting effect will need to be identified, quantified, and assessed for likelihood of significant landscape and/or visual effect.

Once identified, the description of the landscape and visual change will include both a causation (impact) and a quantitative and qualitative (effect) assessment. The following descriptions as to the nature/magnitude of effects will be considered (refer to Environmental Protection Agency (EPA) 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (hereafter referred to as the 'EPA draft guidelines'), 2017):

- **Character, Extent, Scale and Context of effects** (e.g. area, number, localised, wide-spread, construction, or operation, direct/indirect/cumulative, seasonal, day/night etc.);
- **Duration of effects** (e.g. momentary, temporary, short-term, long-term, permanent etc.);
- **Frequency of effects** (i.e. will occur once, rarely, daily, monthly, constant etc.);
- **Probability of effects** (i.e. likelihood that identified effects will occur. e.g. likely/unlikely); and
- **Quality of effects** (i.e. positive, neutral, negative/adverse).

Consideration of these aspects will allow for the determination of the magnitude of landscape and visual effects. The magnitude of change depends on the nature, scale, duration, and reversibility of the particular change that is envisaged, the location in which it is proposed, and the overall effect on a particular landscape or view.

13.3.5 Significance of Effects

The objective of the assessment process is to identify and evaluate the potentially significant effects arising from the Proposed Road Development. The assessment will identify the residual effects likely to arise from the finalised design considering mitigation measures and the change over time.

When assessing significance, individual effects may fall across several different categories of significance and professional judgement is therefore used to determine which category of significance best fits the overall effect to a landscape or visual receptor.

The approach to significance of effects, i.e. comparing the nature of effect to the significance and sensitivity of the baseline environment, applies equally to landscape (or townscape/seascape) and to visual effects.

The chart overleaf indicates that 'significance of effect' is determined by comparing the Description/Nature of the Effect against the Existing Landscape and Visual Environment. The significance of effects can be adverse (negative), neutral or beneficial (positive) as described in TII Standard PE-ENV-01102, pp. 58-60.

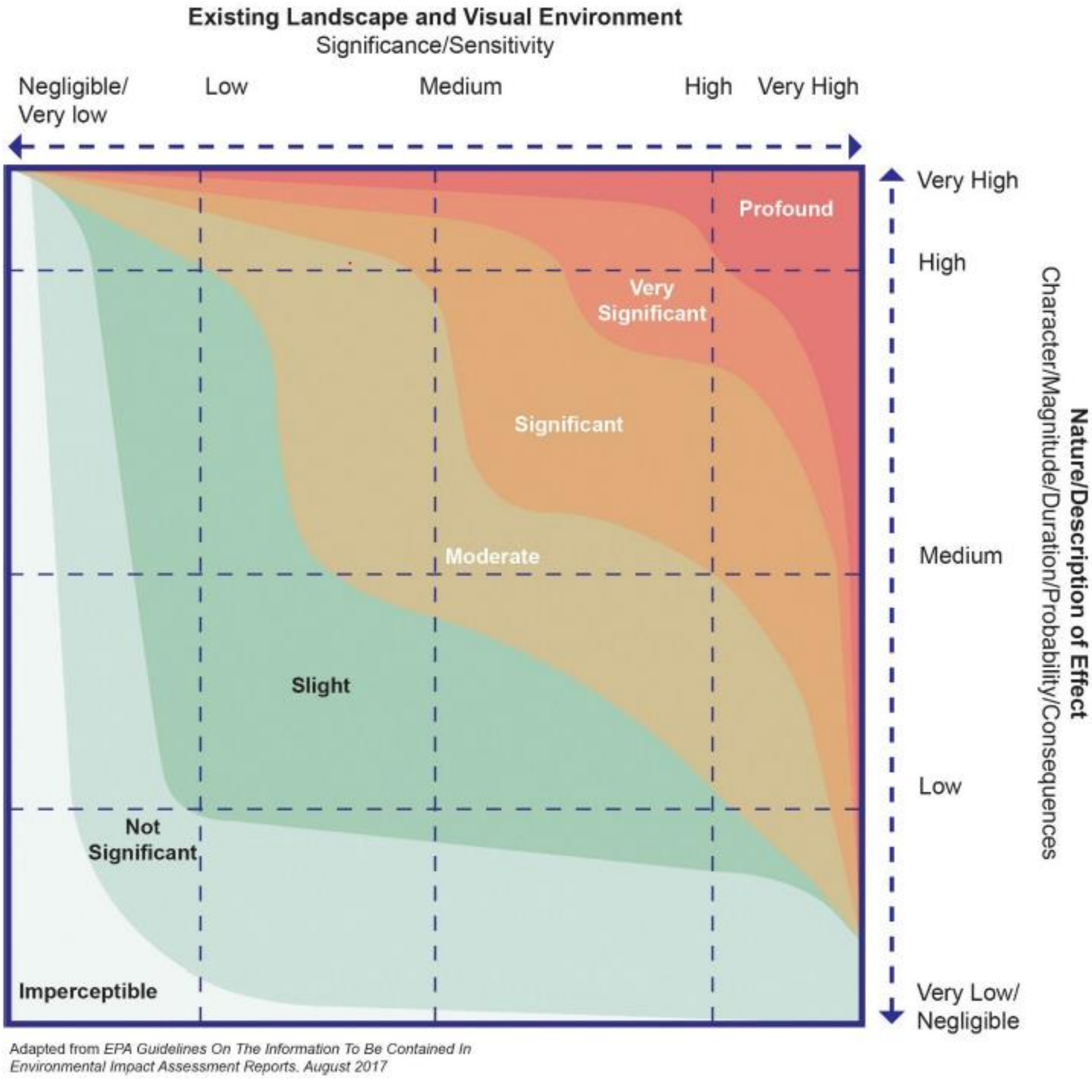

Figure 13-1 Classification of Significance of Effects

Source: Adapted from source Table 3.5, EPA draft guidelines 2017

Table 13-1 Describing the Significance of Effects

Significance of Effects	Typical Descriptions of Effect
Profound	An effect that obliterates sensitive characteristics within the landscape and/or visual environment.
Very Significant	An effect which, by its character, magnitude, duration, or intensity significantly alters most of a sensitive aspect of the landscape and/or visual environment.
Significant	An effect which, by its character, magnitude, duration, or intensity alters a sensitive aspect of the landscape and/or visual environment.
Moderate	An effect that alters the landscape in a manner that is consistent with existing and emerging baseline trends.
Slight	An effect which causes noticeable changes in the landscape and/or visual environment without affecting its sensitivities.
Not Significant	An effect which causes noticeable changes in the landscape and/or visual environment but without significant landscape and/or visual consequences.
Imperceptible	An effect capable of measurement but without significant landscape and/or visual consequences.

Source: Extract from Table 13, TII Standard PE-ENV-01102

Effects will be assessed for all phases of the Proposed Road Development. Construction effects are considered to be temporary, short term effects which occur during the construction/decommission phase only. Operational/residual effects are those long-term effects, which will occur as a result of the presence or operation of the development.

The quality of each effect is based on the ability of the landscape character or visual receptor to accommodate the Proposed Road Development, and the impact of the development within the receiving context. Once this is done, the quality of the effect is then is assessed as being neutral, beneficial, or adverse. A change to the landscape or visual resource is not considered to be adverse simply because it constitutes an alteration to the existing situation.

13.3.5.1 Cumulative Effects

In addition to landscape and visual effects, it is also important to consider potential cumulative effects. Significant cumulative effects may occur where a number of similar developments combine to increase the prevalence of that type of development within a landscape or view to the extent that they become a defining characteristic. Cumulative effects will also arise from incremental changes caused by other past, present, or reasonably foreseeable actions together with the Proposed Road Development.

The cumulative assessment evaluates the additional change resulting from the Proposed Development in relation to the theoretical baseline scenario and follows a similar methodology to that used for the landscape and visual assessments. The table below states definitions which are used to determine cumulative effects.

Magnitude of Cumulative Effects

The principle of magnitude of cumulative effects makes it possible for a proposed development to have major effects on a particular receptor, while having only minor cumulative effects in conjunction with other existing developments.

The magnitude of cumulative effects arising from the Proposed Road Development is assessed as Very High, High, Medium, Low or Negligible, with intermediate categories, based on interpretation of the following parameters:

- The additional extent, direction, and distribution of existing and other developments in combination with the Proposed Road Development;
- The distance between the viewpoint, the Proposed Road Development, and the cumulative developments; and
- The townscape setting, context, and degree of visual coalescence of existing and Proposed Road Development and cumulative developments.

Significance of Cumulative Effects

As for the assessment of landscape and visual effects, the significance of any cumulative effects follows a same classification described in Section 13.3.2.5 above, and will be assessed as Profound, Very Significant, Moderate, Slight, Not Significant, Imperceptible.

Types of Visual Cumulative Effects

In addition to the magnitude of cumulative visual effects, the below types of visual cumulative effects will also be assessed. The table below states definitions which are used to determine cumulative effects.

Table 13-2 Definition of Specific Types of Cumulative Effects

Specific Types of Cumulative Effects	Characteristics
In combination	Where two or more developments are or would be within the observer's arc of vision at the same time without moving her/his head.
In Succession	Where the observer has to turn her/his head to see various developments actual and visualised.[1]

Limitations of Cumulative Assessment

The cumulative assessment focuses on potential cumulative effects relating to the main permanent structure of each cumulative development. This is due to the uncertainty of the timing of construction activities for each of the identified developments. As a result, temporary structures and activity relating to construction have not been considered within the cumulative assessment.

13.3.6 Interaction of Environmental Factors

There is a requirement under the EIA Directive to consider the assessment of any effects likely to arise from the interaction of effects between different environmental factors e.g. landscape and biodiversity; visual and cultural heritage (refer to Chapter 18 Interactions). In this case a key interaction is between Landscape and Visual and Cultural Heritage due to the dominant position of a ruined medieval abbey (National Monument) in the local landscape.

The LVIA is focused on the physical and visual appearance and character of the landscape as it is experienced today. Identification and potential interactions of effects between the landscape and visual environment and other related landscape environments/environmental assessments will be recorded and assessed in the same manner as other landscape and visual effects. However, assessments of different environmental factors are generally addressed separately by relevant competent specialists.

13.3.7 Selection of Viewpoints

Viewpoint selection has been carried out according to current best practice standards and the following industry guidelines:

- Photography and Photomontage in Landscape and Visual Impact Assessment, Landscape Institute Advice Note 01/2011; and
- 'Photography and Photomontage in Landscape and Visual Impact Assessment', Landscape Institute, Technical Guidance Note, public consultation Draft 2018-06-01.

[1] Guidelines for Landscape and Visual Impact Assessment, Third Edition, LI and Institute of Environmental Management & Assessment (2013).

It is not feasible to produce photomontages from every possible viewpoint in the study area. Photomontages have been produced from key landscape designations, showing the nature of visibility at these sites. Photomontages are used as a tool to come to understand the nature of potential effects and to assist the determination of the magnitude and significance of residual landscape and visual effects. The selection process of viewpoint locations is as follows:

- The location of viewpoints within the study area is informed by desktop and site surveys;
- Identification and selection of specific views from protected key designations in the landscape such as routes or locations valued for their scenic or heritage value; and
- Visual impact mapping of open and intermittent views during the site survey assesses the potential visibility of the Proposed Road Development from key sensitive locations. Seven key viewpoints were chosen to give a representative range of views from public access points.

13.3.8 Photomontages

Photomontages are photorealistic visualisations produced using specialist software, the technique aims to represent the field of depth and range of vision experienced by the human eye. They illustrate the likely future appearance of the Proposed Road Development from a specific viewing point. They are useful tools for examining the impact of the development from a number of critical viewpoint positions along the public road network within the study area.

However, photomontages in themselves can never provide the full picture in terms of potential effects, they can only inform the assessment process by which judgements are made. A visualisation can never show exactly what the Proposed Road Development will look like in reality due to factors such as; different lighting, weather and seasonal conditions which vary through time and the resolution of the image. As the photomontages are representative of viewing conditions encountered, some of them may show existing buildings or vegetation screening some or all parts of the developments. Such conditions are normal and representative.

The images provided give a reasonable impression of the scale of the development and the distance to the development but can never be 100% accurate. It is recommended that decision-makers and any interested parties or members of the public should ideally visit the viewpoints onsite, where visualisations can be compared to the ‘real life’ view, and the full effect of the Proposed Road Development can be understood.

The landscape and visual impact assessment onsite identified a range of viewpoints located within the study area at varying distances from the Proposed Road Development to show the effect of the development in key close, middle, and distant views.

Volume 04; Appendix A13-1, Viewpoints/Photomontages 1(a) and 1(b) and 4 show the Proposed Road Development including the following information for each:

- Existing View - Showing the baseline image; and
- Photomontage - Showing the Proposed Road Development including all visible components following the implementation of landscape mitigation measures (semi mature at 7 years growth).

The booklet of photomontages is included in Volume 04 - Appendices, A13 Landscape and Visual.

13.3.9 Interaction with other Environmental Factors

The landscape and visual impact assessment is focused on the physical and visual appearance as well as the character of the landscape as it is experienced today.

Landscape is also a consideration under other environmental aspects and assessments, e.g. the natural landscape (Biodiversity, refer to Chapter 07), the geological landscape (Land and Soil, refer to Chapter 08), the cultural/historical landscape (archaeology and architecture, refer to Chapter 14 – Cultural Heritage), the human landscape (community, social, etc., refer to Chapter 06 - Population and Human Health).

While it is evident that an interaction of effects exists between the landscape and visual environment and these other related landscape environments/environmental factors – not least in terms of potential for interactions of effects – assessments under these areas are generally addressed separately by other competent specialists in the relevant chapters of this Environmental Impact Assessment Report (EIAR).

13.3.10 Consultation

Consultations have been undertaken with Galway County Council from an early stage in the planning process. This has enabled the desk study and data collection to be supplemented.

Public consultation was undertaken on the route options on 1st October 2019 and a second public consultation was held on the emerging preferred route on the 3rd February 2020, where 62 members of the local community attended. Feedback received from the consultations was varied, it expressed concerns over the loss of views or visual intrusion, a desire for visual screening of the road and general approval of the proposed footpath connecting the school with the village.

13.4 Limitations and Assumptions

The assessment is based upon currently available information at the time of writing. The extent of the study area has been defined via a combination of a desktop survey including a review of maps and aerial photographs of the development site and a site survey.

13.5 Baseline Environment

13.5.1 Landscape Character Assessment

The Galway County Development Plan contains a Landscape Character Assessment that identifies the landscape character rating, landscape value rating and landscape sensitivity rating for the county, as included in Section 2.2 of the Landscape and Landscape Character Assessment for County Galway (supporting document to the Galway County Development Plan 2015-2021).

The study area, which lies along the shallow slopes of the Abbert River valley, is characterised by a patchwork field pattern. The existing N63 follows the river from the east along mature treelined riverbanks, before crossing the river at Liss Bridge. Here, at the junction with L3110 are several community facilities including the National School, GAA grounds and St. Bernard’s Church, linked via the N63 to Abbeyknockmoy village 1.2 km to the west, from where a linear cluster of residential properties emerges along the south of the existing N63 with views across the low valley to the north.

The majority of the study area is located within the Landscape Character Area (LCA) 1 ‘Northeast Galway (Balinasloe to Ballymaloe). This LCA is described as:

> “*Landscape is flat to undulating open pastoral land bound by field hedgerows, with small scattered coniferous plantations of 1-6 km² in size. There are no areas of particular scenic value. This area is primarily rural and includes the settlements of Ballinasloe, Mountbellew Bridge, Glennamaddy, Ballymoe and Dumore*”.

A small section of the southern portion of the study area is located within Area 3 ‘East Central Galway (Athenry, Ballinasloe to Portumna) LCA. This LCA is described as:

> *“The landscape is flat, coarse grassland, occasional clumps of coniferous forestry between 1- 3 km² in size, fields defined principally by stone walls. There are no areas of particular scenic value although the stone walls are quite distinct”.*

The ‘Enclosure by Landform’, Landscape Character Map of County Galway produced for the “Landscape and Landscape Character Assessment”, shows the study area within an area of ‘Flat’ land and is therefore considered visually open. The study area is not in an area enclosed by forestry.

There are several cultural heritage aspects to the landscape, including several Record of Monuments and Places (RMP) sites, one national monument under the stewardship of the Minister of Housing, Local Government and

Heritage (Knockmoy Abbey; GA058-004001) and one national monument subject to Preservation Order (earthworks and buildings associated with Knockmoy Abbey; GA058-004004).

There are five sites listed on the National Inventory of Architectural Heritage (NIAH) located within the study area, four of which are identified in the current Galway County Development Plan 2015-2021, Record of Protected Structures as protected structures. More information on cultural heritage features of the site are included in Chapter 14 - Cultural Heritage.

Plate 13-1 Landscape Character, Open Fields with Stone Wall Boundaries, Typical of the LCA 3 "East Central Galway".

Plate 13-2 Knockmoy Abbey (GA058-004001) Viewed Across the Open Farmland with Existing Field Hedgerows and Mature Trees in the Foreground.

13.5.2 Sensitive Landscape Elements

The landscape sensitivity and landscape value of both LCAs in the study area outlined above have been ranked as below in Table 13-3.

Table 13-3 Landscape Sensitivity (Galway County Development Plan)

Character Area	Landscape Values: Cultural	Landscape Values: Socio Economic	Landscape Values: Environmental	Landscape Values: Total Rating	Landscape Sensitivity
Northeast Galway	Low	Low	Low	Low	Class 1- Low with pockets of Class 2 - Moderate
East Central Galway	Low	Low	Low	Low	Class 1- Low with pockets of Class 2 - Moderate

Source: Galway County Development Plan

As outlined in the “Landscape and Landscape Character Assessment”, which forms part of the current Galway County Development Plan 2015-2021, landscape values were derived by consideration of environmental and cultural benefits; for example, aesthetics, historical and socio-economic.

The sensitivity of a landscape to development and therefore to change will vary according to its character and to the importance which is attached to any combination of landscape values. The sensitivity value of the character area was derived by consideration of designations including Special Protection Areas (SPA), Natural Heritage Areas (NHA) and National Parks.

As outlined above, there are several cultural heritage features in the landscape that are located within the study area. The Knockmoy Abbey (GA058-004001) is located to the north-west of the study area

No trees designated for preservation are located within or in close proximity to the study area.

One designed landscape feature is located within the study area (currently information on this record has not been uploaded to the Record of Monuments and Places). The National Monuments Service/Archaeological Service for Ireland defines a ‘designed landscape feature’ as follows:

“*A man-made feature that is laid out to produce the effect of natural scenery, or other features, usually within demesnes and associated with a country house. These date from the 17th to the 19th century AD*”.

Full details of the designed landscape are described in Chapter 14, Cultural Heritage, Section 14.5.6 National Inventory of Architectural Heritage – Designed Landscapes, Newtown House (NIAH Ref: 5365) is located at the eastern extent of the Proposed Road Development. Both house and surrounding grounds are shown on the 1st edition OS six-inch map (1838). The main features of the designed include outbuildings and a walled garden to the rear of the house with densely planted wooded areas surrounding the house. The footprint of the designed landscape is still visible today, while the buildings, entrances and walks through the woods are still extant.

13.5.3 Landform

As outlined in the Galway Development Plan, the study area lies in a generally flat agricultural landscape, however, the assessment is considering a large area of the county. On a more localised scale, the Abbert River lies at the centre of the study area, with land rising gently from the river to the north and south. In particular, Knockroe Hill (168 m) forms a high point to the South of the site (approximately 1.5 – 2 km south), with some elevated views to the north across the Abbert River achieved from residential properties off the L7138. To the north, the landscape is gently undulating, with no discernible high points; the landscape is dominated by the field patterns, formed by walls, fences and fragmented hedgerows. Further to the west, outside the visual envelope of the study area, are significant areas of low-lying peat bog. To the east, the existing N63 corridor is tree-lined on approach to the Abbert River, with significant woodlands to north of the road in the grounds of Newtown House.

The result of the low-lying terrain, stone ditches and hedgerows means views are sporadic and limited by local features, rather than long panoramic views associated with more elevated landscapes. The river and the setting of Knockmoy Abbey (also referred to throughout this chapter as the Abbey) do create some localised scenic views of note within the rural setting.

13.5.4 Landuse and Settlement

The landscape of the Abbert River valley is agricultural, mostly laid out in a patchwork pattern of pasture fields. Between Liss Bridge and Abbeyknockmoy village the field boundaries are largely post and wire fences; which have over time, replaced the more traditional stone walls and hedgerows found throughout this region. However this is not truly representative of the entire study area, as elsewhere and particularly to the east of Liss Bridge there are mature and treelined hedgerows. This small area of degraded field boundaries represents an opportunity to re-establish hedgerows and create new habitat corridors along the full length of the Proposed Road Development.

The area is best known for the Knockmoy Abbey founded in 1190 which lies directly to the south of the Proposed Road Development. The main settlement in the area is Abbeyknockmoy village, the village is fragmented, with a core to the west and community buildings including school and church to the east, with linear residential settlement interspersed along the N63 between. In accordance with the TII publication, The Treatment of Transition Zones to Towns and Villages on National Roads (DN-GEO-03084) the section between the National School and the 50 km/h traffic zone at the village can be described as Rural Fringe. The TII describes rural fringe as being the area between the high speed and low speed section of road, generally the 400 m to 500 m section of road on the approach to the 50 km/h or 60 km/h speed limit zone. The core of the village will have little or no visibility of the Proposed Road Development and experience little direct effects, while the housing in the rural fringe zone will be more directly affected.

This rural fringe settlement extends along the southern side of the existing N63 from the village core, directly to the east of the proposed route, to the Community Centre and Newtown National School situated approximately 1.2 km west of the village. St. Bernard's Church, which serves the catchment area of Abbeyknockmoy, is just south of the school on the L7138. Next to the existing Abbert Bridge on the banks of the river, lies a small community picnic area named Abbey View. The proposed development of a new footpath/cycleway on the existing N63 to connect the village core with these community areas will have a positive effect on the local community and result in only very minor visual changes to the landscape.

At the eastern extents of the immediate study area, where the Proposed Road Development will merge with the existing road, the landscape is more heavily treed as the road follows the tree-lined riverbanks. Forestry plantation to the east and the wooded grounds of Newtown House to the south of the study area create a more enclosed and landscape than the open grass fields near the Abbey.

13.5.5 Determination of Sensitive Receptors

Section 13.3 above describes the criteria and consideration that has been applied in the identification and rating of sensitive receptors. The majority of the northern section of the study area is located within a designated focal point/view (No. 26) as identified in the Galway County Development Plan 2015-2021. The protected focal point/view is associated with the Abbey, located in the north west section of the study area.

There are no designated scenic driving routes, national walking routes, including looped walks, on-road cycling and waymarked ways, located within the study area. A small cluster of houses are aligned along the N63, all of which are orientated towards the Abbey. These receptors are highly sensitive as they have direct and open views of the Proposed Road Development.

13.6 Assessment of Impacts

13.6.1 Construction Phase

Chapter 04 'Description of the Proposed Road Development' contains a detailed schedule of proposed construction works for the project. The construction stage for the Proposed Road Development will be approximately 15-18 months and therefore both landscape and visual effects arising from the construction stage will be short-term. There are limited opportunities for mitigating the short-term visual effects associated with road construction.

The construction of the Proposed Road Development will be undertaken in a number of stages starting with accesses, fencing and vegetation removal to allow plant, equipment, materials, and workforce to access the construction site. The most likely significant landscape and visual effects arising at construction stage are described below.

13.6.1.1 Vegetation Removal

The visual significance of the removal of hedgerows, areas of scrub and mature treelined hedgerows will range from **moderate to significant adverse** in the **short-term**. Changes to the physical landscape due to the disruption of hedgerows and the associated field patterns will have an adverse effect ranging from **moderate to significant**. The greatest significant effects are those arising from areas where more extensive vegetation cover will be removed, these are summarised as follows:

- Ch. 0+000 sections of the existing roadside boundary will be removed, including some tall thorn bushes/minor trees;
- Ch. 0+1000 removal of all vegetation in this location;
- Ch. 0+1000 to 1500 minimal effect on existing vegetation, some hedges/ditches are crossed;
- Ch. 0+1600 to 2200 minimal effect on existing vegetation, some hedges/ditches are crossed;
- Ch. 0+2200 removal of a stone ditch with some low growing thorn bushes;
- Ch. 0+2300 to 2600 minimal effect on existing vegetation, some hedges/ditches are crossed; and
- C0+2600 to 3100 wholesale removal of a mature hedgerow with trees up to 6.0 m tall on the northern boundary and preservation of the majority of trees along the southern roadside.

Refer to the General Alignment plans, Volume 03; Figures A4-1 to A4-6 .

The significance of landscape and visual effects within the study area arising from vegetation removal to construct the Proposed Road Development will be **moderate and adverse** in the **short-term**, reducing to slight and neutral as new planting establishes.

13.6.1.2 Machinery & Materials

The site compound located between chainage 0+000 and 0+050, north-west of the proposed route, heavy plant and material stockpiles will also have temporary **moderate adverse to significant adverse** visual effects locally during the construction phase.

The movement and activity of heavy plant, which has a significant visual presence on a local scale due to size/scale and hazard lighting, will remain a transient impact, irrespective of where the site compound(s) is located.

Temporary fencing, removal of road/pavement surfaces, taking down of existing structures, road closures, traffic management works, and signage will have a moderate adverse effect upon the local landscape and views towards the construction site. However, effects will be **temporary** and will not result in **long-term** landscape or visual effects.

13.6.1.3 Earthworks

Site clearance and earthworks are among the more visible operations and will inevitably have a **very significant effect** on the local landscape during the construction period. However, the effects will be **short-term**, as proposed landscape mitigation measures will be implemented as part of the construction works, which will come into effect as the vegetation establishes and matures.

Excavation of the attenuation ponds will create exposed earth pits; which will result in **short-term significant adverse** landscape and visual effects as they will be-reinstated with marginal plants to the edges.

13.6.1.4 Construction of New Bridge over the Abbert River

The Proposed Road Development will incorporate a new bridge over the Abbert River. The bridge crosses the Abbert River in a south-west to north-east orientation in a single span to minimise the impact on the Abbert River.

The steel bridge over the Abbert River consists of a single span of approximately 60.5 m, ensuring a clear span over the river channel and Lough Corrib Special Area of Conservation (SAC). The superstructure is formed of 6 no. braced weathering steel girders. To improve aesthetics, the girders will be fabricated with an arched profile. The bridge abutments are located outside the river channel to minimise in-stream works for the construction of the bridge over Lough Corrib SAC The bridge abutments will be clad in stone to resemble the local dry stone wall field boundaries that form an integral characteristic of the regional landscape setting.

The main activities during the construction stage of the bridge with the potential for visual effects include:

- Installation of sediment control measures, e.g. silt fences and straw bales, sediment lagoons, settlement trenches;
- Diversion of necessary utilities;
- Excavation, as required, for all bridge supports;
- Construction of reinforced concrete abutments and subsequent stone cladding;
- Construction of approach embankments;
- Construction of the wing walls; and
- Completion of waterproofing and the additional protective layer and installation of parapets and finishes.

Excavation, earthworks, machinery, and material movements will result in **temporary very significant adverse** landscape and visual effects in available views within the study area. Visibility diminishes quickly with distance from the construction site due to intervening vegetation, topography and/or built structures.

13.6.2 Operational Phase

13.6.2.1 General Description of Potential for Change to the Landscape

This section describes the general potential for landscape change along the proposed route using chainage as a reference. A detailed assessment of landscape and visual impacts including a statement of the likely magnitude of effects and their significance is included in Sections 13.6.1.3 – 13.6.1.14 herein.

- Ch. 0+000: The proposed route diverges from the existing N63 in a north-easterly direction. The existing N63 will be retained as a feeder road for local housing will continue to carry live traffic between the two nodes of the village, the truncation of the existing N63 west of the roundabout will form a new cul-de-sac which will require a turning lane. This new section of road will also be the location of a viewing area for the Abbey. In total there will be a significant increase in road surface. In order for the viewing area, located on the Abbey side, to provide an effective view point, it will be required to be elevated on an embankment, while acknowledging this is a benefit to the village and road users, it will be an intrusion on the relatively flat agricultural landscape. The formation of the embankments will be carried out with flowing contours to avoid an overly man-made appearance.

Plate 13-3 View from Existing N63 Towards the Abbey at the Location of the Proposed Viewing Area and Roundabout

- Ch. 0+500 (viewing area): The Proposed Road Development passes in close proximity to the ruins of the Abbey. The Abbey is a significant feature in the landscape and heritage of the local area. From a visual point of view, it provides a definite focal point within the landscape and this is acknowledged in the designation of the Abbey as a listed View/Focal Point in the Development Plan. In consideration of the uniqueness of the views to the Abbey, a viewing point has been provided as part of the road design. The preferred location for the viewing point is within close proximity to the village with connected footpaths from the village. In order to gain the best vantage point, the viewing area will be elevated and will form a new landscape feature on the periphery of the village (further information is included in Section 4.5.10 of Chapter 04 'Description of the Proposed Road Development').

Plate 13-4 View from the Abbey Towards Abbeyknockmoy Village

- Ch. 0+1000 (roundabout): Introduction of a new roundabout on the N63 will have a significant effect on the landscape, it will demarcate the entrance to Abbeyknockmoy village. As such, it will become a new and recognisable feature of the landscape. The roundabout will be elevated above the existing fields and will be lit at night. The removal of mature trees at this location as described below will further effect the landscape character at this location.
- Ch 0+1200 to 1500: The road crosses flat fields with fenced boundaries, as the road approaches the Abbert River crossing, it rises on an embankment up to 6.0 m. This will be a considerable level change in an the otherwise flat landscape. Where the road passes through field boundaries there is an opportunity to re-establish field patterns with new hedgerows that will help integrate the Proposed Road Development into the landscape and restore missing wildlife corridors to areas where currently fences have replaced the traditional field boundaries. This is explored further in Section 13.7.4 Landscape Remediation Measures.
- Ch 0+1500 to 1600 (bridge crossing): The bridge will be highly visible in the landscape and a new prominent feature. The bridge design is low and slender spanning the river on weathered steel arched beams, between stone clad abutments. The stone cladding will closely resemble the natural dry stone walls in the local area. The bridge crossing will be of sufficient width to ensure the watercourse will not be affected by the road, and it will not result in any changes to the flow of the river or the natural form and vegetation on the riverbanks. Although a new bridge and road are a significant change to the existing landscape, over time a bridge can become a recognisable feature within a landscape setting and become integrated with character of the surrounding landscape.

Plate 13-5 View from the Car Park of the Community Centre Towards the Abbert River and the Proposed Bridge Crossing with Abbey in the Background

- Ch. 0+1600 to 2600: The Proposed Road Development drops down to existing levels and continues through flat low-lying pasture lands, crossing a minor road and associated stone ditches. This section of the Proposed Road Development will have low impact on the character of the local landscape.

Plate 13-6 View from the North of the Proposed Road Development Showing the Low-Lying Agricultural Landscape Setting. The nearest tree will be removed in this view to create a new staggered road junction.

- Ch. 0+2600 to 3100: The Proposed Road Development merges with the existing N63. The resultant road widening will cause the loss of the northern roadside hedge. The vegetation is mature and up to 6.0 m height resulting in a significant change to local landscape of low sensitivity, over time this will be reduced as mitigation proposals mature (refer to Section 13.7.4 Landscape Remediation Measures). However it should be noted, retention of the southern boundary will restrict the effects to a very localised area. The merging of the existing and proposed roads will also require a new junction as the existing N63 will become a minor feeder road. The cumulative impact of both roads in close proximity will be considered when assessing the effects.

13.6.2.2 Vegetation Removal

Vegetation will be removed to facilitate construction of the Proposed Road Development. See also Chapter 07 - Biodiversity (Flora and Fauna) for details of significance of vegetation removal. The key areas of vegetation to be removed include the following:

- Ch. 0+000 (merging of the Proposed Road Development with the existing road) as the Proposed Road Development route is redirected away from the current road, sections of the existing roadside boundary will be removed, including some tall thorn bushes/minor trees;
- Ch. 0+500 (viewing area) the proposed viewing area will be on the periphery of the village located in what is currently pastureland and will have little effect on any existing vegetation;
- Ch. 0+1000 (roundabout) the Proposed Road Development will be 2.0 m above existing ground level, requiring removal of all vegetation in this location, including a tree lined hedgerow;
- Ch. 0+1000 to 1500 the Proposed Road Development continues eastwards parallel to the existing N63, also to be retained, crossing several fenced field boundaries on a raised embankment on the approaches to the Abbert River and has minimal effect on existing vegetation;
- Ch. 0+1600 to 2200 following the river crossing the road embankment drops down to following the existing gradients, through pastureland and has minimal effect on vegetation;
- Ch. 0+2200, the proposed junction with the country road requires minor road widening works to the existing road and removal of a stone ditch with some low growing thorn bushes;
- Ch. 0+2300 to 2600 the Proposed Road Development crosses through fenced pastureland prior to merging back with the existing N63 alignment, with minimal effect on existing vegetation; and
- Ch. 0+2600 to 3100, as the proposed route merges with the existing road alignment, road widening is required along the northern roadside. This will require wholesale removal of a mature hedgerow with trees up to 6.0 m tall. It will however enable preservation of the trees along the southern roadside.

The impacts and effects of the above are discussed in the following sections.

Plate 13-7 View Looking West Along the Existing N63 where the eastern end of the Proposed Road Development will Merge with the Existing Road.

The Proposed Road Development will result in the loss of vegetation on the northern roadside (right hand side), but importantly preserve the denser riverside trees to the south.

All vegetation being retained will be protected in accordance with the recommendations of National Roads Authority (NRA)/now TII: Guidelines for Protection and Preservation of Trees, Hedgerows and Scrub Prior to, during and Post Construction of National Road Schemes.

13.6.2.3 Landscape Effects

Direct or indirect landscape effects on the fabric of the landscape and its receptors are closely related to the nature and extent of visibility. In the case of a road development, this may also include the related effects of noise and air quality.

The Proposed Road Development is located within an area of Low Sensitivity and Low Value (Galway County Development Plan). The location of the Proposed Road Development will adversely affect the landscape, but the severity of the effect is to be assessed in relation to these designations. There will be a perceivable change to the landscape character locally given that much of the route is through existing agricultural fields, requiring the removal of established trees and hedgerows along with the addition of associated features such as roadside embankments and the bridge crossing. In conjunction with the change in character to existing fields, areas where the road connects with the existing road network will also experience landscape character changes. Good design, landscape mitigation and maintenance of connections and frontage to the Proposed Road Development will minimise these adverse landscape effects and help to integrate the Proposed Road Development into the landscape over time.

With good landscape mitigation along the road edge, the development will be able to sit within the landscape as a new feature, but without dominating the existing character. The Proposed Road Development will improve travel times and road safety when compared to the existing N63, but it is not a new route and will therefore cater for the same level of traffic as currently using the route, with no greater impact from extra traffic use or cause any further congestion to adjoining roads and settlements. The new road will become the primary road and the existing road retained as a secondary road and also incorporate a new shared surface footpath and cycleway.

Along the length of the existing N63, a shared use pedestrian and cyclist path will be provided on the south side. Un-controlled crossings will be provided at road junctions and a new controlled pedestrian crossing connecting to the Newtown National School and Abbeyknockmoy Community Centre. The shared use pedestrian and cycle path will cross the Abbert River at the existing Liss Bridge, where it will then continue parallel to the proposed N63, making use of the paved surface of the existing N63 where possible. Pedestrian and cycling facilities are presented in Figures A4-11 to A4-18 contained in Volume 03 of this EIAR.

Potentially sensitive landscape receptors include the river crossing and the tree-lined, roadside boundaries to the east of the Proposed Road Development. In particular the new, raised road embankments will introduce a new landscape feature on the approaches to the Abbert River crossing. As these embankments will rise to 6.0m above existing ground level at the highest point, they will become a prominent feature in an otherwise flat landscape and have a **significant** but **localised** change to the landscape character.

Further change will result from the introduction of attenuation ponds to deal with surface water runoff. These ponds are shown on the plans as linear features with hard edges. As such they will be in contrast to the natural contours and less regimented field boundaries. While it is important to ensure adequate volumes of water can be stored, landscape mitigation of the ponds will ensure a softer blending of the ponds with naturalised edges and appropriate planting that will benefit the local species diversity and provide suitable habitat creation for native wildlife. The attenuation ponds will be enclosed with secure steel fencing, which will have a more significant effect on the landscape and views than the treatment of the ponds. As such it is proposed to use a black finish on the fencing which is the least visually intrusive to the landscape. Screen planting is proposed to the rear of the fence (southern edge).

Where boundaries at residential properties are removed as part of the works, they will generally be replaced on a like-for-like basis, subject to final agreement on accommodation works with individual property owners.

Standard detailed fencing typically used on schemes of this nature will be used. Where the Proposed Road Development traverses' agricultural lands, the road boundary fencing will typically be timber post and tension mesh fencing, in accordance with TII CC-SCD-00320 – Fencing: Timber Post and Tension Mesh Fence (TII, 2018). In order to reduce the effect on landscape and views the majority of roadside fencing will include hedgerow planting to the rear of the fence and can be expected to reach maturity over 7-10 years.(refer to landscape mitigation plans and planting schedule).

A summary of landscape effects of the Proposed Road Development on these receptors is provided in the table below. In general, the highest landscape effects will arise from changes to landform on the approaches to the river crossing. There are also positive landscape effects arising from the new proposed planting as it establishes and matures over time. However, the main effects associated with the Proposed Road Development will relate to the views associated with the Abbey and the perception of the road passing through the rural landscape as described below in the Visual Impact Assessment.

Table 13-4 Summary of Landscape Effects

Receptor	Susceptibility to Change	Sensitivity to Change	Magnitude of Landscape Change	Direct/Indirect Effects	Level of Significance
LCA 1 – Northeast Galway (Proposed Road Development contained within this LCA)	Low	Low	Medium	Direct & Indirect	Slight Adverse (localised effects)
LCA 2 – East Central Galway	Low	Low	Medium	Direct & Indirect	Slight Adverse (localised effects)
Abbert River	Moderate	Moderate	Medium	Direct	High Adverse (localised effects)
Field and Road Boundaries	Moderate	Low	Medium	Direct	Slight to Moderate Adverse (localised effects)
New Fencing	High	Moderate	Medium	Direct	Moderate Adverse
Proposed Shared Footpath Cyclepath	Low	Low	Low	Direct	Slight/Neutral

13.6.2.4 Visual Effects

The Proposed Road Development is located in a low flat landscape and therefore even relatively low vegetation or intervening buildings will provide screening to receptors for the majority of the route. The main receptor groups are local residents, pedestrians and visitors to Knockmoy Abbey as well as vehicle occupants and cyclists along adjacent roads. The sensitivity of residents and pedestrians is considered High. The sensitivity of vehicle occupants is considered Medium to Low. The susceptibility to change is highest for residents and pedestrians and cyclists as they will experience available views of the Proposed Road Development on a daily basis and views are of primary importance so that these receptors are likely to notice even minor changes. The susceptibility of vehicle occupants is considered Medium as the view is important but not the primary focus, so they are tolerant of some change.

The highest visual effects tend to occur where there is no intervening vegetation between the viewer and the Proposed Road Development, or where the viewer or development is at an elevated position.

The scale or magnitude of any changes as result of the Proposed Road Development will reduce proportionately as the distance between the visual receptor and the Proposed Road Development increases. When determining the extents of the study area, it was evident that distant views were limited due to the low lying topography of the study area, and visible effects of the Proposed Road Development will be contained within a 1.5 km radius. When considering the potential significance of effects, it is therefore important to bear in mind the distance of the viewpoint from the Proposed Road Development.

The existing sensitivity of the locality of the visual receptor will also have a bearing on the perceived effect of the Proposed Road Development. For example, a view of the countryside with the existing N63 in the foreground, is less sensitive to change than uninterrupted views across the countryside.

Seven key viewpoints have been photographed and 3 photomontages have been prepared which illustrate the nature of visibility of the proposals at key locations recognised for their heritage and amenity value. The following provides a detailed description of each viewpoint with fit to scale photography. Full scale versions of the photomontage images are included in Volume 04 - Appendices, A13 Landscape and Visual.

13.6.2.5 Viewpoint 1 – Knockmoy Abbey

The views from the Abbey are of considerable importance to the setting and are integral to visitor experience. The selected viewpoint is looking south-east directly towards the Proposed Road Development. The Abbey sits slightly elevated above the Abbert River, with views across the shallow valley to a ridgeline formed by Knockroe Hill to the south. Abbeyknockmoy village lies to the west of the view and linear settlement of housing along the existing N63 is visible, the existing road itself is not discernible, visibly contained by the low field boundaries.

The Proposed Road Development however will be closer to the Abbey, at approximately 300 m distance and elevated on embankments. In particular the new roundabout will be a new feature of views with little intervening existing vegetation, the roundabout will also be illuminated, with lighting columns 8.0 m tall. The main receptor groups are pedestrians and recreational visitors to the Abbey grounds. Their sensitivity and susceptibility are considered High. The Proposed Road Development will light up a previously unlit landscape during hours of darkness. However, even at 300 m distance, the Proposed Road Development sits low in the landscape, does not break the skyline, or have any effect on the intervening landscape. Prior to establishment of mitigation the magnitude of visual change is Moderate resulting in a **Significant Adverse Visual Effect**.

Plate 13-8 View 1(a) Existing View Looking to the South-East from the Abbey

Plate 13-9 Photomontage 1(a) of the Proposed Road Development and Bridge to the South-East of the Abbey (Vegetation at approximately 7 years maturity).

Plate 13-10 Existing View Looking to the South from the Abbey

Plate 13-11 Photomontage 1(b) of Proposed Road Development, Roundabout and Viewing Area, to the South of the Abbey (Vegetation at approximately 7 years maturity).

Potential to mitigate the visual effect is described below in Section 13.7 – Mitigation and Monitoring Measures.

13.6.2.6 Viewpoint 2 – Abbeyknockmoy Village

The view from the eastern village transition zone looking north across the Proposed Road Development to the Abbey. Abbeyknockmoy village, is best known for the Abbey. Historically, the village will have developed in conjunction with the Abbey and it is therefore important to maintain a close association between the village and the Abbey by maintaining good visibility. Existing residences (on the existing N63 are mostly orientated to the south of the road with views in a northerly direction, directly to the Abbey. This view is therefore already impacted by the existing road in the foreground and as such properties do not enjoy an uninterrupted view of the countryside. From the periphery of the village, the view is currently of fields enclosed with hedgerows with glimpses of the Abbey between the trees. The Proposed Road Development will be in the foreground with the roundabout and associated lighting and signage prominent in the landscape. The retention of the existing N63 will also be visible in the foreground creating a cumulative impact. (Refer to Plate 13-12). Opportunity does exist to reduce the impact through planting the roadside and approximately half an acre of woodland in the open space formed between the roads. This will screen much of the view of the roundabout, but also screen the existing view to the Abbey, it will therefore by reducing the effect of the road in the landscape still create a significant change to the existing open scenic views.

Plate 13-12 View looking North towards the Abbey from the N63, just west of Abbeyknockmoy Village

It should be noted that the Proposed Road Development has included a unique viewing area of the Abbey. The viewing area is linked by footpath to the village to ensure that residents and visitors can enjoy a gentle stroll to the viewing area. Views from this area will retain views to the Abbey across the unspoilt landscape, albeit with periphery views of the new roundabout.

The main receptor groups are residents and pedestrians. Their sensitivity to change is considered **Slight** and susceptibility **Moderate** as the existing N63 is currently in the foreground of views to the north and east from the village and nearby residences. The proposed roundabout will illuminate a previously unlit area during hours of darkness, but when viewed from the village limits it can be considered as an extension of the village street lighting as opposed to an isolated incident. Prior to establishment of mitigation, the magnitude of visual change is expected to be **High** resulting in a **Moderate Adverse Visual Effect**.

As described below in Section 13.7 Mitigation and Monitoring Measures, the residual impact can be expected to lessen over time.

13.6.2.7 Viewpoint 3 – View from the Existing N63

The existing N63 will be retained as a service road to existing residences, it will have a new connection via the roundabout to the Proposed Road Development. Emerging from the village, the Proposed Road Development will run parallel to the existing road for approximately 0.5 km, before veering northeast to cross the Abbert River. Viewpoint 3 is situated about midway between the village and the community centre. The location is chosen as it will have direct views of the new bridge crossing. The Proposed Road Development will rise on embankments to a height of 6.0 m above ground level to connect with the new bridge crossing. As the terrain is relatively flat along the river course (approximately 38.0 m Above Ordnance Datum (AOD) at the crossing point), the road embankment will be highly visible (44 m AOD), from nearby housing off the existing N63 (approximately 45-48 m AOD). The proposed bridge crossing will be relatively long and slender, with metal railings, it will sit low in the landscape and not break the skyline. (Refer to Figure 13-2). The bridge is formed from weathering steel girders, with an arched profile supported on stone clad abutments. An in-situ concrete deck will span between the steel girders with parapet edge beams. The details of the proposed bridge can be seen in the elevation and cross-sections shown in Chapter 04 'Description of the Proposed Road Development', Figure 4-2 and Figure 4-3 respectively.

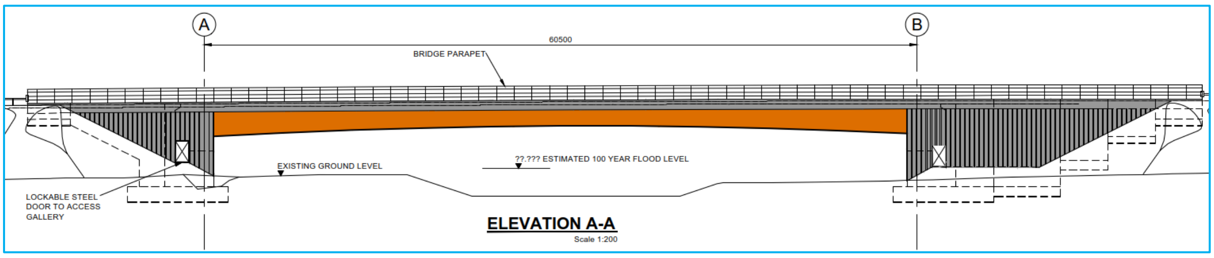

Figure 13-2 Structural Elevation of the Proposed Bridge Crossing

(NTS shown for design intent only - refer to Road Drawings for bridge details)

Plate 13-13 View from the N63 Looking Northwest Towards the Proposed Bridge Crossing.

The main receptor groups are motorists and residents, their sensitivity and susceptibility are considered **Moderate** as the Proposed Road Development is viewed across the existing road which sets a precedent. Prior to establishment of mitigation, the magnitude of visual change is **High** resulting in a **Significant Adverse Visual Effect** associated with the elevated road for approximately 500 m. One residence in particular situated to the south of the existing N63 (visible in Plate 13-13above), is located less than 100 m from the proposed bridge crossing and will have clear uninterrupted views to the bridge. The residents will experience **High** sensitivity and susceptibility to significant change from the existing rural landscape to the proposed road bridge, resulting in **Very Significant Adverse Visual Effect**.

13.6.2.8 Viewpoint 4 – View from Abbeyknockmoy Community Centre

The Community Centre and Newtown National School are located on the existing N63 about 1 km east of Abbeyknockmoy village. Both buildings front onto the existing road with rear views to the north towards the tree-lined banks of the Abbert River. As the Proposed Road Development will be on the opposite side of the river about 250 m from the school, direct views south of the Proposed Road Development will be screened. Views will be achieved to the south-west from the grounds of the school and the car park of the Community Centre to the proposed bridge crossing at a distance of approximately 500 m. (Refer to photograph Plate 13-14).

Plate 13-14 View Northwest from Abbeyknockmoy Community Centre Carpark

Plate 13-15 Photomontage of Proposed Road Development and Bridge Crossing from Community Centre Carpark

The main receptor groups are users of the buildings, school grounds and community centre grounds, their sensitivity and susceptibility are considered **Slight** as the Proposed Road Development is either screened by vegetation or viewed at an oblique angle. The proposed new footpath/cycleway and road crossings will be visible along the route of the existing N63, but this will be contained within the existing road boundaries and have a neutral effect on views. Prior to establishment of mitigation, the magnitude of visual change is **Moderate** resulting in a **Moderate Adverse Visual Effect** associated with the elevated road for approximately a half kilometre.

13.6.2.9 Viewpoint 5 – View from Existing Abbert River Bridge

Approaching the Abbert River bridge from the east at the junction with the rural road (L6159), there is a clear view towards the Abbeyknockmoy Abbey, 1 km from the bridge. The gables of the Abbey are clearly distinguishable above the flat landscape of open fields in the foreground. The Proposed Road Development will be elevated on embankments as it approaches the Abbert River, 600 m from the existing bridge. As such, it will partly obscure the distant view to the Abbey. Taking into consideration the view is mostly experienced by motorists moving through the landscape and the distance of the view, prior to establishment of any mitigation, visual receptors are considered **slightly** sensitive and susceptible to change. The magnitude of visual change is **moderate** resulting in a **Slight Adverse Visual Effect**. Located next to the bridge on the riverbanks is the local community picnic area. Although named Abbey View, this area is set low in the landscape and views are largely obscured by existing riverside vegetation; as such, the predicted visual effect from the riverbanks will be **barely perceptible**.

Plate 13-16 View West from the Existing N63 Bridge over the Abbert River

13.6.2.10 Viewpoint 6 – View from Local Road (L6159)

The L6159 (Old Road) traverses the Proposed Road Development route and the road design incorporates a staggered crossroad junction to provide new means of access. It is inevitable then that there will be both landscape and visual impacts from the country road and in particular from the solitary residential property, facing due south towards the proposed route. The L6156 descends gently downhill from Old Road in the north to the Abbert River bridge crossing in the south (42 m AOD). The current view from the road looking to the west takes in the low fields along the Abbert River extending to Abbeyknockmoy village. The views extend as far as Knockroe Hill (168 m AOD), which is located approximately 2 km to the South. Looking to the east, the views are limited to 200 – 300 m by the tree-lined field boundaries and the treed riverbanks.

The Proposed Road Development and associated works to the new road junction will be at existing grade (approximately 42.0 m AOD) as it crosses the L6159 and for the extents of the scheme to the east, limiting the extent of both landscape and visual impacts. The view to the west, however, will be largely obscured by the Proposed Road Development embankments required for the new Abbert River crossing. The distant ridgeline of Knockroe Hill will still be visible beyond the Proposed Road Development, but the existing views to the Abbert River will be lost.

Plate 13-17 View South from the L6159 Country Road Towards the Proposed Junction

The main receptor groups on the L6159 are motorists and passengers whose sensitivity and susceptibility to change is considered Moderate, while the residents with direct, uninterrupted, and static views of the Proposed Road Development will be highly sensitive and susceptible to the proposed changes. Prior to establishment of any mitigation planting, the view from the Old Road will experience **Moderate Adverse Visual Effects**, while views from the residence which is directly north and within 100 m of the property will experience a **Very Significant Adverse Visual Effect**.

13.6.2.11 Viewpoint 7 – View from the Eastern Extents of the Proposed Road Development

Travelling west towards Abbeyknockmoy, the existing N63 will merge with the Proposed Road Development at the junction with the L6234. The road will be widened primarily along the northern side to allow the existing N63 veer southwards, while the Proposed Road Development continues to the west. The result of the road widening will be loss of the mature hedgerow. Currently the view west is limited by vegetation on both sides of the road. Loss of trees on the north side will open-up views to the north. Retention of the trees along the southern boundary will retain the tree-lined riverbanks which are a strong feature in this low-lying landscape.

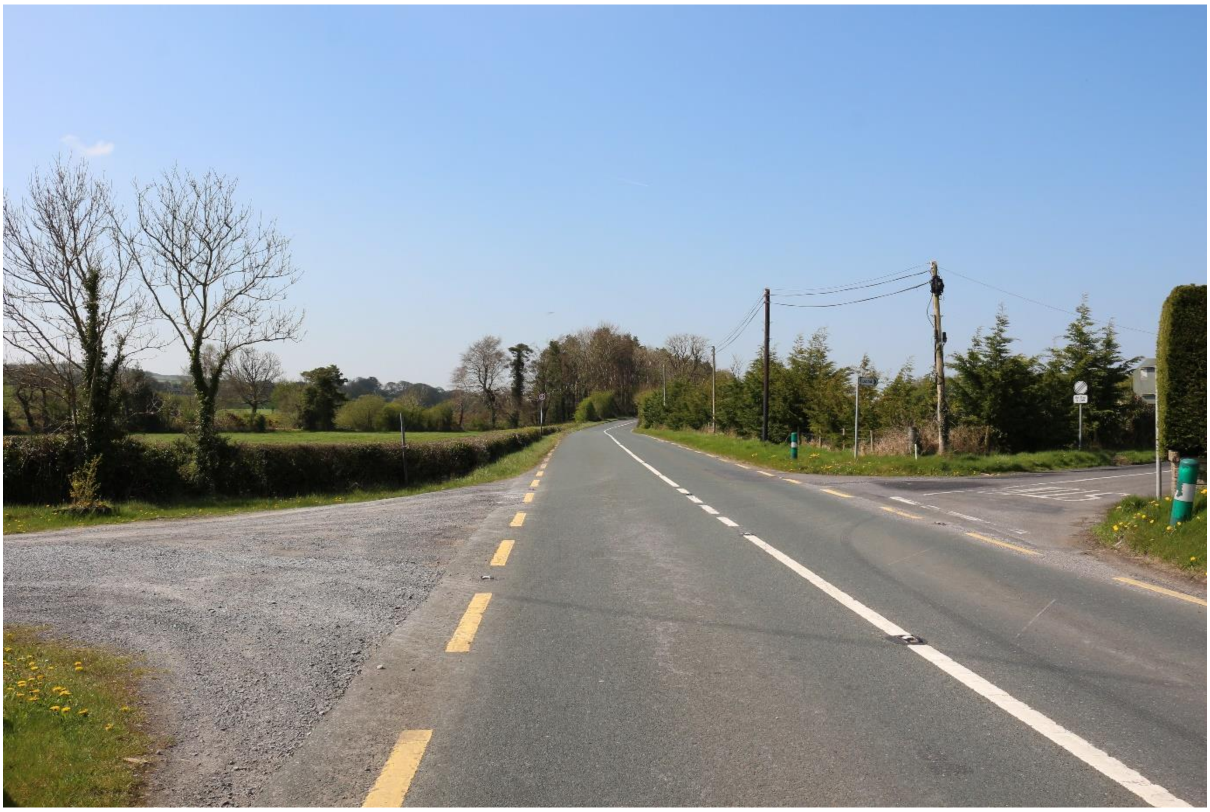

Plate 13-18 View from the N63 Looking Due West, where Road Widening will be required to the Right Hand Side

The main receptor groups are users of the Proposed Road Development and two residences located at the junction of the N63 with the L6234 which will be impacted by the revised road junction and road widening, however they currently experience views of the existing road.

The road user's sensitivity and susceptibility are considered **Slight** as the Proposed Road Development is viewed in the context of widening the existing road. For the two residential properties, the view is static and direct, but impacts will be limited by proposed hedge planting and retention of vegetation along the south roadside. Prior to establishment of mitigation, the magnitude of visual change is **Moderate** resulting in a **Moderate Adverse Visual Effect**.

A summary of visual effects for each viewpoint/photomontage is outlined in Table 13-5.

Table 13-5 Summary of Visual Effects for each Viewpoint/Photomontage

Viewpoints/Photomontages	Receptor Group	Susceptibility to Change	Sensitivity to Change	Magnitude of Landscape Change	Level of Significance
Viewpoint 1 Knockmoy Abbey	Visitors to the Abbey	High	High	Moderate	Significant Adverse
Viewpoint 2 Abbeyknockmoy Village	Residents, pedestrians, and Motorists	Moderate	Slight	High	Moderate Adverse
Viewpoint 3 Existing N63	Residents	Moderate	Moderate	High	Significant Adverse
Viewpoint 3 Existing N63	Motorists	Moderate	Slight	High	Moderate
Viewpoint 4 Abbeyknockmoy Community Centre	Users of the Buildings	Slight	Slight	Moderate	Moderate Adverse

Viewpoints/Photomontages	Receptor Group	Susceptibility to Change	Sensitivity to Change	Magnitude of Landscape Change	Level of Significance
Viewpoint 5 Abbert River, Liss Bridge	Motorists	Slight	Moderate	High	Moderate Adverse
Viewpoint 6 Old Road (L6159)	Motorists	Moderate	Moderate	High	Moderate Adverse
Viewpoint 6 Old Road (L6159)	Residents	High	High	High	Very Significant Adverse
Viewpoint 7 Eastern end of the Proposal	Motorists	Slight	Slight	Moderate	Slight Adverse
Viewpoint 7 Eastern end of the Proposal	Residents	Moderate	Moderate	Moderate	Moderate Adverse

13.6.2.12 Effects on Designated Driving Routes

There are no designated driving routes.

13.6.2.13 Effects on Focal Points and Views

The Galway County Development Plan Objective (FPV 1) aims to preserve listed focal points and views as listed in Map FPV1 from development that will cause negative impact. The Abbey is listed as Focal Point no. 26 in the Development Plan. The view from the Abbey is listed above as Viewpoint 1.

13.6.2.14 Lighting Effects

Lighting effects will arise from both the lighting columns proposed to illuminate the roundabout and the glare of cars using the road at night and in low light conditions. The frequency of vehicles will likely not be any greater than currently experienced on the existing N63. Lighting on the roundabout will be a change from the current level of lighting; one mitigating factor to be considered is the proximity of the roundabout to Abbeyknockmoy village and the associated streetlights. Therefore, the effect of the roundabout lighting will be seen as an extension of the town lighting and not entirely isolated.

The sensitivity of receptors, which will mainly include local residents, vehicle occupants along nearby roads and pedestrians/cyclists on the existing N63 is considered **Medium-High**, depending on the viewing angle. The magnitude of visual change is considered **Medium** and the significance is considered **Moderate Adverse.**

Mitigation measures include the use of directional lighting and flat panel cut-off glass used to minimise light spillage. Planting along the road will reduce the amount of glare from traffic where this has the potential to impact on residences. This is of particular importance for residences experiencing significant visual effects from introduction of the Proposed Road Development into otherwise uninterrupted rural views.

13.7 Mitigation and Monitoring Measures

Mitigation is a term used to describe the measures that are employed to address environmental effects. The purpose of mitigation is to avoid, reduce and where possible remedy or offset, any significant adverse direct and indirect effects on the environment arising from the Proposed Road Development.

Proposed landscape mitigation measures take into account considerations and recommendations outlined in Chapter 08, Biodiversity and will ensure that, species which are locally indigenous are utilised where possible in the proposed planting scheme.

13.7.1 Avoidance Measures

A Constraints Study/Preliminary Route Options Assessment (Stage 1) and an Appraisal of Route Options (Stage 2) were carried out to assess a number of potential sites and route options for this development. The examination of the above concluded (considering all disciplines involved) that the development of Route Option B will have least adverse effect whilst maintaining an optimal standard of geometric design. This route now forms the basis for the current proposal.

13.7.2 Embedded Control Measures

- Minimising the earthworks and change in levels has been considered, the significant level of change at the approached to the river crossing is a result of road design; and
- Maximising the span of the new bridge over the Abbert River to reduce potential landscape impacts on the riverbanks and natural water flows.

13.7.3 Construction Stage

During the construction stage, the Outline Construction Environmental Management Plan (OCEMP) in Appendix A4-1 will be finalised and adopted by the Contractor. Adherence to the OCEMP will be a contract requirement and this will ensure good working practices are followed so as to minimise and manage any significant, negative environmental impacts arising from construction. In terms of landscape and visual effects, these include:

13.7.3.1 Reduction Measures

- Disturbance of existing vegetation will be minimised where possible and proposed planting will help integrate the Proposed Road Development into the surrounding landscape, provide screening where needed, reflect vegetation patterns of local habitats, re-connect hedgerows to re-establish field patterns, and minimise the effect on the landscape character of the area;
- Road boundaries will be planted to reduce headlight glare intrusion into adjacent properties;
- Signage will be located sensitively so that it does not increase the visual effect upon dwellings;
- Rounding of the top and bottom of cut and fill slopes to tie in smoothly with existing adjacent landform; and
- Provision of sufficient protection for trees to be retained in areas close to construction works (as described in BS 5837:2005).

13.7.4 Remediation Measures

13.7.4.1 Field Boundary Strategy

The Proposed Road Development will run through agricultural fields, which have established field boundaries made up of stone walls, fences and hedgerows. The design intent of the landscape mitigation is to provide a proposal that addresses and responds sympathetically to the surrounding context through scale, proportion and materiality. The landscape mitigation proposals form a strategy for integrating the Proposed Road Development into the existing river valley by introducing tree and woodland planting and re-connecting the field patterns with new hedgerows. Positive impact will be experienced locally through the planting of non-annex habitats, including species-rich wildflower meadow, wetland habitat reinstatement and the reuse of spoil/vegetated turves. Hedgerow planting of native mixed species will be used to integrate the road in the existing field patterns but will also improve local bio-diversity with the substantial planting of native hedgerow mixes containing hawthorn, blackthorn, alder buckthorn, guelder rose and dog rose. When planted along the banks and roadsides the hedgerows will form a physical barrier to encourage Barn Owls to fly up and over the road and avoid potentially high risk of collision with on-coming traffic. Tree planting will be introduced in clusters or copses of native trees within the field patterns, combined with the new hedgerows they will provide both new habitat creation and commuting routes for local species

13.7.4.2 Key Principles for the landscape mitigation

- The Proposed Road Development will include a new viewing area looking towards the Abbey. The viewing area will be elevated to maximise the views, it will include layby space for motorists to pull over and walk to the viewing point and it will have a footpath connecting the viewing area with Abbeyknockmoy village. Planting to screen the proposed roundabout will frame views of the Abbey and restrict views to the new road.
- Minimise disturbance of existing vegetation, provide tree and hedgerow protection during construction works (as described in BS 5837:2005).
- Mainly native screen planting will be provided where the road will have an adverse visual effect on adjacent properties or views (further details about the species mix is included in the planting schedule in the landscape mitigation drawings accompanying this planning application, refer to Volume 03 & Volume 04, Appendix A07).
- Reflect field patterns and local habitats to re-connect field boundaries bisected by the Proposed Road Development in order to establish field patterns. Hedgerow planting will be a mix of native shrub and tree species that will provide good range of flowering and fruiting trees to improve the local biodiversity.
- Introduce stands of trees in informal pockets of woodland. Denser planting of trees and native woodland copses will be introduced at the proposed roundabout to provide additional screening and to improve the volume of woodland cover in the local area.
- Construction compounds and former areas of material stockpiles will be fully reinstated and landscaped, matching the vegetation and land use in the vicinity, following completion of the works.
- Wildflower mixes will be used on verges to maximise biodiversity.
- Wetland wildflower meadow (Annex I *Molinia* Meadows) will be impacted by the Proposed Road Development as outlined in Chapter 07 Biodiversity. To mitigate the loss of protected habitat it is proposed to undertake habitat creation and translocate grass sods from the affected area to a nearby field. These works will require specialist design, monitoring and maintenance to ensure the correct hydrological characteristics and soil conditions are retained as described in greater detail in Chapter 07 (also see Volume 03; Figure A7-2). Construction compounds and former areas of material stockpiles will be fully reinstated and landscaped, matching the vegetation and land use in the vicinity, following completion of the works.
- Attenuation ponds will be naturalised with planting of marginal wetland species to the edges.
- All contracted landscape works will be monitored and maintained over an agreed establishment period, trees and shrubs that fail will be replaced with species matching the original planting proposals. Replacement stock size must reflect the size and form of adjacent planting of the same species.
- Planting works will be in compliance with British Standard BS 3998 ‘Recommendations for tree work’ and should be implemented in suitable weather conditions during the winter planting season.

13.7.5 Operational Stage

The proposed landscape mitigation proposals are contained within the set of planning application drawings (Volume 03; Figures A13-2 to A13-7). The landscape mitigation plan shows an approach which screens where necessary, softens the effect of the Proposed Road Development construction in other areas allowing for the road and bridge crossing to be integrated within the landscape over time.

A number of boundary treatments are proposed to best suit the context of the Proposed Road Development as follows:

- Ch. 0+000 – 0+500

The integration of the Proposed Road Development with the existing road should be as seamless as possible. The Proposed Road Development begins on the periphery of the village at the existing transition from 50 km speed limit to 100 km. The existing northern boundary treatments at this point change from residential walls to roadside verge and hedges. The southern boundary of the existing road is lined with ornamental trees and stone wall boundary of the Granary residential estate. As the new road veers north towards the proposed viewing area and the roundabout, the existing footpath will be extended to converge with the old road. It is proposed to add a cluster of tree planting to the space between the new and the old roads to create a visual break and reduce the cumulative effect from the two roads in close proximity.

The proposed viewing area looking north towards the Abbey provides a benefit to the local community, it is important therefore to maintain uninterrupted views to the Abbey, while providing some screening of the roundabout. Landscape mitigation will introduce field hedges to the southern road boundary with some native woodland copses east of the viewing area and on the embankments of the roundabout. Any areas retained open for improved views will be seeded in species rich grasslands suitable for pollinators. However, while retaining views to the Abbey is important, the view from the Abbey is considered to be highly sensitive to change and the screening of the roundabout and embankments from the Abbey is equally important. The clusters of trees will also provide screening from the south.

- Ch. 0+500 – 0+1000

The proposed roundabout has been identified as a significant landscape effect, resulting in the loss of trees and being visually dominant to residents on the fringes of the village. The opportunity to introduce woodland copses at this location will break up views of the Proposed Road Development without attempting to screen it entirely and will also allow distant views to the Abbey. The central median of the roundabout will allow direct replacement of the lost tree by planting of a small cluster of three (3 no.) semi-mature trees.

- Ch. 0+1000 – 0+1500

Between the roundabout and the river crossing the Proposed Road Development is raised on an embankment. Roadside boundary treatments will comprise clusters of feature trees and hedgerow planting, it will avoid creating a linear belt of woodland. Grass verges will be seeded in species rich grasslands suitable for pollinators. The introduction of woodland clusters will visually break up the embankment and reflect the plant mixes of established tree lined hedgerows and riverbanks in the near vicinity.

- Ch 0+1500 to 1600 (bridge crossing)

The bridge will be a prominent feature of the landscape from many viewpoints, in particular when considering the rear views from a property due south of the proposed route with clear uninterrupted views north to the bridge. While it is not possible or appropriate to entirely screen the bridge introduction of denser tree planting along the riverbanks will reflect the nature of the treelined riverbanks at the existing N63 bridge crossing. As the proposed bridge crosses the river at an oblique angle planting of the roadside embankments north and south will allow a partial overlap of tree planting, thus in time the trees will be higher than the bridge parapets viewed from most angles and adverse effects will be substantially reduced.

- Ch. 0+1600 – 0+2500

East of the Abbert River, the Proposed Road Development drops down to existing levels and continues through flat low-lying pasture lands, crossing a minor road and associated stone ditches. The Proposed Road Development will have little effect on the existing landscape through this section, crossing mostly fenced field boundaries, however the route is within close proximity to a residential property off the L6159 and will result in a significant visual effect. Proposed mitigation along this route will introduce a higher proportion of tree clusters to the proposed roadside boundary hedges. This treatment is considered appropriate to the landscape setting of the tree lined riverbanks to the south of the route.

- Ch. 0+2500 to 3100

As the Proposed Road Development merges with the existing N63, the resultant road widening will cause the loss of the northern roadside hedge. The proposed mitigation will be to replace like-for-like for the duration of approximately 600 m. As the existing hedge has trees up to 6.0 m height, planting of mixed species hedgerows should include frequent occurrences of heavy standard trees in small clusters. Consideration of denser planting will be given at the junction of the Proposed Road Development with the existing N63, to reduce cumulative effect from both roads running adjacent to one another.

13.8 Residual Effects

13.8.1 Residual Landscape Effects

The location of the Proposed Road Development will change the landscape character locally, the route is through existing agricultural fields, requiring the removal of established trees and hedgerows. Introduction of the road surface and associated features such as roadside embankments will have an inevitable change on the immediate environment, however the significance of these changes rapidly diminishes within the broader context of the landscape.

Slight to Significant Adverse effects on the Abbert River and its setting will be experienced initially due to the introduction of roadway infrastructure, bridge, and associated barriers and railings along with the introduction of vehicle movements in a location where there haven't been any previously. Greater impacts have been avoided due to proposed mitigation by the approach to design of the new bridge and the routing of the Proposed Road Development.

As the proposed planting matures and becomes established the perceivable change to the landscape character that resulted from the removal of established trees and hedgerows will be neutralised. Specification of mixed native hedgerow planting and wildflower meadow grass for pollinators can improve local biodiversity and have a positive effect through creation of a wildlife corridor.

The Proposed Road Development embankments and the proposed bridge cannot be entirely screened and will remain visible as man-made elements of the rural landscape. In time, this will be softened by boundary planting, in addition introduction of tree clusters along the route will break up the linear form of the road in the rural landscape and allow the road boundaries to merge with the existing field patterns. This will result in a reducing the residual impact on the landscape from a **Moderate to Significant** Adverse Effect to a **Slight** to **Moderate and Adverse** Residual Effect

Where the Proposed Road Development connects with the existing road network to the east, 'like-for-like' boundary planting will reduce any residual landscape effects caused by vegetation removal to **neutral**.

The proposed landscape mitigation of the ponds will help naturalise the formal edges and improve species diversity. The creation of new wildlife habitat will bring positive changes to the biodiversity and enhance the local area giving a **Slight and Positive Change to the Landscape.**

A summary of landscape effects of the Proposed Road Development on these receptors is provided in the table below. In general, the highest landscape effects will arise from changes to landform on the approaches to the river crossing. There are also positive landscape effects arising from the proposed planting.

Table 13-6 Summary of Mitigated Landscape Effects

Receptor	Susceptibility to Change	Sensitivity to Change	Magnitude of Change	Initial Effect	Mitigated Effect (Vegetation 10 yrs.)
LCA 1 - Northeast Galway	Low	Low	Medium	Slight Adverse	Slight Neutral
LCA 2 - East Central Galway	Low	Low	Medium	Slight Adverse	Slight Neutral
Abbert River	Moderate	Moderate	High	Significant Adverse	Moderate Adverse
Field and Road Boundaries	Moderate	Low	Medium	Slight to Moderate Adverse	Slight neutral

13.8.2 Residual Visual Effects

The most significant residual visual effects will arise due to the visibility of landform changes, vehicles, the roundabout, and the new vehicular bridge. Adherence to the proposed landscape mitigation measures, their successful implementation and maintenance will result in a reduction of visual effects over time as the proposed screening vegetation matures. This section of the report re-evaluates the visual assessment following an establishment period of approximately 10 years. During this period hedge rows will have reached maturity and young trees while not fully mature will have gained a reasonable height up to 8.0 m or greater depending on species choice. The proposed mitigation planting aims to reduce the impact by introduction of hedgerows and clusters of trees. This will not entirely screen the road, but it will avoid an unnatural tree belt along the line of the road that will adversely affect the character of the area.

13.8.2.1 Viewpoint 1 – Knockmoy Abbey

Prior to establishment of mitigation the magnitude of visual change is predicted as High resulting in **Significant Adverse Visual Effects**. Proposed mitigation includes hedgerow planting of the embankments and clusters of trees becoming denser at the roundabout. This will enable partial screening of the roundabout, and it will break up the massing of the linear road form. Views more easterly towards the river and bridge crossing embankments will likewise be broken up by tree clusters and hedge planting, which will screen the road surface. The proposed mitigation cannot entirely screen the Proposed Road Development or camouflage its embankments, but it will substantially reduce the visual effect to **Slight and Adverse.** (Refer to Volume 04; Appendix A13-1, Photomontages 1a and 1b (Figures 13.14 and 13.16).

13.8.2.2 Viewpoint 2 – View from the Periphery of Abbeyknockmoy Village

Prior to establishment of mitigation, the magnitude of visual change is **High**, but the sensitivity to change is considered **Slight**, resulting in **Moderate and Adverse Visual Effects**. In considering the residual effect on the views experienced on the periphery of Abbeyknockmoy, consideration has been given to the design of a viewing area of the Abbey. In order to gain the most benefit of this view, considerable screen planting has been proposed along the roadside boundary of the roundabout, along with clusters of tree planting at the convergence of the new road with the old road. Thus, allowing views to the Abbey to be framed by tree planting and limiting the visibility of the new road. It is considered on establishment of the planting the visual effect will be reduced from Moderate and Adverse to **Slight and Adverse.**

13.8.2.3 Viewpoint 3 – View from the Existing N63

Prior to establishment of mitigation, the magnitude of visual change is considered to be **High** resulting in a **Significant Adverse Visual Effects** associated with the elevated road. One residence to the south of the existing N63 is predicted to experience **High** sensitivity and susceptibility to significant change resulting in **Very Significant Adverse Visual Effects**.

On establishment of the proposed planting, tree clusters will break up the continuity of the road and hedges will screen the road surface and vehicular movement. The majority of viewers will experience residual **Slight to Moderate and Adverse Visual Effects**. The visual effect from the nearest residence while partially screened will remain as **Significant and Adverse**.

13.8.2.4 Viewpoint 4 – View from Abbeyknockmoy Community Centre

Prior to establishment of mitigation, the magnitude of visual change is **Moderate** resulting in **Moderate Adverse Visual Effects** associated with the elevated road. On maturity of the proposed planting, it is predicted the Proposed Road Development as viewed from the Community Centre and School will become largely integrated with the tree-lined riverbanks in the foreground of the view, resulting in **Slight and Adverse Residual Effects**. (Refer to Volume 04; Appendix A13-1, Photomontage Figure 13.21).

13.8.2.5 Viewpoint 5 – View from Existing Abbert River Bridge

Taking into consideration the view is mostly experienced by motorists moving through the landscape and prior to establishment of any mitigation, a **Moderate Adverse Visual Effect** could be expected form the existing bridge. On maturity of the planting, the Proposed Road Development and associated embankments will be partially visible, but the roadside planting will be integrated with field boundaries giving the road a permanent and acceptable setting in the landscape resulting in **Slight and Adverse Visual Effects.**

13.8.2.6 Viewpoint 6 – View from Local Road (L6159)

The main receptor groups on the L6159 are motorists whose sensitivity and susceptibility to change is considered Moderate, while the residents with direct, uninterrupted, and static views of the Proposed Road Development will be highly sensitive and susceptible to the proposed changes. Prior to establishment of any mitigation, planting the view from the country road will experience **Moderate Adverse Visual Effects**, while views from the residence, which are directly north and within 100 m of the property, will experience **Very Significant Adverse Visual Effects**.

Over time, the planting will largely screen views from the retained sections of L6159, resulting only in slight and adverse effects for vehicle users. However the views of the Proposed Road Development from the residence due north will not be entirely screened, planting will break up the linear form of the road and screen the vehicles on the road, the road embankments and bridge crossing will be visible resulting in residual **Significant and Adverse Visual Effects.**

13.8.2.7 Viewpoint 7 – View from the Eastern Extents of the Proposed Road Development

Prior to establishment of mitigation, the magnitude of visual change is **Moderate** resulting in **Moderate Adverse Visual Effects**. On maturity of the proposed planting, the southern roadside boundary will effectively replace the removed vegetation and result in a **slight but neutral effect.**

A summary of visual effects for each viewpoint/photomontage is enclosed in the table below.

Table 13-7 Summary of Visual Effects for each Viewpoint/Photomontage

Viewpoints/Photomontages	Receptor Group	Susceptibility to Change	Sensitivity to Change	Magnitude of Change	Original Effect	Residual Effect
Viewpoint 1 Knockmoy Abbey	Visitors to the Abbey	High	High	High	Significant Adverse	Moderate Adverse
Viewpoint 2 Abbeyknockmoy Village	Residents, pedestrians, and Motorists	Moderate	Slight	High	Moderate Adverse	Slight Adverse
Viewpoint 3 Existing N63	Residents	Moderate	Moderate	High	Significant Adverse	Significant Adverse
Viewpoint 3 Existing N63	Motorists	Moderate	Slight	High	Moderate Adverse	Slight Adverse
Viewpoint 4 Abbeyknockmoy Community Centre	Users of the Buildings	Slight	Slight	Moderate	Moderate Adverse	Slight Adverse
Viewpoint 5 Abbert River Bridge	Motorists	Slight	Moderate	High	Moderate Adverse	Slight Adverse
Viewpoint 6 Old Road (L6159)	Motorists	Moderate	Moderate	High	Moderate Adverse	Slight Adverse
Viewpoint 6 Old Road (L6159)	Residents	High	High	High	Very Significant Adverse	Significant Adverse
Viewpoint 7 East of the Proposal	Motorists	Slight	Slight	Moderate	Slight Adverse	Slight Neutral
Viewpoint 7 East of the Proposal	Residents	Moderate	Moderate	Moderate	Moderate Adverse	Slight Neutral

13.9 Do-Nothing Scenario

A 'Do Nothing' scenario, in which the Proposed Road Development does not proceed is the baseline against which the impact of the Proposed Road Development will be compared within the EIAR.

In landscape terms, if the works did not go ahead, the site and the current landscape character will remain unchanged.

In visual terms, the content in available views will remain the same, although changes will occur to existing vegetation due to maturing, pruning or natural decay and the likelihood of additional housing being constructed along the existing N63 corridor or the eastern fringes of Abbeyknockmoy.

13.10 Cumulative Impacts and Effects

Cumulative effects are expected at the convergence of the proposed and existing roads, as the old road is to be retained to provide access to residences. The combined effect of both roads will create a substantial area of road surface, particularly when combined with footpaths and private accesses. At the western end of the route this is further effected by the requirement for a turning space.

Potential cumulative projects have been reviewed as listed in Volume 04, Appendix A1-1, and no projects of similar character and scale have been identified which would lead to cumulative landscape and visual effects.

13.11 Summary

The majority but not all of the identified likely adverse landscape and visual effects can be mitigated. The road design has incorporated a new viewing area for the Knockmoy Abbey for the benefit of users and in particular for the benefit of the local community. A new roundabout is introduced to the periphery of Abbeyknockmoy that links up with the retained N63. A new footway/cycleway will be introduced along the existing N63 connecting the school and community centre with the village core to the west.

The Proposed Road Development takes a more northerly route than the existing road and crosses the Abbert River on an embankment and bridge. The raised road embankments will create the most significant landscape effects and are the most challenging feature to mitigate. Mitigation has avoided planting woodland along the entire road corridor as the resultant tree belt will further effect the landscape character. Instead clusters of trees are proposed to break up the linear form of the road. Substantial planting of new hedgerows is proposed to integrate the roadside boundaries with the existing hedgerows and riverbanks.

Proposed planting will mitigate the majority but not all of the likely adverse visual effects. From certain viewpoints, vehicles and elevated parts of the road alignment including the new bridge will remain visible, particularly from residential properties directly overlooking the Abbert River.

13.12 References

- TII: Landscape Character Assessment (LCA) and Landscape and Visual Impact Assessment (LVIA) of Proposed National Roads - Standard, PE-ENV-01102, December 2020.
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- National Parks and Wildlife Service (NPWS), http://www.npws.ie/.
- Irishtrails, https://www.sportireland.ie/outdoors/find-your-trails.
- National Monuments Service, Archaeological Survey of Ireland, https://webgis.archaeology.ie/NationalMonuments/WebServiceQuery/Lookup.aspx.
- Ordnance Survey Ireland, 1:50,000 Discovery Mapping.

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 14: Cultural Heritage

Galway County Council

February 2022

Table of Contents

Figures

No figures entries.

Tables

Volume 03 Figures

Volume 04 Appendices

14. Cultural Heritage

14.1 Introduction

This chapter presents an assessment of the impacts of the Proposed Road Development on cultural heritage assets. It defines the study area; the methodology used for developing the baseline and impact assessment; provides a description of the baseline environment in relation to cultural heritage and presents the findings of the impact assessment.

The main points of this chapter are outlined below.

- A study area of 500 m extending from the Proposed Road Development boundaries was adopted for this chapter. This determined that there are several interesting architectural heritage features in proximity to the Proposed Road Development including Knockmoy Abbey (National Monument No.166), a National Monument, Liss Bridge (National Monument No. 3925), and the demesne landscape of Newtown House (National Inventory of Architectural Heritage (NIAH) ref: 5365).
- Only a peripheral part of the demesne landscape of Newtown House (NIAH ref: 5365) will be directly affected by the Proposed Road Development.
- There are no other known archaeological or architectural heritage assets within the footprint of the Proposed Road Development although there is the potential for the discovery of previously unknown, buried archaeological features within the site.
- An archaeological geophysical survey completed within the footprint of the Proposed Road Development has identified some buried soil anomalies of possible archaeological provenance.
- Archaeological test excavations will be conducted throughout the footprint of the Proposed Road Development, if approved, and any sites uncovered will be fully excavated by hand and published for the public benefit.
- The effect on the rural setting of Knockmoy Abbey (National Monument No.166) from the presence of the Proposed Road Development will be reduced to some degree by sensitive landscaping and planting; and a new viewing area is incorporated in the design of the Proposed Road Development.

14.2 Legislation, Policy and Guidance

This Environmental Impact Assessment Report (EIAR) chapter has been undertaken in accordance with all relevant legislation, policies and guidelines. The documents utilised in the preparation of this study include:

- National Monuments Acts (1930 – 2004);
- The Heritage Act 1995 (as amended);
- National Heritage Plan (2002);
- Planning and Development Acts 2000 – 2020;
- Galway County Development Plan 2015 – 2021 (GCC, 2015);
- Environmental Protection Agency's (EPA) draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017);
- Transport Infrastructure Ireland (formerly NRA)'s 'Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes' (TII, 2005a);
- Transport Infrastructure Ireland's 'Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes' (TII, 2005b);
- Department of the Environment, Heritage and Local Government's (DEHLG) 'Government Policy on Architecture 2009 – 2015' (DEHLG, 2009); and
- Department of Arts, Heritage and the Gaeltacht's (DAHG) 'Architectural Heritage Guidelines, Guidelines for Planning Authorities' (DAHG, 2011).

It should also be noted that the new national heritage plan- Heritage Ireland 2030 and the Cultural Heritage Impact Assessment (CHIA) of Transport Infrastructure Ireland (TII) Projects – Overarching Technical Document are currently being drafted and may be in the public domain by the time this EIAR is published.

14.2.1 Local and National Policy Framework

14.2.1.1 Galway County Development Plan 2015 – 2021

The Galway County Development Plan 2015 – 2021 (GCC, 2015) was effective from 23 February 2015 and sets out an overall strategy for the proper planning and sustainable development of the functional area of Galway County Council (GCC). The plan includes 11 strategic aims with the strategic aim in regard to heritage to "*enhance and protect the built heritage and national environment including buildings, archaeology, landscape and biodiversity within the County*".

Chapter 9 of the plan provides for a strategic context in relation to heritage, landscape and environmental management. It recognises that heritage is a very valuable, finite resource. As such, the chapter sets out general heritage policies as well as the legislative context to built heritage including the architectural heritage, protected structures, architectural conservation areas, vernacular architecture, energy efficiency, traditional built structures, designed landscapes and archaeological heritage. The chapter also contains architectural and archaeological heritage policies and objectives. The landscape character and important focal points and views are also dealt with in the chapter with accompanying policies and objectives.

The general heritage policies outlined in Chapter 9 are:

- Policy GH 1 – Conserve, protect and enhance the special character of the County as defined by its natural heritage and biodiversity, its built environment, landscape and cultural, social and sporting heritage;
- Policy GH 2 – Ensure that heritage protection is an integral part of coherent policies on economic and social development and of urban and rural planning;
- Policy GH 3 – Implement the legislative provisions of the Planning and Development Act, 2000 (as amended), which offers protection to the architectural, archaeological and natural heritage; and
- Policy GH 4 – Engage with all relevant stakeholders (and in particular local communities) in matters relating to the protection of natural, built and cultural heritage.

In consideration of the archaeological heritage of County Galway, the Council have established a number of policies to govern proposed development in the area and to further promote the archaeological heritage. The policies are:

- Policy ARC 1 – Legislative Context: It is the policy of Galway County Council to support and promote the conservation and appropriate management and enhancement of the County's archaeological heritage within the plan area. Galway County Council will ensure the implementation of the legislative, statutory and policy provisions relevant to the conservation of the archaeological heritage;
- Policy ARC 2 – Archaeological Sites: Seek to promote awareness of and access to archaeological sites in the County where appropriate;
- Policy ARC 3 – Consultation: Consult with the National Monuments Service of the Department of Arts, Heritage and the Gaeltacht in relation to proposed developments adjoining archaeological sites;
- Policy ARC 4 – Management of Archaeological Sites and Monuments: Support the preservation, conservation and management of archaeological sites and monuments, together with the settings of these monuments;
- Policy ARC 5 – Archaeological Heritage: Ensure the protection and sympathetic enhancement of archaeological heritage in the plan area, in particular by implementing the relevant provisions of the Planning and Development Act, 2000 (as amended), The National Monuments Act, 1930 (as amended), and The National Policy on Town Defences, 2008 (Department of the Environment, Heritage and Local Government); and
- Policy ARC 6 – Archaeological Landscapes: To facilitate where possible the identification of important archaeological landscapes in the County.

These policies are supplemented with seven objectives to help achieve the aims of the policies above. These objectives are a material consideration in the planning process with the following [five] applicable to this project:

- Objective ARC 1 – Protection of Archaeological Sites: Protect archaeological sites and monuments their settings and visual amenity and archaeological objects and underwater archaeological sites that are listed in the Record of Monuments and Places, in the ownership/guardianship of the State, or that are subject of Preservation Orders or have been registered in the Register of Historic Monuments and seek to protect important archaeological landscapes;
- Objective ARC 2 – Development Management: All planning applications for new development, redevelopment, any ground works, refurbishment, and restoration, etc. within areas of archaeological potential or within close proximity to Recorded Monuments or within the historic towns of County Galway (Ardrahan, Athenry, Dunmore, Eyrecourt, Loughrea and Tuam) will take account of the archaeological heritage of the area and the need for archaeological mitigation;
- Objective ARC 3 – Protection of New Archaeological Sites: Protect and preserve archaeological sites, which have been identified subsequent to the publication of the Record of Monuments and Places;
- Objective ARC 6 – Underwater Archaeological Sites: To protect and preserve the underwater archaeological sites in rivers, lakes, intertidal and sub-tidal locations; and
- Objective ARC 7 – Recorded Monuments: Ensure that any development in the immediate vicinity of a Recorded Monument is sensitively designed and sited and does not detract from the monument or its visual amenity.

The architectural heritage, or historic built environment, is considered in two policies designed to preserve those structures. Policy AH 1 is applicable to this Proposed Road Development:

- Policy AH 1 – Architectural Heritage: Protect the architectural heritage of County Galway which is a unique and special resource.

There are in addition, a number of objectives set by the Council with regards to the architectural heritage. These are:

- Objective AH 1 – Legislative Context: Ensure the protection of the architectural heritage of County Galway, which is a unique and special resource, in particular by implementing the legislative provisions of the Planning and Development Act, 2000 (as amended) in relation to architectural heritage and the policy guidance contained in the Architectural Heritage Protection Guidelines 2011 (and any updated/superseding document);
- Objective AH 2 – Protected Structures (Refer to Appendix V): Ensure the protection and sympathetic enhancement of structures included and proposed for inclusion in the Record of Protected Structures (RPS) that are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest, together with the integrity of their character and setting;
- Objective AH 5 – Demolition: Prohibit development proposals, either in whole or in part, for the demolition of protected structures, save in exceptional circumstances, or the demolition of a structure within an Architectural Conservation Area that contributes to the special character of the area; and
- Objective AH 6 – Vernacular Architecture: Recognise the importance of the contribution of vernacular architecture to the character of a place and ensure the protection, retention and appropriate revitalisation and use of the vernacular built heritage, including structures that contribute to landscape and streetscape character and resist the demolition of these structures.

14.3 Methodology

14.3.1 Study area

The 'Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Proposed Road Developments' (TII, 2005a) and the 'Guidelines for the Assessment of Architectural Heritage Impacts of National Road Proposed Road Developments' (TII, 2005b) provide guidance for the preparation of an Environmental Impact Statement (now referred to Environmental Impact Assessment Reports or EIARs). These state that an appropriate study area would be 50 m either side of the centre line of the new road. The guidelines also state that professional judgement should be used to determine if the study corridor should be extended in respect of the chosen route to take account of assets, planned landscapes and the settings of heritage sites beyond the proposed study area.

The archaeological impact considers a study area that extends 500 m from the boundary of the Proposed Road Development site. The extent of this study area was determined by the nature of the Proposed Road Development which consists of a limited surface area and therefore, unlikely to impact upon cultural heritage assets located beyond this distance whilst also taking account of the settings of designated heritage assets within the study area.

14.3.2 Determination of the Baseline Environment

A study area of 500 m from the Proposed Road Development site boundary has been used to identify all known and potential cultural heritage (archaeological, architectural heritage and designed landscapes) assets. This study area is illustrated on Figure A14-1 in Volume 03 and has been utilised to produce a figure illustrating the surrounding cultural heritage assets. Heritage data from all sources has been identified within this 500 m buffer. The size of this study area enabled a detailed examination of the heritage assets surrounding the site, in order to provide sufficient archaeological and historical contextual information and allow an assessment of the archaeological potential of the site to be made.

A programme of geophysical survey was carried out within the Proposed Road Development site in August 2020, in order to further clarify the character, extent and significance of the archaeological resource, and to inform potential mitigation measures and detailed design elements of the Proposed Road Development (Earthsound, 2020). The geophysical survey method statement and report are included as Appendix A14-1 in Volume 04 of the EIAR.

Additionally, an assessment of setting was utilised for designated heritage assets (Protected Structures, National Monuments, Recorded Monuments and sites on the Register of Historic Monuments) within the 500 m study area.

14.3.3 Determination of Sensitive Receptors

A heritage asset is defined as a monument, building, group of buildings and sites, which are the combined works of nature and man constituting the historic or built environment (World Heritage Convention, 1972). A heritage asset's value is not solely expressed through any designated status but can also be exhibited through a series of values or special interests. These include architectural, historical, artistic, archaeological, cultural, scientific, social or technical interests. In order to assess the potential effects of a development upon a heritage asset, it must first be assigned a level of importance. This can be done in accordance with a four-point scale (Table 14-1). This table has been derived from the following guidance, with reference to relevant legislation and policy, and using professional judgement outlined in Section 14.2.1:

- NIAH Handbook (DAHG, 2013);
- EPA's draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017);
- Code of Practice for Archaeology agreed between the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs and Transport Infrastructure Ireland, (DAHRRG, 2017);
- TII's 'Guidelines for the Assessment of Archaeological Heritage Impacts' (particularly Appendix 2, Significance Criteria) (TII, 2005a); and
- TII's 'Guidelines for the Assessment of Architectural Heritage Impacts' (particularly Table 8) (TII, 2005b).

Table 14-1 Factors Determining the Importance of Heritage Assets

Importance	Criteria
National/High	• National Monuments. • Recorded Monuments deemed to be of high importance using legislation, EPA guidance, TII Significance Criteria and professional judgement. • Protected Structures deemed to be of high importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Structures recorded by the NIAH Building Survey with a National Rating or deemed to be of high importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Designed landscapes recorded by the NIAH Garden survey with main features substantially present and deemed to be of high importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Architectural Conservation Areas containing structures and/or designed landscapes of predominantly national importance. • Undesignated archaeological remains which are rare or complex in nature, and deemed to be of high importance using legislation, EPA guidance, TII Significance Criteria and professional judgement.
Regional/Medium	• Recorded Monuments deemed to be of medium importance using legislation, EPA guidance, TII Significance Criteria and professional judgement. • Protected Structures deemed to be of medium importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Structures recorded by the NIAH Building Survey with a Regional Rating or deemed to be of medium importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Designed landscapes recorded by the NIAH garden survey with main features substantially present and deemed to be of medium importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Architectural Conservation Areas containing structures and/or designed landscapes of predominantly regional importance. • Undesignated architectural heritage assets which are deemed to be of medium importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Undesignated archaeological remains which are neither particularly common nor uncommon, and/or of moderate complexity, and deemed to be of medium importance using legislation, EPA guidance, TII Significance Criteria and professional judgement.
Local/Low	• Structures recorded by the NIAH Building Survey with a Local or Record Only Rating or deemed to be of low importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Designed landscapes recorded by the NIAH garden survey with only peripheral features surviving, and deemed to be of low importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Townland Boundary Features. • Undesignated architectural heritage assets which are deemed to be of low importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. • Undesignated archaeological features which are particularly common or in poor condition, and deemed to be of low importance using legislation, EPA guidance, TII Significance Criteria and professional judgement. • Parks/Gardens/Demesnes recorded by the NIAH Garden Survey which have poor historic legibility.

14.3.4 Describing Potential Effects

14.3.4.1 Criteria for Assessing the Magnitude of Effect

Having identified the importance of the heritage asset, the magnitude of the effect from the proposed development is assessed. Potential effects are defined as a change resulting from the proposed development which affects a heritage asset. Effects may arise during construction or operation and can be temporary or permanent.

The quality can be reported on a three-point scale:

- Positive – a change which improves the quality or the special interests of the asset, for example the removal of an element of the surrounding setting which detracts from the appreciation of an asset;
- Neutral – a change which does not affect the quality or special interests of the asset; and
- Negative/adverse – a change which reduces the quality or special interest of the asset, for example the removal of a below-ground archaeological deposit through construction.

The extent and context can be assessed by the following two descriptions:

- Extent – the description of the size of the area and number of assets affected by the impact; and
- Context – the description whether the extent, duration, or frequency will conform or contrast with established baseline conditions relating to an asset.

The probability can be described by the following two points:

- Likely – these are effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented; and
- Unlikely – these are effects than can reasonably be not expected to occur because of the planned project if all mitigation measures are properly implemented.

The duration can be defined by the following criteria:

- Momentary – lasting from seconds to minutes;
- Brief – lasting for a day or less;
- Temporary – lasting for one year or less;
- Short-term – lasting one to seven years;
- Medium-term – lasting seven to fifteen years; and
- Long-term impact – lasting fifteen to sixty years.

Effects can also be identified as permanent, i.e. lasting over sixty years and reversible impact, i.e. can be reversed through remediation or restoration. Another consideration is the frequency of the effect, i.e. how often will the impact occur; once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually.

These effects have been derived from the EPA's draft 'Guidelines for the Information to be Contained in an Environmental Impact Assessment Reports' (hereafter referred to as the 'EPA draft guidelines') (EPA, 2017) and as outlined in Chapter 01: Introduction. The effect upon the setting of an asset is also taken into account. Taking these criteria into consideration, the magnitude of effects can be assigned by reference to a four-point scale (Table 14-2).

Table 14-2 Factors Determining the Magnitude of Effect

Magnitude of Effect	Description
High	Change such that the special interests or qualities of the asset are totally altered or destroyed. Comprehensive change to setting affecting importance of asset, resulting in a serious loss in our ability to understand and appreciate the asset.
Medium	Change such that the special interests or qualities of the asset are affected. Noticeably different change to setting affecting importance, resulting in erosion in our ability to understand and appreciate the asset.
Low	Change such that the special interests or qualities of the asset are slightly affected. Slight change to setting affecting significance resulting in a change in our ability to understand and appreciate the asset.
Negligible	Minimal change to the asset that has little effect on its special interests or qualities. Does not affect our ability to understand and appreciate the asset.

Source: EPA draft guidelines 2017

The level of effects takes into account mitigation measures, which have been embedded within the Proposed Road Development as part of the design development process.

14.3.5 Significance of Effect

Once the magnitude of the effect has been identified, this can be cross-referenced with the importance of the asset to derive the overall significance of the effect, or the consequence of the change resulting from the Proposed Road Development. Effects can be neutral, positive or negative

The significance can be judged on a six-point scale:

- Not significant – an effect which causes noticeable changes in the character of the asset but without significant consequences;
- Slight – an effect which causes a noticeable change without affecting the special interests or qualities of the asset to any particular degree;
- Moderate – a change which alters the character or special qualities of an asset in a manner that is consistent with existing and emerging baseline trends;
- Significant – an effect, which by its character, magnitude, duration or intensity, alters the special interests or qualities of an asset;
- Very significant – an effect which by its character, magnitude, duration or intensity significantly changed the special interests or qualities of an asset; and
- Profound – an effect which obliterates the special interest or qualities of an asset.

Table 14-3 Significance of Effect Matrix

Magnitude of Effect	Importance of Cultural Heritage Asset			
	Local	Regional	National	International
High	Significant	Significant	Profound	Profound
Medium	Moderate	Significant	Significant	Profound
Low	Slight	Moderate	Significant	Significant
Negligible	Imperceptible	Slight	Slight	Moderate

Source: EPA draft guidelines 2017

This chapter considers that moderate to profound effects are significant. Once a significant effect has been identified, additional mitigation may be used to offset or compensate for any significant adverse effects, or to enhance positive effects. Re-assessing the significance of the effect after applying additional mitigation allows the level of residual effect to be assessed.

14.4 Limitations and Assumptions

The assessment is based upon currently available information at the time of writing and on a walkover survey of the study area. Non-intrusive archaeological fieldwork has been undertaken to inform this assessment, though the results of this fieldwork have not been verified by intrusive archaeological fieldwork.

14.5 Baseline Environment

14.5.1 Geology and Topography

The geology within the Proposed Road Development consists of underlying bedrock described as 'pale grey clean skeletal limestone' from the Burren Formation overlain by well drained, 'Coarse loamy drift with limestone' from the Mullabane soil association, well drained 'Coarse loamy over calcareous gravels' from the Baggotstown soil association, as well as poorly drained river alluvium and peat[1].

The topography of the study area is generally flat (Ordnance Datum (O.D.) 144) along the Abbert River which runs parallel to the N63 with higher ground (O.D. 160) to north and south. Abbeyknockmoy village is located at the western extent of the Proposed Road Development with agricultural land to the east. The majority of housing is located along the N63, as are community facilities such as the local school, church and community centre. The N63 crosses the Abbert River at the Liss Bridge.

14.5.2 National Monuments

There are no sites or monuments under Preservation Order and no National Monuments in state care or ownership and guardianship of the Minister for Housing, Local Government and Heritage, within the Proposed Road Development site boundaries. One National Monument in state care, Knockmoy Abbey (National Monument No.166) (hereafter referred to as the 'Abbey'), is located within the study area. The Abbey is recorded on the Record of Monuments and Places as GA058-004 with six associated elements - Religious House (GA058-004001), Monastic building (GA058-004002), graveyard (GA058-004003), field system/earthworks (GA058-004004), corn mill (GA058-004005) and chapel (GA058-004006) (Volume 03; Figure A14-1).

Of these six elements, only GA058-004001 - GA058-004004 are designated as part of the National Monument No.166. The Abbey was founded in 1189-90 by Cathal Croberg O'Conor, King of Connacht, who invited monks from the existing Cistercian Abbey in Boyle, County Roscommon (De Breffney and Mott, 1976). The circumstances behind O'Conor founding the Abbey are unclear with Lewis citing the reason as fulfilment of a vow made by O'Conor previously in regard to a battle with English forces under Almeric de St. Lawrence in which O'Conor was victorious (Lewis, 1837).

Lewis (1837) further states that 'Knockmoy' is translated by some writers as *Cnoc Mugha* or 'the hill of slaughter' while other writers refer to it as the *Monasterium de Colle Victoriae*. De Breffney and Mott, however, state that O'Conor founded the Abbey after his ship had sunk in Lough Reagh with the loss of 36 of his men (De Breffney and Mott, 1976). Whichever reason is correct, the Abbey was built between 1202 and 1216 with O'Connor's wife buried there in 1217, while O'Connor, himself, ended his days as a monk at the Abbey to atone for his sins. His grandson Tirlogh, the King of Connaught died at Knockmoy in 1266, while Tirlogh's son, Brian died in the monastery in 1267. O'Conor was not the only king to do penance at the Abbey as Domhnall O'Kelly, King of the Ui-Maine died in the habit of a monk at Knockmoy in 1295.

The abbey was surrendered to the crown in 1542 as part of Henry VIII's dissolution of the monasteries (Skehana & District Heritage Group, 2015). Abbot Hugh O'Kelly was appointed to collect rents while the abbey church continued in use as a parish church. It was referred to as *Porta Magna* or *Teampollandorusmoir* at this time. In 1620, Abbeyknockmoy was granted by James I to Valentine Blake with the property still owned by the Blake family during the middle of the 19th century (Skehana & District Heritage Group, 2015).

The main Abbey building (GA058-004001) is a Transistional style church which is orientated east to west measuring 60 m long by 9.15 m wide. It consists of an aisled nave, a chancel and two transepts. The chancel has a fine ribbed vault and ornamented capitols and east altar windows. The transepts both contain two barrel-vaulted chapels at their eastern ends. The nave has pointed arches and carved capitals which are similar to those of Boyle Abbey suggesting they were completed by the same school of stonemasons (De Breffney and Mott, 1976).

[1] http://gis.teagasc.ie/

The north wall of the chancel still bears mural paintings from the 15th century depicting the Holy Trinity, the martyrdom of St. Sebastian and the Three Dead and Three Live Kings. Three of the arches of the crossing are walled up possibly in association with the construction of the central tower during the 15th century while the claustral buildings and cloister are located to the south. Of these, only the eastern wing including the sacristy, chapter house and later garderobe is well preserved. Limited archaeological excavations took place at the Abbey during the summers of 1982 and 1983. These were prompted by Office of Public Works conservation and maintenance works to the Abbey. The foundation levels of a 15th century cloister were revealed, while the north and south transepts were also investigated (Sweetman, 1987).

Further associated assets within the immediate vicinity include the ruins of a building (GA058-004002) to the north and a field system/earthworks (GA058-004004) to the north and west. The building (GA058-004002) is rectangular measuring 11.35 m east to west by 5.8 m north to south with wall thickness between 1.1 m and 1.25 m. It is constructed with double-faced uncut stones laid down in uneven courses. The building is featureless apart from a 2 m wide break which may be a former doorway. Three walls each 0.6 m high about the east wall of the building. The first, measuring 3.5 m long and 0.55 m wide, is on the line of the north wall, the second is located 0.75 m to the south of the former and measures 3.6 m long by 0.65 m wide. The third is on the line of the south wall and measures 4.15 m long by 0.9 m wide. The foundation lines of the third wall continue 8.75 m further to the east before turning to run north for 3.9 m.

Sweetman investigated the building during his excavations at the Abbey in 1982 and 1983 in order to determine its relationship with the main complex. He found that the foundations of the main building were not similar to those of a medieval building, while the surviving stonework suggested that it was post 17th century in date (Sweetman, 1987). The middle and south abutting walls formed a second structure measuring 12 m east to west by 4.7 m north to south. The foundation courses of these and the north abutting wall were stratified above those of the main building which indicated that they were a later addition while all the buildings were set over an extensive layer of dark soil and charcoal from which a sherd of medieval pottery was found outside the east wall of the main building suggesting that medieval buildings associated with the abbey were located in this area. The building (GA058-004002) is subject to a preservation order made under the National Monuments 1930 to 2014 (PO no.4/1989) as well as being part of the National Monument No.166.

The field system/earthworks (GA058-004004) extend to the west and north of the main Abbey complex consisting of a series of fields covering an area approximately 550 m northwest to south-east by approximately 400 m northeast to southwest. The area is defined by low grassed-over collapsed stone walls, while some of the fields are rectilinear in plan with traces of cultivation visible. The field system/earthworks (GA058-004004) are also subject to a preservation order made under the National Monuments 1930 to 2014 (PO no.4/1989).

In 1620 the Abbey was granted by King James I to Valentine Blake Esq and remained in the ownership of the Blake family with Francis Blake Forster of Ashfield the owner when Lewis surveyed the area in 1837 (Lewis, 1837). The site continued in use as a graveyard (GA058-004003) after it ceased to be an Abbey. The 1st edition OS map (1838) notes a graveyard within the Abbey while post-medieval headstones and a ledger slab are still visible within the claustral area. A Zone of Notification has been identified around the elements GA058-004001 - GA058-004004. Such zones do not define the exact extent of the associated monument but are intended to identify them for purposes of notification under Section 12 of the National Monuments Act (1930-2004) whereby a notification of proposed works must be submitted to the National Monument Service at least two months in advance of works commencing. The closest point of the Zone of Notification is located 100 m from the Proposed Road Development.

There are two further assets associated with the Abbey. These are located 400 m to the west and northwest of the main complex and consist of a corn mill (GA058-004005) and the site of a chapel (GA058-004006). Neither is part of the National Monument No.166 nor are they included within the Zone of Notification. They are discussed here as part of the overall Abbey site. The corn mill (GA058-004005) is located 400 m north-northwest of the west extent of the Proposed Road Development and is marked on the 1st edition OS map (1838) as a corn mill in ruins. The mill complex is still extant with mill wheel gears in place against the west gable end of the mill. The Mill is said to occupy the location of the original abbey mill and is situated on the north bank of the Abbert River.

The chapel (GA058-004006) is located at the edge of the study area 500 m north-northwest of the western extent of the Proposed Road Development. It is marked on the 1st edition OS map (1838) as a rectangular building, fronted by a rectangular courtyard. A single stretch of wall measuring 6 m long by 1 m wide now remains. This wall is orientated east to west and is constructed of roughly coursed limestone rubble. The chapel is interpreted as a post-medieval construction most likely dating to the 18th century.

14.5.3 Record of Monuments and Places

The baseline identified 12 assets recorded on the Record of Monuments and Places (RMP) within the study area (Volume 03; Figure A14-1). None are located within the boundaries of the Proposed Road Development. Six of these assets (GA058-004001-006) are associated with the Abbey and have been discussed in relation to the National Monument.

The closest of the remaining six RMP assets to the Proposed Road Development is a *Leacht Cuimhne* (GA058-057) which is located 200 m to the northwest of the western end of the Proposed Road Development. A *Leacht Cuimhne* is a type of cenotaph with the name derived from *leacht* which translates as grave and *cuimhne* which translates as commemoration or memorial. It consists of a stone memorial, situated within what is now a children's playground on the east side of the roadway. The memorial is a roughly built stone pier measuring 2.7 m high, 1.3 m long and 1.22 m wide erected on a stone plinth. It tapers slightly towards the top where it is capped by a rectangular stone. A small pillar stone rises from the rectangular stone. There is a recess in the north wall which probably held a commemorative plaque which is no longer in place. The *Leacht Cuimhne* dates to 1720 and is also recorded as Protected Structure (No. 3921) on the Galway County Development Plan 2015-2021. It is also recorded on the National Inventory of Architectural Heritage (NIAH) (NIAH 30405807).

An asset described as an architectural fragment (GA058-058) is located 300 m to the west of the Proposed Road Development beside a farmhouse and buildings on a slight rise overlooking Abbeyknockmoy to the northeast. It consists of a mound of cylindrical stone carved from limestone. The stone varies between 0.09 m and 0.18 m with the maximum length of any piece being 0.32 m. All the stone is badly damaged and was lying on the ground at the time of the visit by the National Monuments Service (NMS) in 1984. It is surmised that the stone may have been removed from the Cloister Arcade of Abbeyknockmoy (GA058-004001).

A ringfort (GA058-055) is located 400 m to the west of the Proposed Road Development on the north facing slope of a rise in grassland. This asset is poorly preserved consisting of a sub-circular area enclosed by a bank and external ditch. The bank is present from southeast to south to west while a scarp forms the enclosing element from north to east to southeast. The exterior ditch only survives at south, while quarrying has disturbed the asset at the northwest.

A designed landscape feature (GA058-056) is located in a slightly undulating field 400 m to the southwest of the Proposed Road Development. This field is shown as heavily wooded on the 1930 edition OS map though a subsequent site visit by the NMS found many of the trees have since been cleared, while garden walks also appear to have been present including a small walkway leading to the asset from the southwest. The asset is sub-circular in outline and enclosed by an earthen bank which barely survives on the exterior. The interior is sunk 1m below the exterior which strongly suggests that the asset is not a ringfort but is more likely a tree-ring enclosure or ornamental folly.

A redundant record (GA058-067) is located 500 m to the southeast of the Proposed Road Development at Liss. This feature has been confirmed as a hollow and, therefore, a natural feature and not an archaeological site. The last RMP located within the study area is another *Leacht Cuimhne* (GA058-074) which is located at Moyne 500 m to the north-northeast of the east extent of the Proposed Road Development. It consists of a freestanding monument which was erected around 1800 and was most likely associated with Moyne House which was built in the first half of the 18th century by Michael. J. Browne. The monument has a square plan with recesses on the east, west and south sides and a plaque fixed to the north face. It is constructed of random rubble and is set on a stone plinth on the apex of a mound which is likely artificial. The remains of a corbelled limestone pyramidal roof are also present on the monument. The *Leacht Cuimhne* is also a Protected Structure (RPS No. 3918) and is recorded on the NIAH (NIAH 30405803).

The full details Recorded Monuments within 500 m of the Proposed Development are included in Volume 04; Appendix A14-2; Gazetteer 14.1.

14.5.4 Record of Protected Structures

There are five assets noted on the Record of Protected Structures (RPS) as recorded on the Galway County Development Plan 2015-2021 located within the study area (Volume 03; Figure A14-2). None of these are located within the boundaries of the Proposed Road Development. These assets are also noted on the NIAH and two are also RMP sites. Those Protected Structures noted on the RMP are the *Leacht Cuimhne* (GA058-057 and 074) which have already been discussed in Section 14.3.3.

The closest of the remaining Protected Structures is Liss Bridge (RPS No. 3925) which currently carries the N63 across the Abbert River, 10 m to the south of the Proposed Road Development. Liss Bridge consists of a seven-arch limestone road bridge, which was built around 1800. It has round arches with rubble voussoirs to the arch rings and random rubble to the spandrels. Single triangular and semi-circular cutwaters are located on the northeast face with cement coping with a pipe inlaid. The random rubble parapet is topped with flat rubble coping. An area of repair is apparent on the northwest face. Cut-stone voussoirs on the northern two arches have squared limestone infill to the spandrel panels and parapet, flat cut-stone coping. The bridge is recorded in the National Inventory of Architectural Heritage as NIAH 30405811.

Rose Villa (RPS No. 3923) is located 61 m to the south of the Proposed Road Development. The Record of Protected Structures describes this asset as a detached three-bay single-storey teacher’s house. It is located to the south of the N63 having been built around 1870. It has a dormer roof with gable to front, and a single-storey lean-to extension to rear. Rose Villa is recorded in the National Inventory of Architectural Heritage as NIAH 30405814.

The final Protected Structure within the study area is St. Bernard’s Church (RPS No. 83) which is located to the immediate east of Lisch Road, 240 m southwest of the Proposed Road Development. The chapel is set back from the N63 on an elevated site with a car park to the north which incorporates a Marian grotto. It is a freestanding cruciform-plan Roman Catholic Church, which was built around 1820. It has a two-bay nave with a four-bay lower 20th-century extension to the altar end, and a glazed entrance porch to the northwest transept. The roof is pitched slate roof with stone copings to the gables. There are pointed-arch windows throughout, with stained glass and stone sills, and smaller windows flanking statue niches. A triple-light window in set in the west gable with a moulded string sill course, while the transept gables have windows with Y-tracery, and the apse is lit by an oculus. Pointed-arch doorways are located to the north-west and northeast with timber doors. A bell stand is in the grounds with cast-iron support structure and bell. St. Bernard’s Church is recorded on the NIAH as NIAH 30405815.

14.5.5 National Inventory of Architectural Heritage Structures

A total of seven buildings and structures listed on the NIAH are located within the study area. None of these assets are located within the footprint of the Proposed Road Development. Three assets are also Protected Structures and have been assessed under this higher statutory designation while two are also recorded on the RMP and have been discussed under this designation. The remaining two assets are a handball alley (NIAH 30405810) and a mill (NIAH 30405804) (Volume 03; Figure A14-1).

The handball alley (NIAH 30405810) is located to the immediate north of the N63 adjacent to Abbeyknockmoy Community Centre 200 m to the south of the Proposed Road Development. It consists of a detached open-air handball alley which was constructed around 1950 and which is now disused. It is formed with concrete walls with four concrete buttresses to the external face of the rear wall and another one to the side walls. There is a square-headed entrance opening to the west while the remains of iron posts are evident on the tops of the rear and side walls.

The mill (NIAH 30405804) is located 300 m northeast of the eastern extent of the Proposed Road Development. Built in 1832, it consists of a detached six bay, four storey former linen mill which is now in ruins. It is rectangular in plan with a two-storey with dormer attic living quarters to the northeast. The walls of the mill are constructed with random rubble rendered with lime mortar, while the openings are all square headed with tooled limestone sills. There is a segmental arch to the northwest with cut limestone voussoirs above the former route of the mill stream (since diverted). The former wheel pit is located on the northeast gable although this has been infilled. The mill and associated structures still provide a striking feature within the rural landscape despite its ruinous condition.

The full details NIAH sites within 500 m of the Proposed Development are included in Volume 04; Appendix A14-2; Gazetteer 14.2.

14.5.6 National Inventory of Architectural Heritage Designed Landscapes

The NIAH notes one designed landscape within the study area (Volume 03; Figure A14-1). This is Newtown (NIAH Ref: 5365) which is located at the eastern extent of the Proposed Road Development. The designed landscape was associated with Newtown House, which was constructed during the first half of the 19th century. Both house and surrounding grounds are shown on the 1st edition Ordnance Survey (OS) six-inch map (1838) with the area to the south labelled Newtown and shown as an area of tree plantations and fields. The Abbert River crosses Newtown with the main features of the designed landscape located to the north of the Abbert River. These features included outbuildings and a walled garden to the rear of the house with densely planted wooded areas surrounding the house. The house is accessed by roads leading from the west and north, with the main access coming from the south.

The designed landscape was outside the study area at the time of the 1st edition OS six-inch map (1838) but had expanded on the subsequent 2nd edition OS six-inch map (1927), and again on the later revised OS edition. The expanded designed landscape now extended to the N63 incorporating the southeast extent of the Proposed Road Development. The footprint of the designed landscape is still visible today, while the buildings, entrances and walks through the woods are still extant.

The full details of this designed landscape are included in Volume 04; Appendix A14-2; Gazetteer 14.3.

14.5.7 Previous Archaeological Investigations

Previous archaeological investigation has taken place in regard to the Abbey (GA058-004) and associated structures. This investigation took place during 1982 and 1983 and has been discussed in relation to this asset.

Excavations.ie, the database of Irish excavation reports, was examined for evidence of further archaeological investigations within the study area. Particular attention was paid to the townlands located within the Proposed Road Development namely Culliagh North, Liss, Abbey, Moyne and Newtown. Of these, only one previous archaeological investigation was noted in the townland of Abbey. This took place in 2008 and related to predevelopment testing at the site of a single dwelling house and associated services adjacent to the medieval monastic complex (GA058-004). The testing took the form of three trenches excavated across the development site. The underlying ground conditions consisted of sod and topsoil overlying the natural gravel with occasional boulders encountered throughout. No archaeological layers or features were uncovered during the testing (Rooney, 2008).

14.5.8 Archaeological Geophysical Survey

An archaeological geophysical survey was carried out across the site by Earthsound Geophysics (geophysical contractor) during August 2020 (Earthsound, 2020). A copy of the geophysical report is included as Volume 4; Appendix A14-1. The survey, conducted using a magnetic gradiometer, had the following aims:

- To assess the archaeological potential of the survey areas that were surveyed (this was limited in some areas by unsuitable ground conditions and/or nil access);
- To establish the presence/absence of archaeological anomalies within the survey areas, and to define their extent and, where possible, characterise the anomalies/features; and
- To inform the impacts and mitigation of the Proposed Road Development.

The majority of the survey area consisted of marginal pastureland and some overgrown fields, the majority of which were cut prior to survey. A river and a number of deep ditches and field boundaries divide the western fields, while most of the fields were wet or partially waterlogged at the time of survey. It was noted during the survey that the landscape contains much ferrous debris which could result from either human debris or naturally occurring waterborne minerals. This includes a series of dipolar interference zones which are suggestive of deposition or demolition possibly relating to former buildings within the Proposed Road Development boundary.

The ferrous contamination is unusually high within the western part of the Proposed Road Development and the distribution suggests that it may have been spread by alluvial inundation from the Abbert River. This is supported by the weak background values detected during the magnetometer survey which may be the result of prolonged periods of flooding or waterlogging leaching the magnetic properties within the soil. This could lead to the magnetic signatures of possible archaeological features being significantly reduced or removed, and thereby not detected during the survey. Similarly, the deposition of alluvial material over the original ground surface could mask the presence of archaeological features from the survey.

The survey noted 95 anomalies in the majority of fields within the footprint of the Proposed Road Development (Volume 03; Figures A14-2-A14-4). These anomalies were examined and interpreted by the geophysical contractor with a number identified as potential archaeological features. A full description is included in the geophysical report in Volume 04; Appendix A14-1. The anomalies were broadly of the following sorts:

- Curvilinear magnetic anomaly - interpreted as curvilinear ditch or cut feature possibly of archaeological, agricultural or geological origin;
- Linear magnetic anomalies - interpreted as being of agricultural origin;
- Arcing magnetic anomalies - interpreted as ditch or cut features possibly of archaeological, agricultural or geological origin;
- Zone of magnetic interference - caused by multiple anomalies, which could indicate the presence of archaeological remains or former buildings; and
- Magnetic Trends-areas of weak magnetic trends interpreted as relating to archaeological, agricultural or geological processes.

See Volume 04; Appendix A14-3 for a summary of anomalies detected during Archaeological Geophysical Survey.

The geophysical report states that anomalies have been identified as potentially archaeological in nature unless they can be clearly proven to arise from another source such as agricultural field boundaries (Earthsound, 2020). Contract specifications for the survey required that the geophysical contractor provide recommendations on the anomalies of possible archaeological character, to be tested with the optimum arrangement of test trenches illustrated. The report specifically recommends that the following 25 anomalies are tested by means of a single trench across each. See Volume 04; Appendix A14-3 for anomalies specifically recommended for archaeological testing.

While the anomalies outlined in Volume 04; Appendix A14-3 have been highlighted for archaeological testing, the report caveats that all the anomalies detected should be subject to archaeological investigation in order to verify their nature. None of the anomalies detected suggested the presence of buildings or earthworks associated with the Abbey (National Monument No.166).

14.5.9 Historic Cartographic Evidence

14.5.9.1 1st Edition OS map (1838)

The 1st edition OS map (1838) shows the topography of the area of the Proposed Road Development towards the middle of the 19th century (Volume 03; Figure A14-5). The area is shown as rural and largely formed by fields. The terrain within the line of the Proposed Road Development is bounded by what will become, the N63 to the south while the Abbert River is a major feature within the landscape and also forming the boundary between the townlands of Abbey and Liss within the line of the Proposed Road Development. The route of the river is less defined than currently, suggesting that the river has been channelled during subsequent years. In particular, a tributary can be seen flowing to the south of the main river. While this tributary is still partially extant today, it has been channelled and partially infilled or culverted. It is shown on this map edition as meandering, combining with the Abbert River to create several small islands. Two of these islands (CH1) are located towards the west extent of the line of the Proposed Road Development while another three are located to the immediate east of the Liss Bridge and outside the line of the Proposed Road Development. Liss Bridge (RPS No. 3925) is clearly marked spanning the river. The road narrows on the approach to the bridge which is shown with three cutwaters to each side.

The majority of the terrain within the line of the Proposed Road Development is shown as featureless farmland with a large section within the centre shown as marginal ground. The boundaries between the townlands of Culliagh North and Liss; and Abbey and Moyne are shown within the line of the Proposed Road Development although the physical nature of these boundaries is not indicated though likely comprised field banks or stone dykes. Three small buildings (CH2) are marked towards the eastern end of the line of the Proposed Road Development. These are set within small, adjoined plots of ground orientated north to south. Trees are marked around the outer field boundaries of these plots which suggests that they were part of the one property. Trees are also marked within one of the plots which suggests an orchard.

Industrial activity is also shown at the southeastern extent of the line of the Proposed Road Development. A flour mill is shown to the immediate north of the road leading from the N63 to the Newtown Estate (NIAH Ref: 5365). While this flour mill is located outside the line of the Proposed Road Development, its associated mill pond (CH3) incorporates a sub-rectangular area which extends north into the southeast extent of the line of the Proposed Road Development. A police barrack is marked to the immediate east of the Proposed Road Development to the north of the N63.

The majority of housing within the area is located on the south side of the N63. The village of Abbeyknockmoy is shown as a small collection of buildings set around the junction of the N63 and the road leading north towards the Abbey (GA058-004). Features associated with the village include a pound to the south of the N63 and a Fair Green located on either of the road leading north. The *Leacht cuimhne* (GA058-057) is shown within the east of the Fair Green and is identified as *Laghta*.

The area to the immediate west of the village is occupied by a large house set within a large sub-rectangular plot of ground. The house is accessed via a driveway which curves northeast from the N63. A carriage turning area is marked to the immediate south of the house while a smaller access curves northwest from the turning area to a large rectangular outbuilding to the rear. Rectangular cultivated areas are shown to the immediate north of the outbuilding and may be kitchen gardens. The majority of the remainder of the surrounding sub-rectangular plot is shown as open pasture though four small areas of heavily vegetated ground are shown within the southwest corner. One of these areas is oval in shape and appears to correspond with the location of the designed landscape feature (GA058-056). The rath (GA058-055) is also a prominent feature within the northwest of the sub-rectangular plot of ground. This is shown as a large circular area enclosed by a bank.

The Abbey (GA058-004) is clearly shown as a range of buildings located to the north of the river and the western extent of the line of the Proposed Road Development. It is labelled as in ruins while the central claustral area is labelled as the graveyard (GA058-004003). There are no visible signs of the building (GA058-004002) or the surrounding field system (GA058-004004). The chapel (GA058-004006) is marked as a ruined Roman Catholic chapel located at the junction between the road past the Abbey and a lane leading to the east. The corn mill (GA058-004005) is also identified as a ruined building. It is located at the bridge carrying the road north over the Abbert River. The river is quite wide on the east side of the bridge with islands shown within the river. The mill is actually set across two of these islands with its millwheel presumably located on the body of water between the two islands. A larger island is marked to the northeast of the corn mill. This island has been formed by stream which curves from the river around it with an eel weir marked at its east end. This island and stream have a regular appearance which suggest that they may be an artificial construction possibly associated with the Abbey.

14.5.9.2 2nd edition OS map (1927)

The 2nd edition OS Map (1927) shows the area of the line of the Proposed Road Development during the first half of the 20th century (Volume 03; Figure A14-6). The terrain within the line of the Proposed Road Development is still shown as rural and subdivided into fields. The Abbert River remains the major feature within the landscape subdividing the line of the Proposed Road Development. The route of the river has been straightened while land improvements appear to have taken place within the grounds immediately adjacent. The islands noted on the previous map sheet have now largely been subsumed into the surrounding fields with little visible trace. The exception is one of the larger former islands (CH1) which is located within the centre of the line of the Proposed Road Development. This is still an island in effect being bounded to the north by the Abbert River and all other sides by a stream which also forms part of the boundary between the townlands of Abbey to the north and Liss to the south. The physical forms of the townland boundary are curving streams which represent the original line of the Abbert River instead of the straightened river shown. The fields on either side of the river are marked as prone to flooding.

The east of the line of the Proposed Road Development consists of fields with the property (CH2) formerly noted still shown. It still consists of three small rectangular parcels of ground although these are no longer shown as tree-lined nor is the planted area marked. A building formerly shown fronting onto the road has been replaced by a rectangular building orientated north to south. Two further structures are now shown to the east of the line of the Proposed Road Development consisting of rectangular buildings set adjacent to the N63 which likely represent single dwellings. The mill previously shown adjacent to the southeastern extent of the Proposed Road Development is no longer shown and its millpond (CH3) is now shown as marginal ground with a stream running southeast from it to the former location of the mill before passing under the road to continue to the Abbert River. The remainder of the field appears planted with trees which suggests that it is now part of the planned landscape of Newtown (NIAH Ref: 5365). The police barrack formerly shown to the immediate east of the Proposed Road Development is no longer marked. The road network within the area of the northeastern of the Proposed Road Development remains as previously shown.

The village of Abbeyknockmoy is still focussed on the junction with the road leading north towards the Abbey (GA058-004). The village has not noticeably expanded since the previous map edition with most settlement concentrated on the south side of the N63 to the east. This settlement has remained largely unchanged although there are some additions including Rose Villa (RPS No. 3923). This was the accommodation for the local teacher with Newtown School now also marked.

The large property to the west of the village is still extant although it is no longer well defined. The planted areas to the north of the outbuilding are no longer shown, nor is the Designed Landscape Feature (GA058-056). The rath (GA058-055), while clearly marked, is less well defined than previously. The Abbey (GA058-004) still forms a sizeable complex to the northeast of the village. It is identified as being in ruins, while the graveyard within its claustral area is also marked. There are no signs of the building or field system to the immediate north and west, nor is the chapel shown. The corn mill is identified adjacent to the bridge carrying the road over the Abbert River. While the corn mill is still located on a small island, this part of the river has been modified with the river reduced in size and the smaller islands subsumed into the river banks. The eel weir formerly noted is no longer shown and its associated island is now part of the adjacent field.

14.5.10 Site Walkover

The site walkover took place on Tuesday 6th October 2020. The weather conditions were dry and generally overcast. While attention was paid to the locations where the geophysical survey noted anomalies that could be potential archaeological features, no surface indications were noted at any of the locations within the Proposed Road Development boundary. Photographs are located in Volume 4; Appendix A14-2 Gazetteer, 14.5.

The walkover will be discussed starting at the western extent at Abbeyknockmoy and moving east. The Proposed Road Development commences in a rectangular field of pasture to the north of the N63 immediately to the east of the residential boundary of the village (Photograph 14.1). The historical cartographic evidence shows the western extent of the Proposed Road Development as subdivided into small fields and this land division continues to the present. The terrain within these fields consists of level, good quality pasture to the west becoming more marginal further to the east (Photograph 14.2). The terrain becomes steeper further to the east with the ground sloping downhill from the N63 to the floodplain of the Abbert River. The Abbey (National Monument No. 166) is clearly visible across the Abbert River to the north along this section of the Proposed Road Development (Photograph 14.3).

A branch of the Abbert River, noted on the historic cartographic evidence, is still extant and this feature extends through the Proposed Road Development (Photograph 14.4). This area between the N63 and the Abbert River has been subject to ground improvements with several islands (CH1) reclaimed into farmland. None of these islands (CH1) now exist. Further evidence of land modifications is a bank or bund located on the south side of the river (Photograph 14.5). The Abbert River was subject to drainage works by the Office of Public Works between 1954 and 1964 when the riverbed was enlarged including by blasting (O'Connor, 2015). The bank represents management of the river with the upcast providing a barrier against flooding. More recent land improvements include drainage with evidence in the form of concrete manholes (Photograph 14.6).

The Proposed Road Development crosses the Abbert River to the immediate east of the bank of dredged upcast. The section of the river from here to the Liss Bridge (RPS No. 3925) is straight, evidence of the improvements that have been made within the area. There are no signs of the streams noted on the 2nd edition OS map which indicated the former line of the river. The terrain within the Proposed Road Development to the north of the river is very marginal with large areas of rushes present (Photograph 14.7). Deep drainage ditches have been cut along field boundaries although some of the fields are extremely wet underfoot in places (Photograph 14.8). Low earth banks are present within one of the wetter fields. These banks are straight and respect field boundaries which suggests that they are agricultural.

The terrain rises uphill as the Proposed Road Development progresses to the northeast though still remains marginal and wet underfoot. The Proposed Road Development passes through a large rectangular field to the immediate south of a large modern house. The Proposed Road Development footprint widens at this point to include the ground south almost to the river. This terrain slopes gently downhill to the south and remains quite wet underfoot with a large drainage ditch running across the Proposed Road Development to the river (Photograph 14.9). Liss Bridge (RPS No. 3925) is obliquely visible from this location.

Moving east, the Proposed Road Development crosses the L6159 Old Road which extends north from the N63 before entering another field. The terrain within this field also consists of marginal pasture with an area of dense rushes to the immediate north. Overhead cables orientated southwest to northeast pass over this section of the Proposed Road Development. Further east, the Proposed Road Development crosses the location of one of the properties noted on the 2nd edition OS map. This property was subdivided into small plots of ground and these are still extant defined by low earth banks (Photograph 14.10). The former location of the building is immediately to the south of the Proposed Road Development although there are no longer any visible remains.

The Proposed Road Development narrows as it runs directly adjacent to the north of the N63 with the field in this location unkempt and overgrown with rushes. Further east, the terrain consists of marginal pasture with short grass and clumps of rushes. There are no signs of the second building (CH2) noted on the 2nd edition OS map although the geophysical survey did record evidence of possible demolition debris within this area (Photograph 14.11). An upstanding building (CH4) is located further to the east (Photograph 14.12). This structure is orientated north to south and corresponds with the building noted on the 2nd edition OS map which replaced an earlier building at the location. The building is derelict, roofless and heavily overgrown with ivy on the walls and trees within the interior. It has been rendered with concrete and appears to have most recently used as an agricultural outbuilding.

The Proposed Road Development continues east to cross the L6234. Before it does so, it passes a modern single storey house with a detached garage set within a rectangular plot of ground (Photograph 14.13). The southeast corner of this plot of ground encroaches on the north boundary of the Proposed Road Development. The Proposed Road Development widens at this location to incorporate ground on both sides of the N63. The ground on the north side to the L6234 consists of pasture which is quite firm underfoot. The terrain to the south is flat and set at a lower level to the N63 with the field bounded to the south by the Abbert River which curves northwest (Photograph 14.14). One feature of interest is a large piece of exposed bedrock which is located adjacent to the east boundary of the field though outside the boundary of the Proposed Road Development (Photograph 14.15). This is a natural feature and is probably of no archaeological significance .

The boundary of this field is formed by a high stone wall which separates the field from the adjacent laneway. This laneway was originally one of the accesses into the Newtown Estate (NIAH Ref: 5365) with a flour mill marked to its immediate north on the Historic Cartographic sources. The location of the flour mill is outside the Proposed Road Development boundary, although its mill pond (CH3) formerly incorporated the eastern extent of the Proposed Road Development to the south of the N63. The ground to the south of N63 at the eastern extent of the Proposed Road Development consists of a field of level pasture which is also lower than the N63 (Photograph 14.16). The field is bounded to the west and north with substantial stone walls with the terrain consisting of level pasture which is firm underfoot. Overhead power cables pass over the Proposed Road Development at the southwest corner of the field. The final section of the Proposed Road Development to the south of the N63 is planted with dense tree growth. The mill pond (CH3) will have formerly occupied this area although there are no visible signs with this feature removed by the subsequent tree growth.

The eastern extent of the Proposed Road Development to the north of the N63 consists of a pasture field which rises to a ridge at north (Photograph 14.17). The terrain within this field consists of good quality pasture which is firm underfoot and crossed by the overhead power cables noted in the field to the south of the N63. The Proposed Road Development is bounded to the east by a derelict property which is heavily overgrown (Photograph 14.18). It appears to have been a house with chimney stacks at each gable end and a dormer floor. This building is not shown on the 2nd edition OS map indicating that it is a more recent addition. The building is located outside the footprint of the Proposed Development site.

14.6 Assessment of Impacts

14.6.1 Embedded Control

During development of the Proposed Road Development design, mitigation measures will be incorporated to avoid or reduce adverse effects on historic buildings during its operation. These will include the strategies outlined below.

- The Proposed Road Development will introduce traffic closer to the Abbey (National Monument No. 166). This will allow enhanced views of the monument and greater appreciation of its value. A viewing area with parking is incorporated into the design at the point where the monument can be best appreciated with unobstructed views. This viewing area will allow the public to stop and observe the Abbey as a feature attraction from within the Proposed Road Development. It will also be connected to the village of Abbeyknockmoy by the provision of a 2.5 m wide footpath which will allow pedestrians to access the viewing area on foot.
- A bridge is required to carry the Proposed Road Development across the Abbert River. This bridge has been designed to be constructed with materials so that its appearance will reduce any negative impact upon the surrounding landscape.
- Landscape design has been used as a key tool through which the impacts of the Proposed Road Development on Protected Structures and historic landscape which could result in negative effects on their setting has been mitigated. Throughout the Proposed Road Development, sensitive and appropriate tree and shrub screen planting will be employed to aid the integration of the Proposed Road Development with the surrounding landscape (Chapter 13 Landscape and Visual Effects).

14.6.2 Construction Phase

The baseline study has revealed that there is one heritage asset partially located within the Proposed Road Development site. This is the planned landscape of Newtown (NIAH Ref: 5365) which is located at the east extent of the Proposed Road Development. There are no other recorded heritage assets within the footprint of the Proposed Road Development, though 17 are noted within the surrounding 500 m study area. None of these will be physically impacted by the Proposed Road Development.

Groundworks will impact upon part of the planned landscape of Newtown (NIAH Ref: 5365) which is located at the eastern extent of the Proposed Road Development (Photograph 14.16; Photographs are located in Volume 4; Appendix A14-2 Gazetteer, 14.5. Historic cartographic evidence shows that this planned landscape was gradually extended to incorporate the area of the Proposed Road Development by the early 20th century. It was originally partly industrial in use with a mill pond (CH3) associated with a flour mill located to the south. The entire area of the planned landscape within the Proposed Road Development was then densely planted. Most evidence of this planting within the Proposed Road Development has since been removed, with the exception of the northeastern extent which is still part of a dense plantation.

Newtown (NIAH Ref: 5365) is a planned landscape of **regional** importance. The Proposed Road Development will impact upon a small part of the planned landscape which is already partially denuded and bounded to the north by a busy road. While the physical appearance will be impacted, this will not affect understanding of the asset. The magnitude of effect will be **medium** as defined by the criteria in Table 14-2 leading to a significance of effect of **moderate**, as defined by the criteria in Table 14-3.

The mill pond (CH3) will have been impacted by infilling and subsequent tree growth upon it. The sub-surface remains of the western extent of the mill pond (CH3) including any sluice mechanisms could remain *in situ*. Such features are likely to be of **local interest** and of **low importance** as defined by the criteria in Table 14-1. Groundworks associated with the construction of the Proposed Road Development will severely impact upon any such mill pond remains should they exist and will alter the special interests or qualities of an asset. The magnitude of this effect will be **very high** as defined by the criterial in Table 14-2 leading to a significance of effect of **significant**, as defined by the criteria in Table 14-3.

The buildings (CH2) shown on the 1st edition OS map (1838) are no longer extant although sub-surface remains could still exist while the current structure at the location is a later replacement for one of the original 19th century buildings. These building are of **local interest** and of **low importance** as defined by the criteria in Table 14-1. Groundworks associated with the construction of the Proposed Road Development will severely impact the upstanding building and any sub-surface remains should they exist, altering the special interests or qualities of an asset. The magnitude of this effect will be **very high** as defined by the criterial in Table 14-2leading to a significance of effect of **significant**, as defined by the criteria in Table 14-3.

The Proposed Road Development will cross agricultural land that has potential to contain previously unrecorded archaeological features as shown by the anomalies detected during the geophysical survey. Given the marginal quality of the terrain, any such archaeological features are likely to be of **local interest** and of **low importance** as defined by the criteria in Table 14-1. Groundworks associated with the construction of the Proposed Road Development will severely impact upon any such archaeological remains should they exist and will alter the special interests or qualities of an asset. The magnitude of this effect will be **very high** as defined by the criterial in Table 14-2 leading to a significance of effect of **significant**, as defined by the criteria in Table 14-3**.**

There are heritage assets within the 500 m study area which have been designated, being considered nationally or regionally important. While these assets will not be physically impacted by the Proposed Road Development, there is the possibility of adverse effects to the setting of the designated assets by noise, dust and vibration from construction related traffic which could diminish the importance of these assets.

Liss Bridge (RPS No. 3925) is a Protected Structure and is considered **regionally** important. It is the closest of the designated assets to the Proposed Road Development being located 10 m the south (Photograph 14.9). The bridge carries the N63 across the Abbert River and is orientated perpendicularly to the road and river. There is mature vegetation within the vicinity of the bridge which screens views of the asset. A picnic area named Abbey View has been created on the riverbank to the southwest of Liss Bridge and this provides the best views of the bridge (Photograph 14.19). The picnic area is bounded by hedges formed by mature trees which will screen views of the bridge from the Proposed Road Development. Ironically, the same trees which screen views of the bridge looking east also block views of the Abbey (National Monument No.166) from the Abbey View picnic area.

The setting of Liss Bridge (RPS No. 3925) may be temporarily impacted by noise, dust and vibration from the construction works but these will cease as the road construction progresses moving away from the asset. It should also be noted that the bridge is currently part of a busy road network with high volumes of traffic passing over it. The change to setting will be such that the special interests or qualities of the bridge are slightly affected without a noticeable change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The slight significance of effect will be **short-term** and **adverse**.

The Abbey (National Monument No.166) is located 284 m to the northwest of the Proposed Road Development. The Abbey will have been the largest complex of buildings within the area for hundreds of years and still consists of substantial remains which are prominent at the western extent of the Proposed Road Development (Photograph 14.3). The Abbey stands some distance from the village of Abbeyknockmoy on higher ground in essentially a rural landscape. The Proposed Road Development will be clearly visible during the Construction Phase (Photograph 14.20).

The Abbey is a National Monument and considered of National Importance. The change to setting during the construction phase will be such that the special interests or qualities of the Abbey are moderately affected leading to a magnitude of effect of **high** as defined by the criteria in Table 14-2 leading to a significance of effect of **significant**, as defined by the criteria in Table 14-3. The **significant** significance of effect will be **short-term** and **adverse**.

Rose Villa (RPS No. 3923) is located 61 m to the south of the Proposed Road Development on the south side of the N63 and is a Protected Structure considered of **Regional** Importance (Photograph 14.21). There are no intervening properties or vegetation so the Proposed Road Development will be fully visible during the construction phase though the setting of the Protected Structure is already affected by passing traffic on the N63. The change to setting during the construction phase will be such that the special interests or qualities of Rose Villa will be slightly affected without a noticeable change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The **slight** significance of effect will be **short-term** and **adverse**.

St. Bernard’s Church (RPS No. 83) is located to the immediate east of Lisch Road 240 m southwest of the Proposed Road Development and is a Protected Structure considered of Regional Importance (Photograph 14.22). It is set back from the N63 with intervening buildings and mature tree growth between it and the Proposed Road Development impeding views. The change to setting during the construction phase will be such that the special interests or qualities of St. Bernard’s Church will be slightly affected without a noticeable change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The **slight** significance of effect will be **short-term** and **neutral**.

The *Leacht Cuimhne* (RPS No. 3921) is a Protected Structure considered of **Regional** Importance. It is located in a Children's play area on the east side of the road leading north from Abbeyknockmoy (Photograph 14.23). The modern housing development, *Clos Na hAbhainn* is located to the east. The Proposed Road Development will not be visible from the *Leacht Cuimhne* (No. 3921) which is 250 m to the northwest of its western extent. The change to setting during the construction phase will be such that the special interests or qualities of the *Leacht Cuimhne* will be slightly affected without a noticeable change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The **slight** significance of effect will be **short-term** and **neutral**.

The *Leacht Cuimhne* (RPS No. 3918) at Moyne is a Protected Structure considered of Regional importance. It is located on private lands at the limit of the 500 m study area at the eastern extent of the Proposed Road Development (Photograph 14.24). It is not visible from the Proposed Road Development with intervening mature vegetation effectively screening any views. The change to setting during the construction phase will be such that the special interests or qualities of the *Leacht Cuimhne* will be slightly affected without a noticeable change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The **slight** significance of effect will be **short-term** and **neutral**.

The potential effects during the construction phase are outlined in Table 14-4.

Table 14-4 Potential Effects During Construction Phase

Asset Reference	Importance	Description of Effect (Type, Duration)	Magnitude of Effect	Significance of Effect
Newtown (NIAH Ref: 5365)	Regional	Permanent physical adverse effect through construction of the Proposed Road Development.	Medium	Moderate
CH1 Former Islands	Low	Permanent physical adverse effect on potential unrecorded archaeological assets through construction of the Proposed Road Development.	Very High, if present	Significant
CH2 Former Buildings	Low	Permanent physical adverse effect through construction of the Proposed Road Development	Very High, if present	Significant
CH3 Former Mill Pond	Low	Permanent physical adverse effect through construction of the Proposed Road Development	Very High, if present	Significant
Knockmoy Abbey (National Monument No.166)	National	Temporary adverse effect to setting during construction of the Proposed Road Development	High	Significant
Rose Villa (RPS No. 3923)	Regional	Temporary adverse effect to setting during construction of the Proposed Road Development	Low	Slight
St. Bernard's Church (RPS No. 83)	Regional	Temporary adverse effect to setting during construction of the Proposed Road Development	Low	Slight
Leacht Cuimhne (RPS No. 3921)	Regional	Temporary adverse effect to setting during construction of the Proposed Road Development	Low	Slight
Leacht Cuimhne (RPS No. 3918)	Regional	Temporary adverse effect to setting during construction of the Proposed Road Development	Low	Slight

14.6.3 Operational Phase

All physical impacts to known and unknown heritage assets will occur during the construction phase and there is no requirement for mitigation measures during the operation phase. Significant effects for the operation of the Proposed Road Development derive from changes both positive and negative to the setting of heritage assets. These largely mirror the effects assessed for the permanent presence of the road as detailed above in the assessment of the construction phase with the settings of the same assets being improved by the removal of the sight and sound of traffic.

While the setting of the Protected Structure, Liss Bridge (RPS No. 3925), will continue to be screened by vegetation along the banks of the river, it will be impacted by noise from the traffic using the new section of road located 170 m to the north. This traffic would normally be directly crossing the Liss Bridge as part of the N63. The operational phase of the road will remove the majority of these vehicles with the exception of some local traffic. The change to setting will be such that the special interests or qualities of the bridge could be better appreciated with a beneficial change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The slight significance of effect will be **long-term** and **beneficial**.

The rural landscape surrounding the Abbey (National Monument No. 166) will be permanently changed by the road alignment. Its setting will be negatively affected during the operational phase by noise, pollution and vibration from traffic using the operational Proposed Road Development which could diminish the special interests or qualities of the Abbey. This will be off-set by better views of the monument which will be afforded to passing vehicles especially travelling west towards Abbeyknockmoy and also embedded control within the Proposed Road Development design consisting of a viewing area which will afford unrestricted views of the monument whilst being accessible both by road and by foot. These measures will reduce the magnitude of effect to **medium** resulting in a significance of effect of **significant**. The **significant** significance of effect will be **long-term** and **adverse**.

While the setting of the Protected Structure, Rose Villa (RPS No. 3923), will be visually impacted by the presence of the Proposed Road Development to the north as well as noise from traffic using the new road, this traffic would normally be directly using the existing N63 and passing directly adjacent to the asset. The transfer of this traffic to the Proposed Road Development will result in a reduction of noise, pollution and vibration to the setting of Rose Villa. The change to setting will be such that the special interests or qualities of the bridge could be better appreciated with a beneficial change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The **slight** significance of effect will be **long-term** and **beneficial**.

The Protected Structure, St. Bernard’s Church (RPS No. 83), is set back from the existing N63 and intervening buildings and mature tree growth will continue to impede views between the asset and the Proposed Road Development. Additionally, the operational phase of the Proposed Road Development will remove the majority of the vehicles with the exception of some local traffic from the environs of the Church. The change to setting will be such that the special interests or qualities of the Church could be better appreciated with a beneficial change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The **slight** significance of effect will be **long-term** and **beneficial**.

The *Leacht Cuimhne* (RPS No. 3921) will remain screened from the Proposed Road Development by the modern housing development, *Clos Na hAbhainn* located to its east. Traffic will re-join the existing N63 through Abbeyknockmoy during the operational phase of the Proposed Road Development passing to the south of the *Leacht cuimhne* (No. 3921) as it currently does. The change to setting during the operational phase will be such that the special interests or qualities of the *Leacht Cuimhne* will be slightly affected without a noticeable change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The **slight** significance of effect will be **short-term** and **neutral**.

The *Leacht Cuimhne* (RPS No. 3918) at Moyne will remain screened from the operational phase of the Proposed Road Development by the intervening mature vegetation. The Proposed Road Development will re-join the existing N63 to the south of the asset with the result that there will be no change to the volume of traffic passing. The change to setting during the operation phase will be such that the special interests or qualities of the *Leacht Cuimhne* will be slightly affected without a noticeable change leading to a magnitude of effect of **low** as defined by the criteria in Table 14-2 leading to a significance of effect of **slight**, as defined by the criteria in Table 14-3. The **slight** significance of effect will be **short-term** and **neutral**.

The potential effects during operation are outlined in Table 14-5.

Table 14-5 Potential Effects during Operational Phase

Asset Reference	Importance	Description of Effect (Type, Duration)	Magnitude of Effect	Significance of Effect
Liss Bridge (RPS No. 3925)	Regional	Permanent, beneficial effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Beneficial
Knockmoy Abbey (National Monument No. 166)	National	Permanent, adverse effect upon the setting of the asset during operation of the development.	Medium	Significant Long-Term Adverse
Rose Villa (No. 3923)	Regional	Permanent, beneficial effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Beneficial
St. Bernard's Church (No. 83)	Regional	Permanent, beneficial effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Beneficial
Leacht Cuimhne (No. 3921)	Regional	Permanent, neutral effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Neutral
Leacht Cuimhne (No. 3918)	Regional	Permanent, neutral effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Neutral

14.7 Mitigation and Monitoring Measures

14.7.1 Mitigation Measures to be adopted during Proposed Road Development Construction in relation to Archaeological Assets

During the construction phase, procedures will be adopted, as will be described in the Contractors Construction Environmental Management Plant (CEMP), to ensure that archaeological areas and sites are protected during construction. This will involve temporary fencing where appropriate and clear notices onsite fences. Toolbox talks will be undertaken when necessary to inform construction supervision staff and site operatives of archaeologically-sensitive areas.

A procedure to agree a minimum period of time to undertake mitigation actions for unforeseen finds during the construction process will be agreed with the Employer and will be recorded in the Contractors CEMP.

14.7.1.1 Archaeological Works

Archaeological testing will be carried out at the pre-construction phase in all parts of the Proposed Road Development to a minimum of 15% of the footprint in each area (Volume 03; Figure A14-7). The detail and scope of all archaeological works will be specified by TII on behalf of Galway County Council and carried out in compliance with the National Monuments Acts 1930 – 2004 and Policy and Guidelines on Archaeological Excavation (Department of Arts, Heritage Gaeltacht and the Islands, 1999).

A suitably qualified archaeological contractor will be appointed to carry out the archaeological fieldwork as per the specification supplied by TII. Galway County Council will be the consent holder for the archaeological works. It is anticipated that all archaeological works will be completed pre-construction. This is in accordance with the Code of Practice between the TII and the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (formerly Arts, Heritage, Gaeltacht and Islands), 2017.

14.7.1.1.1 Archaeological Mitigation Programme

It is anticipated that the archaeological mitigation programme will commence prior to the start of the main construction works.

During Phase 1 (during the enabling works or as soon as access is available) – a programme of extensive test trenching, and if appropriate, test pit evaluation will be undertaken along the entire Proposed Road Development, including within the Compulsory Purchase boundary. Sample-based mechanical or hand excavated trenches will be used to assess and record the character of archaeological remains. Targeted trenching will be used where remains have been identified through non-intrusive survey (geophysical survey/assessment of historic cartographic sources such as CH1 former islands and CH3 former mill pond) or where there is potential for archaeological remains to be discovered. The results of these intrusive trenching or test pit investigation works will inform decision-making on further mitigation recording that may be appropriate. Geo-archaeological assessment will also be carried out and the upstanding building at CH2 will be subject to a simple building survey involving photography and a written description.

Phase 2 (during enabling works) – areas or sites that require preservation by record and that were identified at Phase 1 for detailed excavation, will be investigated. This will also determine the scope of further mitigation works. If additional detailed geo-archaeological investigations are required, these will also be carried out. A General Watching Brief (GWB) will be carried out for ground works, such as utility diversions, road diversions, ecology works, and woodland clearance at certain locations. Investigation of important small-scale historic landscape features, such as land boundaries and townland boundaries, will be carried out, including topographic survey of earthwork features and historic building recording. Detailed design work for preservation *in-situ* will be developed if required.

Phase 3 (during later enabling works and in advance of and concurrent with construction) – at the start of the construction period, a Targeted Watching Brief (TWB) will be undertaken before or concurrent with the main topsoil strip at selected locations. The GWB will be undertaken in all other areas where it is required.

Phase 4 – a post-excavation assessment will be undertaken in accordance with DoHLGH/NMS advice, followed by an appropriate scheme of detailed analysis and reporting. Phase 4 will commence as soon as practicable following completion of the main investigative works. Galway County Council will also require that the results of any archaeological discoveries will be disseminated in the form of printed publications, web-based information and public presentations by the archaeological contractor.

14.7.2 Operational Phase

No additional mitigation measures are required for the operational phase of the Proposed Road Development.

14.8 Residual Impacts and Effects

Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines (EPA 2017), the effects from the impacts that remain after all assessment and mitigation are referred to as ‘Residual Effects’. A summary of the residual impacts and associated residual effects is provided in Table 14-6. Only those assets where an impact has been identified are discussed in this section. Those assets where no impact has been identified are not included.

14.8.1 Assets of National, Regional and Local importance

The Newtown Planned landscape (NIAH Ref. 5365) has been identified as experiencing a medium impact from the Proposed Road Development during construction. Newtown Planned landscape (Ref. 5365) is an asset of regional importance. This was identified as experiencing a moderate effect from the Proposed Road Development during construction. This effect will not change so the overall residual significance will not change from moderate. The residual significance of effect will be **moderate**, **long-term** and **adverse**.

The Abbey (National Monument No. 166) has been identified as experiencing a medium impact from the Proposed Road Development during construction. This impact will not change during operation so the overall residual significance of effect will not change from significant. The residual significance of effect will be **significant**, **long-term** and **adverse**.

Liss Bridge (RPS No. 3925), Rose Villa (RPS No. 3923) and St. Bernard's Church (RPS No. 83) have been identified as experiencing a low effect to their settings from the Proposed Road Development while the removal of traffic during operation will enhance their settings. This impact will not change so the overall residual significance of effect will not change from slight. The residual significance of effect will be **slight**, **long-term** and **beneficial**.

The *Leacht Cuimhne* (RPS No. 3921) and *Leacht Cuimhne* (RPS No. 3918) have been identified as experiencing a low effect from the Proposed Road Development during construction and operation. The settings of these assets will not be changed by the Proposed Road Development. This will not change so the overall residual significance of effect will not change from slight. The residual significance of effect will be **slight**, **long-term** and **neutral**.

CH1 Former islands identified through historic cartographic evidence may contain potential currently archaeological deposits Any such archaeological deposits have been identified as experiencing a very high impact from the Proposed Road Development. Mitigation has been proposed in the form of archaeological testing and excavation, if appropriate, to determine the presence/absence of such features and to preserve them by record. Based on the results of the baseline report, it is assessed that previously unrecorded archaeological assets within the former islands are likely to be of local value. The residual effect is therefore assessed to be **moderate**, **adverse** and **long-term**.

CH2 Buildings identified through historic cartographic evidence have been identified as experiencing a very high impact from the Proposed Road Development. Mitigation has been proposed in the form of archaeological testing and excavation, if appropriate, to determine the presence/absence of such features and to preserve them by record including simple building recording. Based on the results of the baseline report, it is assessed that these buildings are of local value. The residual effect is therefore assessed to be **moderate**, **adverse** and **long-term**.

CH3 Former mill pond has been identified as experiencing a very high impact from the Proposed Road Development. Mitigation has been proposed in the form of archaeological testing and excavation, if appropriate, to determine the presence/absence of such features and to preserve them by record including simple building recording. Based on the results of the baseline report, it is assessed that this mill pond is of local value. The residual effect is therefore assessed to be **moderate**, **adverse** and **long-term**.

Potential currently unrecorded archaeological deposits which are likely to be present within the Proposed Road Development site will experience a very high impact from the Proposed Road Development. Mitigation has been proposed in the form of archaeological testing and excavation, if appropriate, to determine the presence/absence of such features and to preserve them by record. Based on the results of the baseline report, it is assessed that previously unrecorded archaeological assets within the site are likely to be of local value. The residual effect is therefore assessed to be **moderate**, **adverse** and **long-term**.

Table 14-6 Residual Impacts and Effects

Asset Reference	Importance	Residual Impact	Description of Effect (Type, Duration)	Magnitude of Effect	Significance of Effect	Mitigation	Residual Effect
Knockmoy Abbey (National Monument No. 166)	National	Presence of Proposed Road Development.	Permanent, adverse effect upon the setting of the asset during operation of the Proposed Road Development.	Medium	Significant Long-Term Adverse	Not applicable	Significant Long-Term Adverse
Liss Bridge (RPS No. 3925)	Regional	Removal of traffic from the bridge.	Permanent, beneficial effect upon the setting of the asset during operation of the Proposed Road Development.	Low	Slight Long-Term Beneficial	Not applicable	Slight Long-Term Beneficial
Rose Villa (RPS No. 3923)	Regional	Removal of traffic from the vicinity of the asset.	Permanent, beneficial effect upon the setting of the asset during operation of the Proposed Road Development.	Low	Slight Long-Term Beneficial	Not applicable	Slight Long-Term Beneficial
St. Bernard's Church (RPS No. 83)	Regional	Removal of traffic from the vicinity of the asset.	Permanent, beneficial effect upon the setting of the asset during operation of the Proposed Road Development.	Low	Slight Long-Term Beneficial	Not applicable	Slight Long-Term Beneficial
Leacht Cuimhne (RPS No. 3921)	Regional	No impact to the asset.	Permanent, neutral effect upon the setting of the asset during operation of the Proposed Road Development.	Low	Slight Long-Term Neutral	Not applicable	Slight Long-Term Neutral
Leacht Cuimhne (RPS No. 3918)	Regional	No impact to the asset.	Permanent, neutral effect upon the setting of the asset during operation of the Proposed Road Development.	Low	Slight Long-Term Neutral	Not applicable	Slight Long-Term Neutral

Asset Reference	Importance	Residual Impact	Description of Effect (Type, Duration)	Magnitude of Effect	Significance of Effect	Mitigation	Residual Effect
Newtown (NIAH Ref: 5365)	Regional	Construction works associated with the Proposed Road Development.	Permanent physical adverse effect through construction of the Proposed Road Development.	Medium	Moderate Long-Term Adverse	Not applicable	Moderate Long-Term Adverse
CH1 Former Islands	Low	Construction works associated with the Proposed Road Development.	Permanent physical adverse effect through construction of the Proposed Road Development upon potential unrecorded archaeological assets.	Very high, if present	Significant Long-Term Adverse	Archaeological testing, excavation and recording, if required	Moderate Long-Term Adverse
CH2 Buildings	Low	Construction works associated with the Proposed Road Development.	Permanent physical adverse effect through construction of the Proposed Road Development.	Very high, if present	Significant Long-Term Adverse	Archaeological testing, excavation and recording, if required	Moderate Long-Term Adverse
CH3 Former Mill Pond	Low	Construction works associated with the Proposed Road Development.	Permanent physical adverse effect through construction of the Proposed Road Development.	Very high, if present	Significant Long-Term Adverse	Archaeological testing, excavation and recording, if required	Moderate Long-Term Adverse

14.9 Do - Nothing Scenario

In the 'do-nothing' scenario, the scheme will not be constructed and therefore will not result in any significant changes to the baseline conditions of the archaeological and architectural heritage resource.

14.10 Cumulative Impacts and Effects

A desktop search of proposed and existing planning applications was undertaken as part of Chapter 02 'Need for the Proposed Road Development and Planning Policy Context'. The search used publicly available data from MyPlan.ie 'National Planning Application' database, Galway County Council planning application portal and An Bord Pleanála online database. The purpose of this search is to inform the cumulative impacts and associated effects in the EIAR.

The initial search flagged planning applications (data outage was recorded from the 11/01/2021) within a period dating back to 2011 while the scope of the search was based within a 5 km radius taken from the approximate centre point of the Proposed Road Development. The cultural heritage assessment uses a study area of 500 m from the site boundary and the local topography consists of valley of Abbert River with higher ground either side of the Proposed Road Development. Given this, it is unlikely that any planning application beyond 1 km from the Proposed Road Development will create a cumulative impact and these have been excluded.

The following planning applications are noted up to 1 km from the Proposed Road Development:

Table 14-7Planning Applications up to 1 km from the Proposed Road Development

App. Ref. No	Summary of Development	Distance Date	Expiry Date	Distance
181657	To retain the existing funeral home, septic tank, percolation area and car parking facilities all on revised site boundaries from the previous planning application Ref. No. 55867 and all ancillary site works. Gross floor space of work to be retained: 100 sqm	04/03/2019	03/03/2024	c.1 km southwest
18717	For the construction of two temporary classrooms and an extension (changing suite) to an existing school together with associated works and an increase in effluent treatment capacity in lieu of Planning Permission 15/371.	24/07/2018	02/09/2023	c.500 m southeast
171704	For the construction of a dwelling house, domestic garage, proprietary treatment system and for all ancillary site works. Gross floor space of proposed works 214.0sqm.	08/03/2018	15/04/2023	c.1 km southwest
171472	For the construction of new 2 storey dwelling along with garage, treatment septic tank system and all associated site works. Gross floor space of proposed works Dwelling 239sqm, Garage 60sqm.	20/02/2018	01/04/2023	c.800 m southwest
17464	For the construction of a new dwelling house, domestic garage, and treatment plant with associated site works. (Gross floor space of proposed works: House 65.7 sqm; Garage 38 sqm.)	01/06/2017	09/07/2022	c.1 km south
151051	To construct serviced dwelling house and domestic garage/store (gross floor space dwelling 225sqm; garage 60sqm)	13/01/2016	21/02/2021	c.1 km south
15374	To construct a playground and associated site services	29/06/2015	28/06/2020	c.800 m west
14318	Of the existing foul sewer connection from existing public house and two no. private residences to existing foul sewer network at the Granary.	12/01/2015	11/01/2020	c.800 m southwest

Application reference number 181657 is located 1 km to the southwest of the Proposed Road Development. It is set at the existing funeral home and is bounded by development to the south and north. There are no views to the area of the Proposed Road Development, and it is unlikely that noise from construction will combine to create a cumulative effects upon settings of the statutory protected heritage features within the study area. It is assessed that there will be no impact.

Application reference numbers 171704 and 171472 are located adjacent to one another 1 km and 800 m respectively to the southwest of the Proposed Road Development. These developments have been constructed and there are no views to the area of the Proposed Road Development. It is assessed that there will be no cumulative impact.

Application reference number 15374 is located 800 m to the west of the Proposed Road Development and comprises a playground which is set between the modern housing development of *Cois Na Habhainn* and the road to Lackagh. This application has been constructed and comprises the playground set around the *Leacht Cuimhne* (RPS No. 3921). There are no views of the area of the Proposed Road Development, and it is assessed that there will be no cumulative impact upon the setting of the *Leacht Cuimhne* (RPS No. 3921).

Application reference number 14318 comprises the construction of a foul sewer 800 m to the southwest of the Proposed Road Development from the public house and two private residences in Abbeyknockmoy to the existing foul sewer network at the Granary. Views towards the area of the Proposed Road Development are blocked by existing modern development which will also screen any noise from construction. It is unlikely that this development will create impacts which will combine with impacts from the Proposed Road Development to create a cumulative effect upon settings of the statutory protected heritage features within the study area. It is assessed that there will be no impact.

Application reference number 18717 comprises the construction of two temporary classrooms and an extension (changing suite) to the existing Newtown National school which is located 500 m to the southeast of the Proposed Road Development and 121 m to the northeast of St. Bernard’s Church (RPS No. 83). This development has been constructed and, while visible from the Protected Structure, it does not form part of its setting and does not detract from the understanding of the heritage asset. The Proposed Road Development will also be visible from St. Bernard’s Church (RPS No. 83) but will not create a cumulative effect with the development upon the setting of the Protected Structure. It is assessed that there will be no impact.

Application reference numbers 151051 and 17464 are each located 1 km to the south of the Proposed Road Development. Both are bounded by modern development. There are no views to the area of the Proposed Road Development, and it is unlikely that noise from construction of either development will combine to create a cumulative effect upon settings of the statutory protected heritage features within the study area. It is assessed that there will be no impact from these developments.

No significant cumulative impacts or subsequent effects to cultural heritage resources in the study area were therefore determined.

14.11 Summary

The impacts to cultural heritage resources from the Proposed Road Development are summarised as follows:

- The assessment identified seven archaeological and architectural heritage assets on which the Proposed Road Development has the potential to impact;
- Mitigation has been proposed to reduce this impact which will ensure any archaeological and architectural assets are identified and recorded to best practice thereby enriching the known heritage of County Galway;
- Following mitigation, there remains an adverse residual effect upon the following assets:
  - previously unrecorded archaeological assets within the Proposed Road Development site. The residual effect is assessed to be **moderate**, **adverse** and **long-term;**
  - National Monument - Knockmoy Abbey (National Monument No. 166). The residual significance of effect is assessed to be **significant**, **long-term** and **adverse**;
  - the Planned Landscape Newtown (NIAH Ref. 5365). The residual effect is assessed to be **moderate**, **adverse** and **long-term**.
  - Previously unrecorded archaeological assets within the former islands (CH1) noted from historic cartographic evidence. The residual effect is assessed to be **moderate**, **adverse** and **long-term**;
  - The buildings (CH2) noted from historic cartographic evidence. The residual effect is assessed to be **moderate**, **adverse** and **long-term**; and
  - The former mill pond (CH3) associated with the planned landscape Newtown (NIAH Ref. 5365). The residual effect is assessed to be **moderate**, **adverse** and **long-term**.
- Liss Bridge (RPS No. 3925), Rose Villa (RPS No. 3923) and St. Bernard's Church (RPS No. 83) have been identified as experiencing a low effect from the Proposed Road Development. The residual significance of effect is assessed to be **slight**, **long-term** and **beneficial**;
- The Protected Structures Leacht Cuimhne (RPS No. 3921) and Leacht Cuimhne (RPS No. 3918) have been identified as experiencing a low effect from the Proposed Road Development. The residual significance of effect is assessed to be **slight**, **long-term** and **neutral**;
- No additional residual effects have been identified; and
- No significant cumulative effects to cultural heritage resources in the study area were determined.

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 15: Major Accidents and Disasters

Galway County Council

February 2022

Table of Contents

Figures

Tables

Volume 04 Appendices

15. Major Accidents and Disasters

15.1 Introduction

This chapter describes the potential for Major Accidents and Disasters (MAD) which are pertinent to the Proposed Road Development and the assessment of likely significant effects on the environment. This prescribed environmental factor is outlined within the revised EIA Directive 2014/52/EU, which entered into force in May 2017. The Directive states a requirement to assess "*the expected significant adverse effects of the project on the environment deriving from the vulnerability of the project to risks of major accidents and/or natural disasters which are relevant to the project concerned*".

A disaster in the context of this assessment, is defined as a:

"…*natural hazard (e.g. earthquake) or a man-made/external hazard (e.g. act of terrorism) with the potential to cause an event or situation that meets the definition of a major accident."* (IEMA, 2020).

A major accident, in the context of this assessment is defined as:

"*Events that threaten immediate or delayed serious environmental effects to human health, welfare and/or the environment and the use of resources beyond those of the client or its appointed representatives to manage. Whilst malicious intent is not accidental, the outcome (e.g. train derailment) may be the same and therefore many mitigation measures will apply to both deliberate and accidental events*." (IEMA, 2020).

There are two key considerations in a MAD assessment, namely:

1. The potential of the project to cause MADs, including implications for human health, cultural heritage, and the environment; and
2. The vulnerability of the project to potential MADs, including the risk to the project of both natural disasters (e.g. flooding) and man-made disasters (e.g. technological disasters).

The assessment aims to identify if major accidents and/or disasters relevant to the Proposed Road Development could result in likely significant environmental effects and if so, what these will be and what mitigation measures are/should be in place to prevent or mitigate the effects of such events on the environment.

The assessment of MAD considers all disciplines outlined within the EIA Directive (including population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape).

Reference should also be made to the characteristics of the Proposed Road Development outlined in Chapter 04 'Description of the Proposed Road Development'. It is important to note that the Proposed Road Development has been designed and will be built and operated in accordance with industry standard best practice; this has been considered when undertaking this assessment.

15.2 Legislation, Policy and Guidance

The following relevant legislation and guidance has informed the MAD impact assessment:

- EIA Directive (85/337/EEC) as amended;
- Environmental Protection Agency's draft 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (hereafter referred to as the 'EPA draft guidelines') (EPA 2017);
- Department of the Environment, Heritage & Local Government (DoEHLG)'s 'Guide to Risk Assessment in Major Emergency Management' (DoEHLG, 2010);
- 'Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive)' (Highways England, 2017); and
- 'Major Accidents and Disasters in EIA: A Primer' (IEMA, 2020).

The following documents prepared for the Proposed Road Development have also informed the assessment:

- Construction Environmental Management Plan (CEMP); and
- Flood Risk Assessment (FRA).

15.3 Methodology

15.3.1 Overview

The Environmental Impact Assessment (EIA) assessment approach prior to the revised EIA Directive considered certain accidents and disasters such as the potential for pollution to ground and surface waters, the potential pathways to sensitive biodiversity receptors (through Appropriate Assessment (AA)) and the potential for flood events (through flood risk assessments). These accidents and disasters continue to be considered within individual chapters of the Environmental Impact Assessment Report (EIAR) (for example, Biodiversity and Water).

Although the assessment of MADs has been included within the revised EIA Directive, national guidelines are not yet available. In the absence of such guidance, information produced by the DoEHLG, Highways England's (equivalent body to Transport Infrastructure Ireland (TII)) and Institute of Environmental Management and Assessment (IEMA) have been consulted. Highways England guidance sets out how projects must implement the new requirements of the EIA Directive, while guidance produced by the DoEHLG identifies a matrix which can be used to identify the risk associated with a potential major emergency. IEMA's 2020 guidance document 'Major Accidents and Disasters in EIA: A Primer, Institute of Environmental Management and Assessment' sets out methodologies that can be adopted during a MADs assessment in an EIAR.

Highways England guidance identifies that the general scope should cover:

- Vulnerability of the project to risks of a MAD; and
- Any consequential changes in the predicted effects of that project on environmental topics.

To achieve this, the guidelines identify that projects should:

- Apply professional judgement to develop project-specific definitions of MAD;
- Identify any MADs that are relevant to and can affect a project;
- Where MADs are identified, describe the potential for any change in the assessed significance of the project on relevant environmental topics in qualitative terms. Report the conclusions of the assessment within the individual environmental topics if deemed necessary; and
- Clearly describe any assumed mitigation measures, to provide an evidence base to support the conclusions and demonstrate that likely effects have been mitigated/managed to an acceptable level.

Potential MADs covered within this chapter are typically rare or low likelihood events with the potential to cause "*significant environmental effects*". It states in IEMA's guidance document (2020) that:

"In general, major accidents and/or disasters should be considered as part of an assessment where the development has the potential to cause the loss of life, permanent injury and/or temporary or permanent destruction of an environmental receptor which cannot be restored through minor clean-up and restoration".

15.3.2 Study Area

As part of the MADs assessment process, details of the surrounding environment which were collated within designated chapters of the EIAR were reviewed, to ensure that full consideration was given to the specific nature of surrounding environs. Therefore, the assessment takes into consideration the study area and assessment under population and human health, biodiversity, noise and vibration, land and soil, water, air quality, climate, material assets, cultural heritage and the landscape and visual.

15.3.3 Assessment Scope

The assessment of MADs has been carried out in two stages which are described as follows:

Stage 1: Hazard Identification and Baseline Establishment

In Stage 1, the Hazard Identification (HAZID) risk analysis-based methodology has been used. The HAZID approach applies guidewords to identify hazards which may be pertinent to the Proposed Road Development and could result in a MAD. This structured risk assessment methodology has been applied to identify the potential hazards associated with the Proposed Road Development in order to prevent a subjective approach being used which could fail to identify important hazards.

As there is no set guidance document on the HAZID approach, the DoEHLG's 'Guide to Risk Assessment in Major Emergency Management' (DoEHLG, 2010) has been utilised in this assessment. Hazard identification consisted of collating data from existing sources and collating risks identified during the design and environmental evaluation process.

The output of this process was an initial long list of hazards (Volume 04; Appendix A15-1) and their associated potential consequences. This process identified potential MADs which could impact the Proposed Road Development or be facilitated as a result of the Proposed Road Development.

The HAZID assessment took into consideration the existing baseline and reviewed potential receptors to identify those not considered necessary to include in Stage 2 of the assessment.

A screening exercise was undertaken on the long list to give consideration to the hazards relevant to the Proposed Road Development, and therefore whether they should be included on the project-specific short list brought forward to Stage 2 of the assessment. In essence, the screening stage identified potential MADs to which the Proposed Road Development is particularly vulnerable or has a particular capacity to exacerbate. These were then brought forward to the next stage of assessment. It is also of importance to consider the potential for the escalation of events should a combination of risks occur in combination (for example, a domino effect).

Although the majority of potential hazards on the long list are already considered under other legislative or design requirements, this was not considered to be a sufficient reason to eliminate them from any further consideration. However, it is considered reasonable and proportionate to exclude certain receptor groups from the outset.

The reasons for not taking identified hazards to the next stage of the assessment included:

- The hazard could not realistically occur due to the type of scheme or its location (e.g. tsunami risk to development located substantially above sea level);
- The potential impact does not meet the definition of 'significant environmental effect'[1]; and
- The hazard could realistically occur, but for which the proposed project, and associated receptors, are no more vulnerable than any other development.

Hazards were screened such that only credible, low likelihood, but potentially high consequence events remain (Figure 15-1).

[1] Significant environmental effect (in relation to a MADs assessment) = "*loss of life or permanent injury and/or permanent or long-lasting damage to an environmental receptor which cannot be restored through minor clean-up and restoration effects*" (IEMA, 2020).

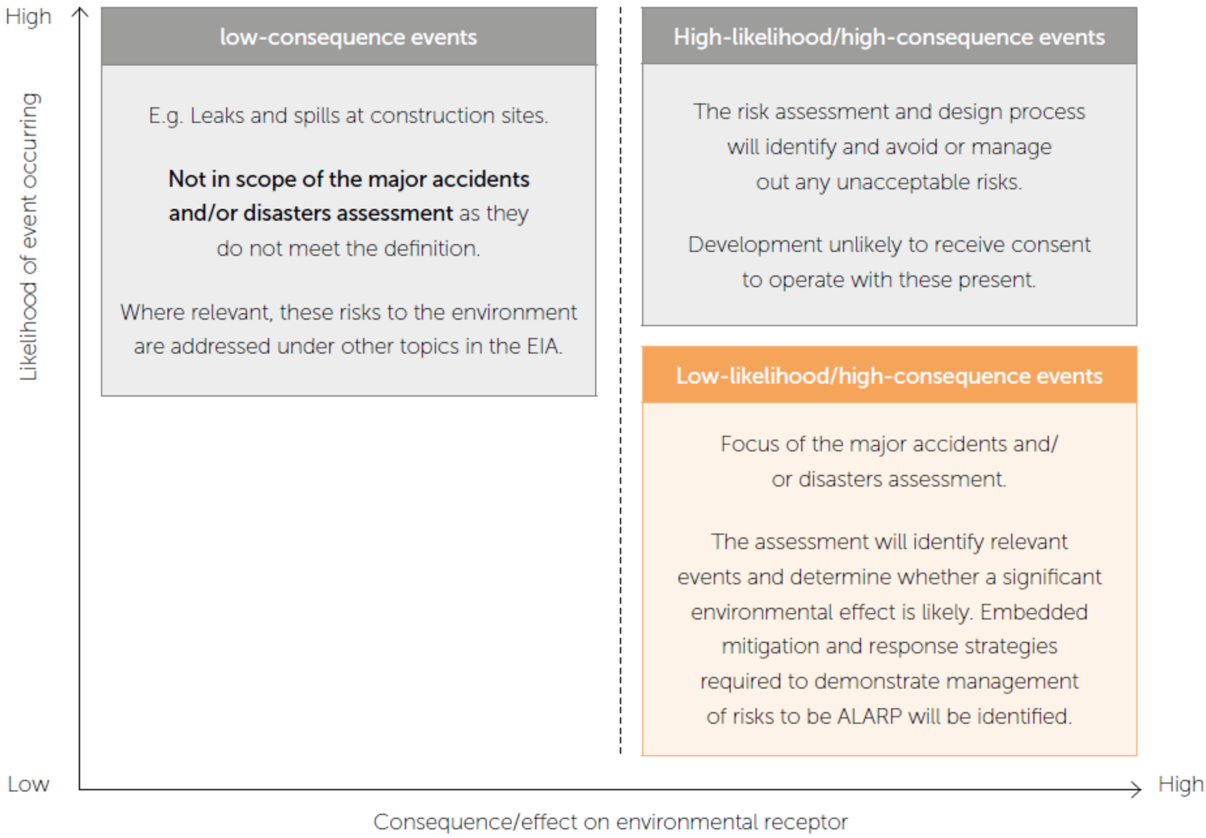

Figure 15-1 Summary of Risks Considered in the Scope of Assessment for Major Accidents and Disasters

Source: Figure 2: Major Accidents and Disasters in EIA: A Primer, Institute of Environmental Management and Assessment (IEMA, 2020)[2]

Stage 2: Hazard Classification: Likelihood and Consequence

In Stage 2, the hazards identified in Stage 1 were considered qualitatively in further detail to identify the likelihood and potential consequences or effects of occurrence. A risk rating/score was then assigned to each event which are then ranked accordingly.

The purpose of identifying a risk rating/score and ranking is to assist in making decisions to identify and prioritise the requirement for mitigation/treatment (see Table 15-1 and Table 15-2). A risk matrix was then developed to allow the risks to be easily displayed and prioritised (Table 15-3).

An analysis of embedded control measures (i.e. those that have been incorporated into the design of the Proposed Road Development) and any proposed additional environmental mitigation measures identified throughout the EIAR were considered when estimating the likelihood and consequence of the identified hazards occurring. This was to identify if these measures would be enough to manage potential MAD risks to As Low As Reasonably Practicable (ALARP). Where this is not the case, additional mitigation measures will be required for risks to reach an acceptable level.

[2] ALARP = As low as reasonably practicable.

Table 15-1 Risk Classification - Likelihood

Ranking	Category	Description
1	Extremely Unlikely	May occur only in exceptional circumstances; once every 500 or more years.
2	Very Unlikely	Is not expected to occur; and/or no recorded incidents or anecdotal evidence; and/or very few incidents in associated organisations, facilities or communicates; and/or little opportunity, reason or means to occur; May occur once every 100-500 years.
3	Unlikely	May occur at some time; and/or few, infrequent, random recorded incidents or little anecdotal evidence; some incidents in associated or comparable organisations worldwide; some opportunity, reason or means to occur; may occur once per 10-100 years.
4	Likely	Likely to or may occur; regular recorded incidents and strong anecdotal evidence and will probably occur once per 1-10 years.
5	Very Likely	Very likely to occur; high level of recorded incidents and/or strong anecdotal evidence. Will probably occur more than once a year.

Source: Table 2: Guide to Risk Assessment in Major Emergency Management (DoEHLG, 2010).

Table 15-2 Risk Classification Severity – Consequence

Ranking	Classification	Impact	Description
1	Minor	Life, Health, Welfare Environment Infrastructure Social	Small number of people affected; no fatalities and small number of minor injuries with first aid treatment. No contamination, localised effects. <0.5 M Euros. Minor localised disruption to community services or infrastructure (<6 hours).
2	Limited	Life, Health, Welfare Environment Infrastructure Social	Single fatality; limited number of people affected; a few serious injuries with hospitalisation and medical treatment required. Localised displacement of a small number of people for 6-24 hours. Personal support satisfied through local arrangements. Simple contamination, localised effects of short duration. 0.5-3 M Euros. Normal community functioning with some inconvenience.
3	Serious	Life, Health, Welfare Environment Infrastructure Social	Significant number of people in affected area impacted with multiple fatalities (<5), multiple serious or extensive injuries (20), significant hospitalisation. Large number of people displaced for 6- 24 hours or possibly beyond; up to 500 evacuated. External resources required for personal support. Simple contamination, widespread effects or extended duration. 3-10M Euros. Community only partially functioning.
4	Very Serious	Life, Health, Welfare Environment Infrastructure Social	5 to 50 fatalities, up to 100 serious injuries, up to 2000 evacuated. Heavy contamination, localised effects or extended duration 10-25 M Euros. Community functioning poorly, minimal services available.
5	Catastrophic	Life, Health, Welfare Environment Infrastructure Social	Large numbers of people impacted with significant numbers of fatalities (>50), injuries in the hundreds, more than 2000 evacuated. Very heavy contamination, widespread effects of extended duration. >25 M Euros Serious damage to infrastructure causing significant disruption to, or loss of, key services for prolonged period. Community unable to function without significant support.

Source: Table 3: Guide to Risk Assessment in Major Emergency Management (DoEHLG, 2010).

Table 15-3 Risk Matrix

Likelihood	5	Very Likely	Low	Medium	High	High	High
	4	Likely	Low	Medium	Medium	High	High
	3	Unlikely	Low	Low	Medium	Medium	High
	2	Very unlikely	Low	Low	Low	Medium	Medium
	1	Extremely Unlikely	Low	Low	Low	Low	Low
Severity			1	2	3	4	5
			Minor	Limited	Serious	Very Serious	Catastrophic

Low Risk – e.g. no additional mitigation required
Med Risk – e.g. consider mitigation measures
High Risk – e.g. consider re-design

15.3.4 Determination of the Baseline Environment

A desktop assessment of publicly available information was undertaken to determine the baseline environment within the study area.

The baseline environment considers the surrounding community, such as its geographic distribution, vulnerable groups in the community and the community demographics (including information from Chapter 06 'Population and Human Health'), the surrounding environment such as environmentally sensitive areas (including information from Chapter 07 'Biodiversity', Chapter 08 'Land and Soils' and Chapter 09 'Water'), the infrastructure in the area such as essential utilities in the area (including information from Chapter 16 'Material Assets'), and Seveso sites in the surrounding area.

15.3.5 Determination of Sensitive Receptors

A MADs assessment does not follow the approach of identifying receptors and determining their sensitivity that is typically used for other environmental aspects. For the purpose of this assessment, the sensitive receptors are regarded as:

- Members of the public and local communities;
- Infrastructure and the built environment (including material assets);
- The natural environment, including ecosystems, land and soil quality, air quality and climate, noise and vibration, surface and groundwater resources, and landscape; and
- The historic environment, including cultural heritage assets.

15.4 Limitations and Assumptions

No limitations or assumptions were identified during this assessment.

15.5 Baseline Environment

15.5.1 Weather Conditions

County Galway has a temperate oceanic climate, resulting in mild winters and cool summers.

The World Meteorological Organization (WMO) recommends that climate averages are computed over a 30-year period of consecutive records. The period of 30 years is considered long enough to smooth out year to year variations. Met Éireann references 1981 to 2010 as the baseline period for day-to-day weather and climate comparisons in Ireland.

The Met Éireann weather station at Claremorris is the nearest weather and climate monitoring station to the Proposed Road Development site; however, averages over the 30-year period are not available for this location. The next nearest weather and climate monitoring station is located in Birr, south of the Proposed Road Development site. Meteorological data recorded at Birr over a 10-year period from 1979-2008 is shown in Table 15-6. The wettest months are October and December, and May is the driest. July is the warmest month with a mean daily temperature of 15.6° Celsius.

More recent data from Athenry between 2017 and 2020 (Tables 15-4 and 15-5) shows similar results when compared to the 30-year averages; however, mean monthly total rainfall values over the 4 years are higher (1192.9 mm annual mean value).

Table 15-4 Mean Rainfall (in mm) for Athenry

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2020	118.7	248.5	108.2	46.8	49.6	70.2	174.3	109.8	90.3	168.0	148.1	77.3	1409.8
2019	84.1	73.5	161.4	67.7	46.1	69.7	71.0	297.3	185.3	115.0	111.4	144.3	1426.8
2018	173.2	78.0	81.4	82.2	62.5	25.2	69.7	126.1	98.8	73.8	86.3	125.0	1082.2
2017	47.4	87.5	142.6	13.5	61.4	119.5	136.8	103.1	118.3	123.2	88.9	157.7	1200.0
mean	116.7	87.8	94.7	72.0	75.3	79.6	86.5	107.8	100.3	128.9	120.3	123.2	1192.9

Source : https://www.met.ie/climate/available-data/monthly-data

Table 15-5 Mean Temperature (in degrees Celsius) for Athenry

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
2020	6.1	5.8	6.3	9.8	12.0	13.7	13.8	15.6	13.0	9.7	8.1	5.7	10.1
2019	6.0	7.6	7.0	9.2	10.6	12.7	15.9	14.9	12.8	9.2	5.9	6.1	9.8
2018	5.3	3.6	4.5	8.6	12.1	15.9	16.0	14.7	11.6	9.2	7.6	7.9	9.8
2017	6.2	6.1	8.0	8.9	12.2	13.8	14.4	13.8	12.2	11.1	6.8	5.6	10.0
mean	5.5	5.6	7.0	8.6	11.3	13.7	15.5	15.2	13.2	10.2	7.5	5.6	9.9

Source : https://www.met.ie/climate/available-data/monthly-data

Table 15-6 Data from Met Éireann Weather Station at Birr 1979-2008: Monthly and Annual Mean and Extreme Values

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean daily max	8.1	8.6	10.3	12.6	15.5	17.8	19.6	19.3	17.1	13.6	10.4	8.6	13.5
mean daily min	2.0	2.0	3.3	4.3	6.6	9.5	11.6	11.3	9.3	6.6	4.0	2.7	6.1
mean temperature	5.1	5.3	6.8	8.4	11.0	13.6	15.6	15.3	13.2	10.1	7.2	5.6	9.8
absolute max.	14.3	15.5	18.6	23.2	25.7	29.7	30.8	29.4	25.6	20.4	17.5	15.3	30.8
min. maximum	-3.5	-0.5	2.0	4.3	6.3	10.5	12.5	11.6	9.7	5.9	2.7	-1.0	-3.5
max. minimum	11.6	12.1	12.2	13.0	15.2	16.6	18.9	18.1	17.9	15.7	12.8	13.0	18.9
absolute min.	-14.6	-7.1	-7.8	-4.7	-2.3	0.2	3.7	2.0	-1.1	-5.2	-6.9	-8.6	-14.6
mean num. of days with air frost	8.2	7.7	4.9	3.5	0.9	0.0	0.0	0.0	0.2	1.6	4.8	7.0	38.8
mean num. of days with ground frost	16.0	15.0	13.0	12.0	7.0	1.0	0.0	0.0	2.0	6.0	11.0	15.0	98.0
mean 5 cm soil	3.9	3.9	5.7	9.0	13.0	16.0	17.2	16.4	13.5	9.4	6.2	4.5	9.9
mean 10 cm soil	4.1	4.2	5.6	8.2	11.8	14.8	16.3	15.6	13.0	9.4	6.5	4.8	9.5
mean 20 cm soil	4.8	5.0	6.4	8.8	12.1	14.9	16.6	16.2	14.0	10.5	7.5	5.6	10.2
RELATIVE HUMIDITY (%)													
mean at 0900UTC	89.8	88.9	86.9	81.5	77.7	78.3	80.9	84.2	86.6	89.1	90.9	90.3	85.4
mean at 1500UTC	82.4	75.6	71.6	65.1	64.7	66.2	67.5	68.5	70.3	76.1	81.1	84.5	72.8
SUNSHINE (hours)													
mean daily duration	1.5	2.2	2.9	4.5	5.1	4.3	3.9	4.0	3.5	2.9	1.9	1.4	3.2
greatest daily duration	7.7	9.4	10.5	13.0	15.1	15.7	15.2	13.6	11.5	9.7	8.5	6.9	15.7
mean num. of days with no sun	11.0	7.1	5.8	2.9	2.2	2.9	2.5	2.5	3.5	6.2	8.8	12.0	67.4
RAINFALL (mm)													
mean monthly total	78.8	58.6	67.4	55.0	59.5	66.5	59.4	81.6	66.4	94.2	74.7	83.8	845.7
greatest daily total	39.2	28.0	22.0	26.3	19.7	41.1	44.5	59.1	35.7	32.3	29.7	37.5	59.1
mean num. of days with >= 0.2 mm	19	15	19	15	16	16	16	18	17	19	18	18	206
mean num. of days with >= 1.0 mm	14	11	14	11	12	11	11	12	11	14	13	13	147

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mean num. of days with >= 5.0 mm	5	4	4	3	4	4	3	5	4	6	5	6	53
WIND (knots)													
mean monthly speed	7.9	8.0	7.8	6.5	6.2	5.8	5.6	5.6	6.0	6.8	7.0	7.5	6.7
max. gust	75	77	64	58	55	49	49	46	51	64	54	69	59.2
max. mean 10-minute speed	40	38	33	29	29	27	24	27	30	37	32	38	32
mean num. of days with gales	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.5
WEATHER (mean no. of days with)													
snow or sleet	3.5	2.6	2.5	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.2	1.9	11.7
snow lying at 0900UTC	2.0	0.6	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	3.7
hail	0.6	0.8	1.8	2.0	0.9	0.1	0.0	0.2	0.1	0.2	0.3	0.3	7.3
thunder	0.1	0.1	0.2	0.3	0.4	0.8	0.9	0.5	0.3	0.1	0.2	0.1	3.9
fog	2.1	1.3	1.1	1.5	1.1	0.8	1.1	1.8	2.5	2.1	1.9	2.9	20.4

Source: Met Eireann Weather Station at Birr 1979—2008 https://www.met.ie/climate/30-year-averages

15.5.2 Demographics

An overview of population demographics of the study area has been summarised below:

- Abbeyknockmoy is the largest settlement in proximity to the Proposed Road Development;
- The population in the study area has seen a significant increase over the last ten years. The Central Statistics Office (CSO) census 2016 reports that the population grew by approximately 16.4% from 1,206 in 2006 to 1,407 in 2016. Most of this population growth occurred between 2006 and 2011, with an increase of only 99 residents between 2011 and 2016. The population growth rate in the study area between 2006 and 2016 is higher than all its comparator areas;
- Approximately 16% of the population in the study area is aged 65 or over. This is higher than County Galway (15%) and at State level (13%);
- Abbey West and Abbey East Electoral Division (ED) is classified as 'marginally below average' (4th least deprived rank out of 8 classifications) in 2016 with a relative index score of -2.91;
- Several community facilities are located in proximity to the junction between the N63 and L3110, both on the north and south side of the existing N63. For example, Abbeyknockmoy Community Centre and Abbeyknockmoy Health Centre;
- There is currently a minor network of footpaths and pedestrian facilities in the vicinity of the community facilities. Residents of the study area rely primarily on private vehicles. Approximately 79% of residents in the study area travel to their respective destinations by driving or as a passenger in a private vehicle; and
- The Proposed Road Development is located in a rural and agricultural area, existing road users include residents in the local community and agricultural vehicles.

Further information can be found in Chapter 06 'Population and Human Health'.

15.5.3 Environment

15.5.3.1 Water (Flood Risk)

The Office of Public Works (OPW) Flood Maps[3] identify a designated flood zone along the Abbert River. No past flood events are recorded on the OPW Flood Maps within or close to the study area.

Historical mapping (25-inch map series (1888-1913) and 6-inch Cassini (1830-1930)) shows lands south of the Abbert River and to the north east of the river are marked as 'Liable to Floods' (Figure 15-2). The 'Stage 1 – Flood Risk Identification' stage of the FRA identified and the 'Stage 2 – Initial Flood Risk Assessment' carried out for the Proposed Road Development identified the potential for fluvial flooding in the vicinity of the Abbert River, however sufficient information was not available to complete the assessment and so a 'Stage 3 – Detailed Flood Assessment' was carried out (AECOM, 2021).

Model output for the Proposed without Mitigation scenario carried out for the FRA indicated a significant increase (maximum of 83 mm in-channel and 169 mm in the floodplain for the 1% Annual Exceedance Probability (AEP)) in flood level upstream of the proposed crossing. The proposed with Mitigation scenario included upsizing of two proposed ditch culverts and the addition of three flood connectivity culverts to improve the conveyance of flow through the proposed approach embankments. Model output for the Proposed Road Development with Mitigation scenario indicated a slight increase (maximum of 33 mm in-channel and 33 mm in the floodplain for the 1% AEP) in flood level upstream of the proposed crossing. Additional information can be found in the FRA, Volume 04; Appendix A09-1.

According to the Environmental Protection Agency (EPA) map viewer, the Abbert River is not a source of drinking water that has extra protection by law. The Abbert River has not been identified as a river with significant abstraction pressures.

[3] https://www.floodinfo.ie/map/floodmaps/ Accessed 09/12/2020

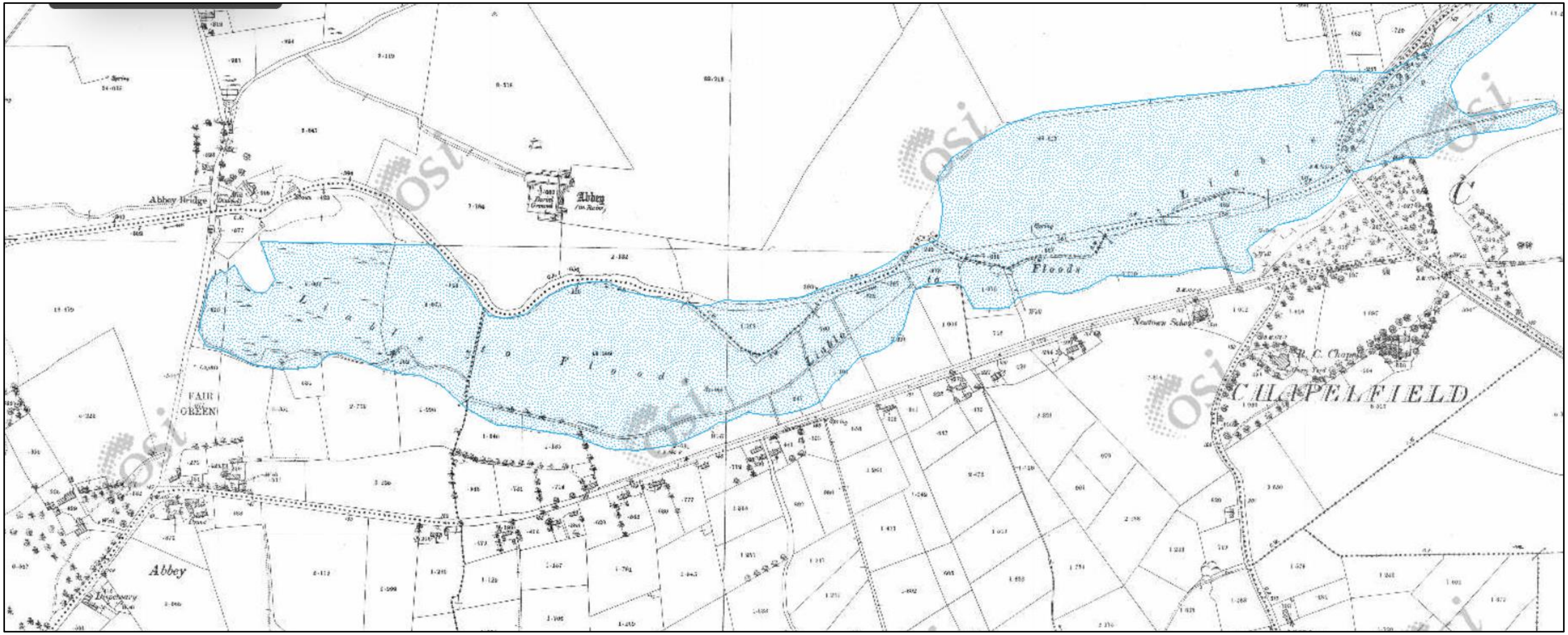

Figure 15-2 Historic 25-Inch Map Showing Lands 'Liable to Floods' within the Study Area

Source: http://map.geohive.ie/

15.5.3.2 Land and Soils

As identified in the Geological Survey Ireland (GSI) Spatial Map Viewer[4], the underlying bedrock is described as "*pale grey clean skeletal limestone*" from the Burren Formation, with soils in the study area consisting of well drained, "*Coarse loamy drift with limestone*" from the Mullabane soil association; well drained "*Coarse loamy over calcareous gravels*" from the Baggotstown soil association; as well as poorly drained river alluvium and peat[5].

A geophysical survey was undertaken by Minerex in 2020, with the aim of determining ground conditions beneath the Proposed Road Development site. It is stated in the survey that the top of the glacial till is likely weathered while the deeper glacial till is expected to be highly consolidated, suitable for heavy foundations and can provide protection against possible karstification of the deep rock.

Further information can be found in Chapter 08 Land and Soils.

15.5.3.3 Nationally and Internationally Designated Sites

The Abbert River, which is a tributary of the Clare River and thus forms part of the Lough Corrib Special Area of Conservation (SAC) (site code:000297), is located within the Proposed Road Development site boundary. The closest Special Protection Area (SPA) is Lough Corrib SPA which is located circa 20 km west of the Proposed Road Development site.

Killaclogher Bog Natural Heritage Area (NHA) (site code: 001280) is located circa 3.5 km south east of the Proposed Road Development site.

Further information can be found in Chapter 07 'Biodiversity'. An Appropriate Assessment (Appropriate Assessment Screening and NIS) has also been prepared for the Proposed Road Development.

15.5.3.4 Cultural Heritage Assets

Chapter 14 Cultural Heritage identified a number of archaeological and architectural heritage assets in the study area, including:

- National Monument - Knockmoy Abbey (National Monument No. 166);
- 12 assets recorded on the Record of Monuments and Places (RMP) within the study, six of which are (GA058-004001-006) are associated with the National Monument;
- Five assets noted on the Record of Protected Structures (RPS) as recorded on the Galway County Development Plan 2015-2021, including Liss Bridge (RPS No. 3925);
- A total of seven buildings and structures listed on the National Inventory of Architectural Heritage (NIAH) are located within the study area; and
- One designed landscape noted on the NIAH (Newtown Ref).

Additional information can be found in Chapter 14 'Cultural Heritage'.

[4] GSI Spatial Map Viewer Accessed 09/12/2020
[5] https://gis.epa.ie/EPAMaps/ Accessed 09/12/2020

15.5.4 Infrastructure

15.5.4.1 Existing Traffic Conditions

The existing traffic conditions are documented within Chapter 05 'Traffic Analysis'. The Annual Average Daily Traffic (AADT) for base year (2019) are summaries in Table 15-7.

Table 15-7 AADT Summary for Base Year (2019)

No.	Link	2019 Base AADT (%HGV)
1	Existing N63 between the eastern end of Abbeyknockmoy and L7138	4859 (5.9% HGV)
2	Existing N63 between L7138 and L3110	3764 (6.8% HGV)
3	Existing N63 between L3110 and L6159 (at Liss Bridge)	3499 (6.5% HGV)
4	Existing N63 between L6159 and L6234	4859 (5.9% HGV)

Traffic surveys carried out in 2019 identified:

- The existing community building and schools in close proximity to the road edge, the single lane bridge with substandard entry radii, and the significant number of road junctions and direct accesses, give rise to a safety concern when considered in conjunction with these high speeds;
- The traffic volumes are relatively high for such a rural link road and this is largely dominated by through flows; and
- There are a number of right turn movements along the route. The movement to the L3110 from the N63 has potential to generate shunt collisions, given the limited junction visibility and proximity to the community facilities and the Liss Bridge.

Additional information can be found in Chapter 05 Traffic Analysis.

15.5.4.2 Existing Road Conditions

This section provides a summary of existing road conditions in the study area and safety concerns. As outlined in Chapter 02 Need for the Proposed Road Development and Planning Policy Context, the existing N63 is generally narrow with no hard shoulders. Alignment of the road is poor in both the horizontal and vertical planes. There is no off-carriageway provision for pedestrians or cyclists. The existing Liss Bridge is narrow and significantly restricts traffic flows, with two HGV's travelling in opposite directions unable to safely pass on the Liss Bridge. Given the rural nature of the study area, agricultural vehicles conflict with local road traffic on the Liss Bridge on a regular basis, which in turn generates localised traffic issues.

There are nineteen direct accesses onto the N63. The overriding principle in TII publication 'DNGEO-03060, Geometric Design of Junctions', priority junctions, direct accesses, roundabouts, grade-separated, and compact grade-separated junctions is that direct access onto national roads should be avoided. Several of these accesses do not have the required sight distance and are thus a safety risk.

15.5.4.3 Essential Utilities

Table 15-8 provides a summary of all the utility providers which were contacted as well as the response received (if any).

The review of utility suppliers identified water, electricity and communications networks. No gas networks were identified in the area of the Proposed Road Development. Procedures will be in place as part of the Contractors CEMP to protect these utilities during construction.

Table 15-8 Utility Providers Contacted

Utility Provider	Response Received	Response
Brighter Networks	Yes	No Infrastructure within Study Area
BT Ireland	Yes	No Infrastructure within Study Area
Clear Channel	Yes	No Infrastructure within Study Area
Colt	Yes	No Infrastructure within Study Area
Cuillagh Group Water Scheme	Yes	Infrastructure Confirmed within Study Area
EIR	Yes	Infrastructure Confirmed within Study Area
Enet	Yes	No Infrastructure within Study Area
ESB (Electricity Supply Board)	Yes	Infrastructure Confirmed within Study Area
EU Networks	Yes	No Infrastructure within Study Area
Gas Networks Ireland	Yes	No Infrastructure within Study Area
Industria (Fibre networks)	No	-
Irish Water	Yes	Infrastructure Confirmed within Study Area
Magnet	Yes	No Infrastructure within Study Area
Siro	Yes	No Infrastructure within Study Area
Verizon	No	-
Viatel	No	-
Virgin Media	Yes	No Infrastructure within Study Area
Vodafone	Yes	No Infrastructure within Study Area

15.5.4.4 Seveso Sites

Seveso sites are highly regulated industrial installations carrying out activities such as chemical manufacturing. These sites are designated due to the presence of dangerous substances, such as flammable liquids, which have the potential for major accidents. The presence of these sites can introduce hazards in the form of domino effects, which is an accident occurring at a facility which could be the source of a major accident or increase the risk or consequences of a major accident at the Proposed Road Development.

There are no Upper or Lower Tier Seveso sites located close to or within the surrounding area of the Proposed Road Development[6,7].

15.6 Hazard Screening

This section details the hazard screening process and the conclusions of assessments undertaken as part of the design and environmental evaluation process.

For each identified potential hazard outlined in Volume 04; Appendix A15-1, a qualitative screening assessment was undertaken which considered the potential impact on the surrounding environment, taking into consideration the proximity and sensitivity of the receptors, relevance to the Proposed Road Development and therefore whether they should be included in Stage 2: Hazard Classification.

All identified potential hazards in this assessment were based on 'guidewords' outlined in Volume 04; Appendix A15-1, which are initiating events which could create a hazard; for example, dense fog or flooding. Often a number of guidewords are considered initiating events for the same hazard. For conciseness the hazard is listed once only, with the potential initiating events associated with the hazard listed.

[6] List of Seveso Establishments (HSA) Accessed 09/12/2020
[7] Seveso Site Locations Ireland Accessed 09/12/2020

15.7 Assessment of Impacts

As outlined in Section 15.3.3, a number of potential hazards were not considered for further assessment for a variety of reasons including the consequence did not meet the criteria of significant environmental effects or the hazard was not considered relevant to the Proposed Road Development by virtue of factors such as the geographic location or nature of the development. Table 15-9 and Table 15-10 outlines the hazards that could cause a MAD and associated risks to which the Proposed Road Development is particularly vulnerable or has a particular capacity to exacerbate during both the construction and operational phase.

Where similar key hazards and associated risks were identified during both the construction and operational phase, these are considered in the operational phase section. The construction phase assessment focused on key hazards and associated risks that could only occur during the construction phase.

The following assessment only focused on hazards that could potentially cause significant environmental effects. An analysis of embedded control measures at the design phase and any proposed environmental mitigation measures identified throughout the EIAR were considered when estimating the likelihood of the identified potential hazards occurring, and their consequence.

Table 15-9 Construction Phase

Description of Hazard	Associated Events	Potential Effects/Consequences	Prevention/Control/Mitigation Measures in Place	Likelihood	Severity	Risk Matrix Category	Are Risks Managed to an Acceptable Level with Existing Mitigation in Place?	If no, What Secondary Mitigation is Required to Reach an Acceptable Level?
Poor driving conditions	• Dense fog • Severe winds • Heavy rain/flooding • Storms High winds/Severe gales • Storm surge • Heat wave • Ice/heavy snow • Loss of electrical power (light)	• Poor driving conditions caused by events such as adverse weather could result in a Road Traffic Accident (RTA) involving construction vehicles and road users. Potential for significant harm to workers and road users.	• Construction activities could be suspended during periods of significant adverse weather. • Implementation of Traffic Management Plan (TMP). • Compliance with national legislation (e.g. reduce speed/design of roads, driver competency).	Unlikely	Serious	Medium	Yes, as adverse conditions listed as associated events are very likely in the study area, highly qualified drivers of construction vehicles will have experience in these conditions and will drive accordingly. In addition, mitigation and control measures will be in place to reduce risk of a major accident throughout the construction phase; for example, the suspension of construction activities should the conditions be unsafe, as defined in the CEMP. Hazards will be managed to reduce risk to an acceptable level.	N/A
Bridge failure	• Structural collapse • Dropped objects e.g. large pre-cast sections	• A bridge failure during the construction phase (e.g. during underpinning works) could result in a bridge collapse which could cause a RTA and lead to potential fatalities and/or permanent injury to persons present.	• Civil engineering design will be compliant with National legislation. • Construction work will be in accordance with safety measures contained in CEMP and method statements.	Unlikely	Serious	Medium	Yes – A bridge failure is unlikely to occur. Although, unlikely, control measures in place during the construction phase will reduce the severity and consequence of potential risks from a bridge failure.	N/A
Release of Pollutants into environment (land, water, air)	• Loss of containment of construction materials e.g. concrete poured in-situ • Fire including firewater runoff	• A release of pollutants into the environment (e.g. from firewater used during major fires leading to run off containing contaminants, or an accident involving a tanker carrying petrol) could result in harm to the environment. • There is also a risk of contamination to land/receiving watercourses/air; for example,	• Implementation of a CEMP which will include pollution control measures. • Mitigation measures set out in Chapter 07 Biodiversity, including: – Contractor to Phase earthworks to avoid periods of relatively high	Unlikely	Serious	Medium	Yes – Control and mitigation measures will be in place for duration of construction to prevent release of pollutants to the environment. Combustible materials will be limited to reduce risk of fire. Any potential risks on air quality, and soils/water environment from the release of pollutants will be immediately remediated and will not	N/A

Description of Hazard	Associated Events	Potential Effects/Consequences	Prevention/Control/Mitigation Measures in Place	Likelihood	Severity	Risk Matrix Category	Are Risks Managed to an Acceptable Level with Existing Mitigation in Place?	If no, What Secondary Mitigation is Required to Reach an Acceptable Level?
	• Heavy rain/Flooding	from runoff of cement and accidental spills and leaks during construction works, and/or contaminated sediments, as well as emissions to from construction works. For example, pollution as a result sediment release could potentially affect the Qualifying Interest (QI) species of Lough Corrib SAC and could have a negative effect on prey availability such as invertebrate communities.	rainfall, in conjunction with flood forecasting. – Use of additional layers of high-performance silt fence, locally, if necessary, to avoid pollution to watercourses or Lough Corrib SAC/SPA • Mitigation measures set out in Chapter 09 Water, including: – Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be away from surface water gullies or drains. • Mitigation measures set out in Chapter 10 Air Quality, including: – Wind breaks and barriers; and – Frequent cleaning and watering of the construction site.				have a significant effect on the environment A Construction and Erosion Sediment Control Plan will be required and will be prepared at detail design stage for the Proposed Road Development. The contract documents for the Proposed Road Development will place an obligation on the construction contractor to further develop this plan. A number of mitigation measures including water quality monitoring have also been outlined within Chapter 07 Biodiversity to protect the Abbert River from pollution. For further information see Chapter 07 Biodiversity. An Appropriate Assessment (AA Screening and Natura Impact Statement (NIS)) has also been prepared for the Proposed Road Development. This considered polluting materials. The NIS concluded that with the implementation of mitigation measures as outlined within the NIS the Proposed Road Development would not result in direct, indirect or cumulative impacts which would have the potential to adversely affect the qualifying interests/special conservation interests of the Natura 2000 site with regard to the range, population densities or the site-specific conservation objectives of the habitats and species for which this site is designated.	

Description of Hazard	Associated Events	Potential Effects/Consequences	Prevention/Control/Mitigation Measures in Place	Likelihood	Severity	Risk Matrix Category	Are Risks Managed to an Acceptable Level with Existing Mitigation in Place?	If no, What Secondary Mitigation is Required to Reach an Acceptable Level?
Construction phase hazards	• Storms/High Winds/Severe Gales • Storm surge • Severe Winds	• Potential accidents caused by severe winds could include impact long-lasting damage to properties and or/permanent injury to pedestrians/cyclists from windblown material from construction vehicles or the construction site compound. • Obstruction during the construction phase (e.g. from falling objects/debris from construction vehicles/swinging loads) could cause a RTA leading to fatality/injury to road users/ pedestrians/cyclists/damage to properties. • Obstructions from heavy and wide construction vehicles could result in long lasting damage to properties and/or permanent injury to pedestrians/cyclists/road users.	• Implementation of a CEMP, which will include control measures for housekeeping onsite and waste management. • The CEMP will include temporary restrictions to activities during adverse weather • Safety method statements onsite.	Unlikely	Serious	Medium	Yes – The control measures in place during the construction phase will reduce the severity and consequence of potential risks from hazards such as large falling objects.	N/A
Impact to heritage assets	• Construction activities	• Potential for harm to heritage assets located within the area of the Proposed Road Development.	• An extensive survey has been carried out to identify the location of heritage assets in the area of the Proposed Road Development. • The CEMP will include measures to protect identified assets • Procedures will be in place during construction to immediately cease if undiscovered heritage material is identified	Unlikely	Serious	Medium	Yes – Design has incorporated protection of identified heritage sites and a cautious approach will be adopted during construction activities.	

Table 15-10 Operational Phase

Description of Hazard	Associated Events	Potential Effects/Consequences	Prevention/Control/Mitigation Measures in Place	Likelihood	Severity	Risk Matrix Category	Are Risks Managed to an Acceptable Level with Existing Mitigation in Place?	If no, What Secondary Mitigation is Required to Reach an Acceptable Level?
Poor driving conditions	• Dense fog • Severe winds • Heavy rain/flooding • Storms/high winds/severe gales • Storm surge • Ice heavy snow • Climate change	• Poor driving conditions during adverse weather could result in a RTA with the potential for fatalities and/or permanent injury to road users/ pedestrians/cyclists/, as well as damage to properties.	• The Proposed Road Development will be of a higher safety standard than existing routes, reducing congestion in the area, and therefore reducing the risk of collisions during operation. • Design features including the attenuation systems which have been designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. This design will ensure that there is no increase in the risk of flooding in the receiving watercourse due to construction of the road up to the 100-year return period. • Compliance with national legislation, for example, national speed limits and driver competence standards.	Unlikely	Serious	Low	Yes- The design of the Proposed Road Development incorporating a settlement pond will attenuate peak discharges from storm events by allowing a controlled release of water into the adjacent watercourse, thus reducing point loading within the channel, This will reduce the risk of flooding and create safer driving conditions. Although risk of accidents from poor driving conditions is outside of the control of the Proposed Road Development, with the identified mitigation measures, the risk during the operational phase will be managed to an acceptable level.	
Bridge failure	• Storms/High Winds/Severe Gales • Structural collapse caused by fatigue, defective materials, impact etc.	• A bridge failure e.g. as a result of impact damage during operation could result in structural collapse and the potential for a RTA leading to fatality and/permanent injury to road users/pedestrians/cyclists.	• Design of the bridge is in accordance with the Eurocode requirements, e.g. 120-year design life based on the required bridge working life category 5 in accordance with IS EN 1990. In addition, a consequence class will be designated for the bridge which shall inform the design and consider the consequence of failure or malfunction of the structure with particular consideration given to the risks to human life, economy, society and the environment. • Accidental actions will be resisted by ensuring sufficient redundancy is provided within the design in accordance with IS EN 1991-2. The accidental actions will include collision forces on kerbs, vehicle restraint systems and structural members as required. Finally, routine inspection of the bridge will be carried out in line with	Extremely Unlikely	Serious	Low	Yes – Although, extremely unlikely, design measures in place will reduce the risk of a potential bridge failure.	N/A

Description of Hazard	Associated Events	Potential Effects/Consequences	Prevention/Control/Mitigation Measures in Place	Likelihood	Severity	Risk Matrix Category	Are Risks Managed to an Acceptable Level with Existing Mitigation in Place?	If no, What Secondary Mitigation is Required to Reach an Acceptable Level?
			recommendations contained within the EIRSPAN Bridge Management System, as defined by TII. • Routine inspection will ensure that any defects to the bridge can be identified as early as possible and repair works carried out to prevent deterioration and failure of the structure during the 120-year design life.					
Release of Pollutants into environment (land, water, air)	• Heavy Rain/flooding.	• A release of pollutants for example, fuel spills or RTA with vehicles carrying hazardous goods could result in harm to the environment. For example, as identified in Chapter 07 Biodiversity, road surface run-off containing contaminants could enter Lough Corrib SAC, with potential long-term impacts.	• Design features (e.g. drainage features) • including: – The Proposed Road Development will include the provision for cut-off and storage in the event of a road accident causing spillage of harmful materials. – Runoff from rainwater that has passed over impermeable surfaces will be prevented from reaching local surface waters as all surface water runoff from the paved areas will be collected in a closed drainage network and will pass through petrol interceptors prior to discharge to ponds before entering the Abbert River 002E	Unlikely	Serious	Medium	Yes- Any potential risks on air quality, and soils/water environment from the release of pollutants will not be permanent or long lasting with the inherent design features and mitigation as outlined within this EIAR and the NIS carried out for the Proposed Road Development in place. The Proposed Road Development will incorporate an embedded drainage system design that will allow storm-water management. This will include petrol interceptors when outfalling to the Abbert River and attenuation ponds. An Appropriate Assessment (AA Screening and NIS) has also been prepared for the Proposed Road Development. This considered polluting materials. The NIS concluded that with the implementation of mitigation measures as outlined within the NIS the Proposed Road Development would not result in direct, indirect or cumulative impacts which would	N/A

Description of Hazard	Associated Events	Potential Effects/Consequences	Prevention/Control/Mitigation Measures in Place	Likelihood	Severity	Risk Matrix Category	Are Risks Managed to an Acceptable Level with Existing Mitigation in Place?	If no, What Secondary Mitigation is Required to Reach an Acceptable Level?
							have the potential to adversely affect the qualifying interests/special conservation interests of the Natura 2000 site with regard to the range, population densities or the site-specific conservation objectives of the habitats and species for which this site is designated.	
Damage to road surface conditions	• Natural disaster-climate change – • Severe winds • Extreme temperatures • Heavy rain/flooding • Storms/high winds/severe sales • Storm surge • Heat wave/drought heavy rain/flooding • Storms/high winds/severe gales • Storm surge • Heat wave/drought	• Extreme weather conditions, for example, as a result of climate change, could cause damage to road surface conditions leading to a RTA. Damage to road surface from extreme weather conditions can include: – Increases in the temperature ranges due to climate change can increase thermal stresses in asphalt layers, and more thermal cracking can be expected. In addition, higher temperatures can lead to faster aging of asphalt mixtures, and pavements can become more prone to cracking due to brittleness. – Flood events can impact integrity of road structures and	• Compliance with national legislation and guidance including TII's 'Strategy for Adapting to Climate Change on Ireland's Light Rail and National Road Network' (TII, 2017). • Compliance with national design standards and features including the attenuation systems, which have been designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. This design will ensure that there is no increase in the risk of flooding in the receiving watercourse due to construction of the road up to the 100-year return period. • The Proposed Road Development will include the addition of three flood connectivity culverts to improve the conveyance of flow through the proposed approach embankments.	Unlikely	Serious	Medium	Yes -Control measures, in addition to inherent design features in place will reduce the severity and consequence of potential risks as a result of damaged road surfaces.	N/A

Description of Hazard	Associated Events	Potential Effects/Consequences	Prevention/Control/Mitigation Measures in Place	Likelihood	Severity	Risk Matrix Category	Are Risks Managed to an Acceptable Level with Existing Mitigation in Place?	If no, What Secondary Mitigation is Required to Reach an Acceptable Level?
		the road surface. The effects of potential increases in groundwater levels are significant for road drainage and pavement foundations.						

15.8 Mitigation and Monitoring Measures

The design of the Proposed Road Development includes inherent features to improve safety and reduce risks such as the incorporation of surface water attenuation to collect spills and surface water runoff. The Proposed Road Development will comply with all applicable legislation and best practices and will include mitigation measures such as adherence to a CEMP during the construction phase as identified throughout the EIAR.

These measures have demonstrated that the Proposed Road Development will not be particularly vulnerable to MADs or have a particular capacity to exacerbate potential MAD risks. The identified risks will therefore be reduced to a level ALARP. Therefore, no secondary mitigation or specific monitoring measures will be required.

15.9 Residual Impacts and Effects

'Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines, the effects from the residual impacts that remain after all assessment and mitigation are referred to as 'Residual Effects' (EPA, 2017). This assessment of MADs has identified the potential for major hazards to occur at sensitive environmental receptors, such as accidental damage to a heritage site during construction. These events have significant consequences; however, the likelihood will be extremely low due to measures such as extensive surveys and protective systems which will be in place during construction.

Hazardous events such as these have been demonstrated to be extremely unlikely, but the risk cannot be entirely eliminated. However, the embedded control measures and identified additional mitigation measures outlined throughout the EIAR, and compliance with national legislation will reduce the risks to a level considered to be ALARP.

No significant residual effects associated with MADs in the context of the Proposed Road Development have been identified in this assessment.

15.10 Do-Nothing Scenario

In the do-nothing scenario, there will be no potential risk of the Proposed Road Development causing, or being affected by a MAD.

15.11 Cumulative Impacts and Effects

In this assessment of MADs, the combined action of a number of different projects, cumulatively with the Proposed Road Development, has also been considered. This has included a search of planning applications made within 5 km of the Proposed Road Development. The relevant planning applications are listed in Volume 04; Appendix A1-1.

This assessment concluded the Proposed Road Development will not be particularly vulnerable to MAD risks or have a particular capacity to exacerbate potential MADs. Therefore, given the scale of the developments outlined in, Volume 04; Appendix A1-1, no significant cumulative MAD effects will be anticipated.

15.12 Summary

In summary:

- The objective of this Proposed Road Development is to improve the safety features of the road and reduce the potential for accidents which could cause harm to people. The number of fatal accidents occurring on the nation's roads has been consistently reducing over the past decade, however continuous improvement must be sought[8]. The potential for MADs to occur cannot be entirely eliminated therefore an assessment of these is required which is the purpose of this assessment;
- The potential MADs pertinent to the Proposed Road Development include major accidents occurring during the construction phase, such as an adverse impact on a previously undiscovered heritage site. Following construction, potential MADs include flooding, release of pollutants into the environment or bridge failure due to collision impacts;
- The potential impacts of climate change have been considered for this Proposed Road Development and it was concluded that measures implemented in design to ensure suitability for predicted atmospheric temperatures and other climatic conditions are suitable and sufficient; and
- Detailed assessment of these potential MADs has concluded that the mitigation measures proposed will be sufficient to reduce risks to a level considered to be ALARP, therefore can be screened out at this stage and require no further detailed assessment.

[8] https://www.rsa.ie/en/RSA/Road-Safety/RSA-Statistics/Collision-Statistics/Road-Collision-Factbooks/

15.13 References

- DoEHLG. (2010). Guide to Risk Assessment in Major Emergency Management. The Department of the Environment, Heritage & Local Government.
- EU. (2014). Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014 amending Directive 2011/92/EU on the assessment of the effects of certain public and private projects on the environment, European Union.
- Highways England. (2017). Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive).
- IEMA. (2020). Major Accidents and Disasters in EIA: A Primer, Institute of Environmental Management and Assessment.
- TII. (2017). Strategy for Adapting to Climate Change on Ireland's Light Rail and National Road Network, Transport Infrastructure Ireland.

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 16: Material Assets

Galway County Council

February 2022

Table of Contents

Figures

No figures entries.

Tables

16. Material Assets – Non-Agriculture

16.1 Introduction

This chapter presents an assessment of the potential impacts of the Proposed Road Development on non-agricultural material assets. For each material asset assessed, this chapter defines the study area; the methodology used for developing the baseline and impact assessment; provides a description of the baseline environment; and presents the findings of the impact assessment.

The Environmental Protection Agency's (EPA) draft 'Guidelines on the information to be contained in an Environmental Impact Assessment Report' (hereafter referred to as the 'EPA draft guidelines') (EPA, 2017) describes material assets to be taken to mean 'built services' (i.e. utilities networks including electricity, telecommunications, gas, water supply and sewerage), 'waste management' and 'infrastructure' (e.g. roads and traffic). This Environmental Impact Assessment Report (EIAR) includes separate chapters for the following:

- Infrastructure (Roads and Traffic) – Chapter 05 'Traffic Analysis'; and
- Built Services and Waste Management are both considered with this chapter.

Other aspects that may impact upon Material Assets or could be consider a Material Asset are included in the following chapters:

- Employment and non-agriculture land-use assets - Chapter 06 'Population & Human Health';
- Agricultural land use – Chapter 17 'Material Assets – Agriculture';
- Ecological assets - Chapter 07 'Biodiversity';
- Waterways, rivers and streams - Chapter 07 'Biodiversity' & Chapter 09 'Water';
- Land and Soils - Chapter 08 'Land and Soils';
- Cultural heritage assets - Chapter 14 'Cultural Heritage'; and
- Visual amenity assets - Chapter 13 'Landscape and Visual.'

This chapter provides an assessment of impacts on:

- Utilities networks including:
  - Electricity Network;
  - Telecommunications (including phone and broadband);
  - Gas Distribution Networks;
  - Water supply networks; and
  - Drainage Network (including stormwater and sewerage effluent).
- Infrastructure: Land Use and Property (non-agricultural); an assessment of impacts on private properties and commercial properties, including full or partial acquisitions, demolition and/or severance, or other changes likely to alter the character and use of the surroundings and therefore effect viability of property/land use; and
- Waste management: the use of excavated and other arisings that fall within the scope of waste exemption criteria; and the production and disposal of waste.

Chapter 08 'Land and Soils' provides the impact assessment related to soils and associated required backfill for the Proposed Road Development. Chapter 05 'Traffic Analysis' provides the impact assessment in relation to roads and traffic.

Impacts on agricultural land holdings are addressed in Chapter 17 'Material Assets – Agriculture' and are not covered under this particular assessment.

16.2 Legislation, Policy and Guidance

16.2.1 Utilities, Land Use and Property

The legislation, policy and guidance applicable to the assessment for utilities, land and property is as follows:

- EIA Directive (EU, 2014);
- EPA's 'Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' (EPA, 2017a);
- Advice Notes for Preparing Environmental Impact Statements (EPA, 2017b); and
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003).

In addition, reference is made to the guidelines provided in the UK Design Manual for Road and Bridges (DMRB) 'LA110-Materal Assets and Waste', a Department of Transport publication (Highways England, 2020).

16.2.2 Waste

The legislation, policy and guidance applicable to the assessment for waste is as follows:

16.2.2.1 European Regulations

European waste management regulations include the following:

- Landfill Directive (2018/850) (EU, 2018a);
- The European Union Waste Framework Directive (2018/851) (EU, 2018b); and
- The European Commission's 'Circular Economy Action Plan' (EC, 2020).

16.2.2.2 National Waste Regulations

National waste management regulations in Ireland include the following:

- Waste Management (Collection Permit) Regulations 2007 – 2016 (as amended) (S.I. No. 820/2007);
- Waste Management (Facility Permit and Registration) Regulations 2007 – 2019 (as amended) (S.I. No. 821/2007);
- Waste Management (Licensing) Regulations 2004 – 2010 (as amended) (S.I. No. 395/2004);
- Waste Management (Packaging) Regulations 2014 (as amended) (S.I No. 282/2014);
- Waste Management (Planning) Regulations 1997 (as amended) (S.I No. 137/1997);
- Waste Management (Landfill Levy) Regulations 2015 -2019 (as amended) (S.I No. 189/2015);
- Waste Management (Food Waste) Regulations 2009 – 2015 (as amended) (S.I. No. 508/2009);
- Waste Management (Hazardous Waste) Regulations 2021 (S.I. No. 589/2021);
- Waste Management (Shipments of Waste) Regulations 2007 (as amended) (S.I. No. 419/2007);
- Waste Management Act 1996 (as amended) (Act No. 10/1996);
- Environmental Protection Agency Acts 1992 – 2011 (as amended) (Act No. 7/1992);
- Protection of the Environment Act 2003 (as amended) (Act No 27/2003);
- Litter Pollution Act 1997 (as amended) (Act No. 12/1997): and
- Planning and Development Act 2000 – 2021 (as amended)[1] (Act No. 30/2000).

[1] https://revisedacts.lawreform.ie/eli/2000/act/30/revised/en/html

16.2.2.3 National Waste Policy

National waste policy include the following:

- A Waste Action Plan for a Circular Economy Ireland's National Waste Policy 2020-2025 (Government of Ireland, 2020);
- Connacht Ulster Region Waste Management Plan (CURWP) 2015-2021; and
- Galway County Council Development Plan.

16.2.2.4 Guidance

Guidance considered include the following:

- EPA draft guidelines (EPA, 2017);
- Advice Notes for Preparing Environmental Impact Statements (EPA, Draft, September 2017);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003); and
- UK Design Manual for Road and Bridges (DMRB) 'LA 110 Material Assets and Waste' (Highways England, 2020).

16.3 Methodology

16.3.1 Study Area

Two geographically distinct study areas were defined for use in the impact assessment. The first study area was based upon the construction footprint/project boundary which included compounds and temporary land take, as well as utilities networks outside of the project boundary that could be impacted by the Proposed Road Development. This study area was used for the utilities, land use and property impact assessment and is referred to herein as the material assets study area (Volume 03; Figure A4-27 to A4-32).

The second study area included the footprint of the Proposed Road Development site (within which waste will be generated from the construction and operation activities, and infrastructure that was suitable (licensed for waste volume and type) to accept arisings and or waste generated by the Development. This was referred to herein as the waste study area.

16.3.2 Determination of the Baseline Environment

16.3.2.1 Desktop Study

A desktop assessment of client provided, and publicly available information was undertaken to determine the baseline utility arrangements within the study area. The information reviewed included the Proposed Road Development site utility plans and preliminary design information.

Data gathered to inform the assessment included:

1. Location and description of existing utilities network;
2. Location and number of properties at risk of demolition, or from which land will be required/access affected by the project;
3. Location of residential development land and number of units that will be affected by the project;
4. Existing land uses in the study area including, residential and commercial properties, amenity and public facilities;
5. Compulsory Purchase Order (CPO) data;
6. Land registry maps;
7. Amount of waste (by % or weight) that will be recovered and diverted from landfill either onsite or offsite ;
8. Types and quantities of waste arising from the Proposed Road Development requiring disposal to landfill;
9. Details of onsite storage and segregation arrangement for waste and any supporting logistical arrangements; and
10. Potential for generation of hazardous waste (type and quantity).

16.3.2.2 Consultation

Table 16-1 provides a summary of all the utility providers which were contacted as well as the response received (if any).

The review of utility suppliers identified water, electricity and communications networks. No gas networks were identified in the area of the Proposed Road Development.

Table 16-1 Utility Providers Consulted

Utility Provider	Response Received	Response
Brighter Networks	Yes	No Infrastructure within study area
BT Ireland	Yes	No Infrastructure within study area
Clear Channel	Yes	No Infrastructure within study area
Colt	Yes	No Infrastructure within study area
Cuillagh Group Water Scheme	Yes	Infrastructure confirmed within study area
EIR	Yes	Infrastructure confirmed within study area
Enet	Yes	No Infrastructure within study area
ESB	Yes	Infrastructure confirmed within study area
EU Networks	Yes	No Infrastructure within study area
Gas Networks Ireland	Yes	No Infrastructure within study area
Industria	No	-
Irish Water	Yes	Infrastructure confirmed within study area
Magnet	Yes	No Infrastructure within study area
Siro	Yes	No Infrastructure within study area
Verizon	No	-
Viatel	No	-
Virgin Media	Yes	No Infrastructure within study area
Vodafone	Yes	No Infrastructure within study area

16.3.3 Determination of Sensitive Receptors

The sensitivity of the existing environment identifies the ability of the receptor to respond to potential effects and can be determined by describing changes to the environment that could limit the access to, or use of, the material asset (EPA, 2003). For the purpose of this assessment, the sensitive receptors are regarded as the existing utilities network, land use and properties and the waste management infrastructure capacity within the study area.

Terminology used to describe the sensitivity of the receptor are as per the EPA draft guidelines (EPA, 2017). As descriptors for sensitivity are not outlined within Irish guidance, the descriptors are based on professional judgement utilising information outlined in the DMRB (Highways England, 2020).

16.3.3.1 Land Use and Properties

Criteria used when applying a sensitivity for land use and properties within this chapter are outlined in Table 16-2.

Table 16-2 Examples of Sensitivities Assigned to Different Land Uses and Property Types

Sensitivity	Description
High	• Private residential buildings, or land allocated for development of housing. • Buildings used for employment use, and land allocated for development of employment uses. • Regularly used community buildings which have only limited alternatives available nearby. • Designated public open spaces, or open spaces which attract users nationally e.g. national parks
Medium	• Land associated with private residential buildings e.g. gardens. • Community buildings which are regularly used or where there are only limited alternatives available in the local area. • Open spaces which span over a regional area and attract visitors from a regional catchment e.g. country parks, forests. • Public rights of way and other routes close to communities which are used for recreational or utility purposes, but for which alternative routes can be taken.
Low	• Community buildings which are infrequently used or where there are many alternatives available in the local area. • Open spaces which are used for informal recreation (e.g. dog walking), and where there are alternative open spaces available. • Locally used community land e.g. local parks and playing fields. • Property consisting of public road/private road and small plots of land.
Negligible	• Derelict or unoccupied buildings.

16.3.3.2 Utilities

Examples of the sensitivities used for existing utilities infrastructure within this chapter are outlined in Table 16-3.

Table 16-3 Examples of Sensitivities Assigned to Different Utilities Networks

Sensitivity	Description
High	• Electricity network 220 kV and above. • Transmission gas pipeline (high pressure).
Medium	• Distribution gas network (medium pressure). • Electricity network 38 kV and 110 kV.
Low	• Low pressure gas pipeline. • Low/medium voltage electricity network 230 v and 400 v. • Telecommunications network. • Water supply network. • Drainage network including foul sewerage.
Negligible	N/A

16.3.3.3 Waste

Assessment of waste impacts does not follow the approach of identifying receptors and determining their sensitivity that is typically used for other environmental aspects. Attempting to identify receptors is problematic since:

- Waste producers have a legal duty of care to manage their waste in accordance with regulations and to ensure that any waste leaving the site of generation is transferred to a suitably licensed, permitted or certified facility for further treatment or disposal;
- Facilities transferring, treating or disposing of waste must be either licensed or apply for an exemption from a license. Impacts arising from the operation of waste management facilities are considered as part of the planning and permitting process for such facilities; and
- Waste collectors are required by the Waste Management (Waste Collection Permit) Regulations 2007 as amended, to have and comply with conditions of a permit to collect waste. Offaly County Council was appointed the National Waste Collection Permit Office (NWCPO) in 2012 and is responsible for administering waste collection permits in the Republic of Ireland.

The receptor for this assessment is therefore the waste management infrastructure capacity in the study area.

16.3.4 Describing Potential Effects

The methodology used for evaluating impact levels and the terminology for describing the quality, significance, extent, probability and duration of effects on existing land use, properties and utilities network is in line with the EPA draft guidelines (EPA, 2017). The process to determine potential effects is described in Chapter 01 'Introduction'. In summary, it involves combining a sensitivity of a receptor with a description of an impact on that receptor (its quality, type, frequency, duration, probability and magnitude) to determine a significance of an effect.

Specific assessment criteria are outlined in the following sections. As specific criteria are not outlined within Irish guidance, the criteria is based upon professional judgement utilising information where required outlined in the DMRB (Highways England, 2020).

16.3.4.1 Utilities

A development could impact existing utilities networks if it involves any of the following:

- Demolition of a utility;
- Diversion of a utility;
- Modification of a utility;
- Connection works to existing utilities infrastructure; and
- Additional demand on existing supply (during construction and operation).

The criteria used to describe effects within this assessment is outlined in Table 16-4.

Table 16-4 Utilities Assessment Criteria

Effect	Criteria for Effects
High	• Connections works resulting in service suspensions of high voltage ESB network (220 kV or above) or transmission gas pipeline (high pressure) or termination of services; and • Additional demand on current utilities network that cannot be met or will put the network under significant pressure.
Medium	• Connections works resulting in service suspension of high voltage ESB network (110 kV or 38 kV) or distribution gas pipe (medium pressure).
Low	• Connections works resulting in service suspension of low and medium voltage ESB network, low pressure gas pipelines (e.g. services pipes) telecommunications or water supply and foul sewer.
Negligible	• Resulting in minimal to no changes to existing utilities network (e.g. no additional demand on existing supply or additional demand on current utilities network that can be accommodated with current capacity without putting the network under significant pressure.)

16.3.4.2 Infrastructure: Land Use and Property

Impacts from a road development on existing land use and properties can include:

- Acquisition of land;
- Changes to accessibility and severance;
- Demolition of residential and commercial properties; and/or
- Revaluation of or change in the development potential of adjoining lands/properties.

The criteria used within this assessment is outlined in Table 16-5.

Table 16-5 Infrastructure: Land Use and Property

Description of Effect	Criteria for Effects
High	• Loss of resource and/or quality and integrity of resource; and • Severe damage to key characteristics, features or elements. e.g. direct acquisition and demolition of buildings and direct development of land.
Medium	• Partial loss of/damage to key characteristics, features or elements, e.g. partial removal or substantial amendment to access; and • Acquisition of land compromising viability of property, businesses, and/or other existing land use.
Low	• A discernible change in attributes, quality or vulnerability; and • Minor loss of, or alteration to, one (maybe more) key characteristics, features or elements, e.g. amendment to access or acquisition of land resulting in changes to operating conditions that do not compromise overall viability of property, businesses, and/or other existing land use.
Negligible	• Very minor loss or detrimental alteration to one or more characteristics, features or elements. e.g. acquisition of non-operational land or buildings not directly affecting the viability of property, businesses, and/or other existing land use.

16.3.4.3 Waste

The criteria used in the waste assessment is outlined in Table 16-6.

Table 16-6 Waste Assessment Criteria

Description of Effect	Criteria for Effects
High	• >1% reduction or alteration in national capacity of landfill, as a result of accommodating waste from a project; and • >50% of project waste for disposal outside of the region; or • construction of new (permanent) waste infrastructure is required to accommodate waste from a project;
Medium	• >1% reduction or alteration in the regional capacity of landfill as a result of accommodating waste from a project; and • 1-50% of project waste for disposal outside of the region.
Low	• ≤1% reduction or alteration in the regional capacity of landfill; and • waste infrastructure has sufficient capacity to accommodate waste from a project, without compromising integrity of the receiving infrastructure (design life or capacity) within the region.
Negligible	• no reduction or alteration in the capacity of waste infrastructure within the region.

Source: Based on DMRB, EPA guidance and professional judgement

16.3.5 Significance of Effect

As outlined in Chapter 01 Introduction, once the description of the effect, including magnitude, character, duration etc. has been identified, this can be cross-referenced with the importance of the sensitivity of the receptor to derive the overall significance of effect as per the EPA draft guidelines (EPA, 2017).

16.3.6 Limitations and Assumptions

No limitations or assumptions have been identified in this assessment.

16.4 Baseline Environment

16.4.1 Utilities

Reference should be made to Volume 03; Figure A4-27 to A4-32, for the location of existing utilities infrastructure.

16.4.1.1 Electricity Network

ESB (Transmission Lines – High Voltage)

Following consultation with service providers, Electricity Supply Board (ESB) has confirmed that it has the following infrastructure within the study area:

- ESB (Transmission Lines – High Voltage); and
- ESB (Distribution Lines – Medium and Low Voltage).

The ESB transmission network comprises High Voltage (HV) (220 kV) electricity lines which are managed by ESB Networks area offices. The ESB distribution network comprises medium voltage (MV) (10 kV/20 kV) and low voltage (LV) (230 V/400 V) electricity lines which are managed by ESB Networks area offices.

16.4.1.2 Water Supply Network

Irish Water have confirmed that they have watermains within the study area adjacent to the existing N63 (Volume 03; Figure 04-27 to A04-32). In addition, the Cuillagh Group Water Scheme have confirmed they have underground pipe infrastructure within the study area adjacent to the existing N63 (Volume 03; Figure A4-27 to A4-32,). There is one underground pipe belonging to the Cuillagh Group Water Scheme running parallel to the existing N63 on the north side and another which crosses under the existing N63.

The Cuillagh Group Water Scheme (Scheme Code 1200PRI0285) supplies a volume of 70 m^3/day to a population of 348. The start date of the scheme is noted as 2009[2].

Irish Water pipes run along the existing N63 (north and west side), along the existing L7138 and along the existing L6234 and local access tracks.

16.4.1.3 Gas Distribution Network

Consultation with Gas Networks Ireland has confirmed there is no known gas distribution networks in the study area.

16.4.1.4 Drainage Network

There are no known significant stormwater or sewerage effluent sewers in the study area. It is assumed the majority of people within the study area utilise septic tanks.

The local environs surrounding the Proposed Development are bisected by numerous land drains and ditches which typically traverse along field boundaries of a number of adjacent agricultural lands and discharge into the River Abbert. There is also potential for buried drains to occur within agricultural lands. The existing drainage infrastructure does not have any environmental protection measures in terms of surface water attenuation and hydrocarbon interceptors.

16.4.1.5 Telecommunications

Following consultation, EIR confirmed that they had the following telecommunications infrastructure in the study area (Volume 03; Figure A4-27 to A4-32):

- Two underground EIR cables located on westernmost extents of the N63 with one running parallel to the carriageway and another running underneath;
- Two over-head cables located at the western extents and central portion of the existing N63. Additionally, there is one other overhead cable at the eastern extents of the study area; and
- Two cables run perpendicular to the carriageway and intersect at the southern portion of the study area.

[2] https://www.epa.ie/publications/compliance--enforcement/drinking-water/Galway-County-Scheme-Details-2019.pdf

16.4.2 Infrastructure: Land Use and Property

The study area is characterised by presence of open greenfield area with some wooded areas in the section south of the Abbert River, which is a tributary of Lough Corrib Special Area of Conservation (SAC), to the south. The existing N63 is lined by residential properties, with several community facilities at the junction with the L3110 including:

- Two schools:
  - Newtown National Primary School; and
  - Newtown Creche.
- Other Recreational/Community facilities within the study area include:
  - Abbeyknockmoy Community Centre;
  - Abbeyknockmoy Church (Saint Bernard's);
  - Frank Manion Lounge Bar; and
  - O'Donohoes Service Station.
- In addition, the following club/groups and cultural heritage sites are located within the study area:
  - Abbeyknockmoy GAA Club;
  - Newtown Kids Club;
  - Saint Bernard's Soccer Club;
  - Knockmoy Abbey; National Monument No. 166; GA058-004001) and one National Monument subject to Preservation Order (earthworks and buildings associated with Knockmoy Abbey; NM No. 166 & PO No. 4/1989; GA058-004004), and
  - Abbeyknockmoy Cemetery.

A list of planning permissions can be found in Volume 4; Appendix A1-1.

16.4.3 Waste

16.4.3.1 Overview

The study area is located within the Connacht Ulster Region (CUR), managed by Mayo County Council, the Waste Enforcement Regional Lead Authority (WERLA). In terms of waste management, the WERLA are responsible for implementing the CURWP 2015-2021, as well as setting priorities and common objectives for waste enforcement within the region.

Waste management in Galway is largely governed by the requirements set out in the CURWP.

16.4.3.2 Construction and Demolition National Waste Arisings

The quantity of construction and demolition (C&D) waste generated in Ireland increased to 6.2 million tonnes in 2018. This represents a large increase of 1.5 million tonnes on the quantity of C&D waste generated in 2017 (4.7 million tonnes), Soil and stones accounted for 77% of the total quantity. The next largest C&D waste types in 2018 were concrete, brick, tile and gypsum waste (12%) and mixed C&D waste (7%)[3]

The baseline target for the recovery of non-hazardous construction and demolition waste (excluding soil and stone) is at least 70% by weight by 2020, as set out in the Waste Framework Directive (as amended). Uncontaminated excavated soil and stones (EPA's List of waste (LoW) code 17 05 04) is specifically excluded from this target. In 2018, 96% of construction, demolition and excavation waste in Ireland underwent final treatment (recovered or disposed). The EPA's 'Progress to EU Targets', updated August 2020, shows that Ireland achieved 77% material recovery in 2018 and are on track to meet the target deadlines, which was due December 2020.

3 https://www.epa.ie/nationalwastestatistics/constructiondemolition/#:~:text=The%20quantity%20of%20construction%20and,increase%20in%20construction%20activity%20nationally. Accessed 26/11/2020

16.4.3.3 Regional Landfills

EPA data shows that there are currently three landfill sites in operation in Ireland (Table 16-7).

There is no commercial hazardous waste landfill in Ireland, and there are limited hazardous waste treatment operations (these are mainly used for oil recovery, healthcare waste treatment and solvent reclamation), meaning that Ireland is dependent on export for treatment of many hazardous waste streams.

Table 16-7 Landfill Sites Operating in Ireland

Authorisation Number	Facility Name and Location	Waste for Disposal (Maximum Tonnes per Annum)	Waste Types for Disposal (Maximum Tonnes per Annum)	Waste Types for Recovery (Maximum Tonnes per Annum)
W0146	Knockharley Landfill Co. Meath	88,000*	100,000 household* 45,000 commercial* 30,000 industrial*	25,000 construction & demolition 70,000 inert waste
W0165	Ballynagran Residual Landfill Co. Wicklow	175,000	62,500 household 67,500 commercial 45,000 industrial	28,000 construction & demolition
W0201	Drehid Waste Management Facility Co. Kildare	120,000	120,000 non-hazardous municipal, commercial and industrial wastes	No limit for inert waste where used in landfill engineering
	Total	383,000		

Source: Environmental Protection Agency[4]

** Note that whilst the EPA data indicates that Knockharley Landfill has an annual capacity of 175,000 tonnes per annum (tpa), due to planning constraints, the actual capacity of the facility is 88,000tpa.*

16.4.3.4 Other Waste Management Infrastructure

Table 16-8 shows that there has been an increase in the availability of incinerators. There are two incinerators currently operating (Table 16-9) with a total capacity of 835,000 tonnes per annum (tpa). An additional 342,875 tonnes of capacity is available for co-incineration in cement kilns.

Table 16-8 Number of Operational Incinerators, 2013-2020

Year	2013	2014	2015	2016	2017	2018	2019	2020
Number of municipal waste incinerators	1	1	1	1	2	2	2	2

Source: Environmental Protection Agency

Table 16-9 Authorised Waste to Energy Capacity

Authorised Waste to Energy Capacity in Ireland		Authorisation Number	Maximum Waste Acceptance Limit Per Year (tonnes)
Incineration	Indaver Ireland Ltd.	W0167	235,000
	Dublin Waste to Energy Ltd.	W0232	600,000
Co-Incineration	Lagan Cement	P0487	95,000
	Irish Cement Ltd.	P0030	120,000
	Quinn Cement Ltd.	P0378	127,875
	Total		*1,177,875*

Source: Environmental Protection Agency[5]

[4] https://www.epa.ie/nationalwastestatistics/infrastructure/
[5] https://www.epa.ie/nationalwastestatistics/infrastructure/

16.5 Assessment of Impacts

16.5.1 Embedded Control

No properties are located within the footprint of the Proposed Road Development. It is proposed to undertake the majority of the online upgrade works within the footprint of the existing N63 line. Therefore, there will be no requirement for demolition of properties or requirement for full acquisition of land; however, the Proposed Road Development will require the partial acquisition of land. This will entail setting back some boundary walls along the existing N63 to build the proposed new footpaths.

Where the partial acquisition of residential land will be required to facilitate the Proposed Road Development, it is proposed to re-build the existing boundary wall in a different location (e.g. 2 m set back) and restore entrance and accesses to residential properties.

16.5.2 Construction Phase

16.5.2.1 Utilities

During the construction phase of the Proposed Road Development, some realignment, or replacement of utilities will be required in conjunction with or to accommodate the proposed works. Locations where conflicts with significant trunk and distribution services occur along the route have been identified and are outlined in the following sections (also see Table 16-10). Preliminary designs and budget costs for the necessary service diversions have been developed following discussions with the utility providers.

16.5.2.1.1 Electricity Network

During the preliminary design phase, the exact locations where conflicts with significant trunk and distribution services occur along the route were confirmed with ESB as outlined below (also see Table 16-10):

- ESB (Transmission Lines – HV): There is one overhead high voltage line which crosses the existing N63 carriageway on the eastern end; and
- ESB (Distribution Lines – MV and LV):
  - There are three separate MV cables which run overhead perpendicular to the existing N63 carriageway;
  - Two LV overhead cables run parallel with the N63, beginning at the far western portion of the existing N63 carriageway and the eastern portion of the carriageway. Additionally, two other low voltage overhead cables run perpendicular to the carriageway at the far western and central portion of the road; and
  - There are also two MV Electricity Lines located at the north eastern-most extents of the Proposed development site.

As a result of these conflicts, necessary service diversions of both LV and NV electricity lines crossing the mainline and the provision of associated support poles and/or protection of existing network infrastructure will be required and were incorporated into the preliminary designs.

No diversions will be needed for the HV ESB transmission line. Further information is given in Table 16-10. In addition to the diversion works, the Proposed Road Development will include the provision for new overhead electricity lines and cables.

Both the diversion works and installation of new overhead lines could potentially result in a suspension of services during the construction phase, which will likely result in a **negative, temporary**, **low** effect on the existing low/medium voltage electricity network of **low** sensitivity; therefore, the significance of the effect on the existing electricity network will be **not significant**.

During the construction phase, electricity to the Proposed Road Development site compounds could be supplied using onsite generators or via a temporary connection to the ESB network. If a temporary connection should be required to the existing network, additional demand on the existing supply will not be excessive given the scale and type of development, as well as the duration of the works. Therefore, the additional power demands on the existing network will likely result in a **neutral, temporary,** and **negligible** effect on the existing electricity supply of **low** sensitivity; therefore, the significance of effect on the existing electricity network will be **imperceptible**.

A temporary connection to the ESB network could also potentially disrupt services in the local area. In addition to this, a new connection to the existing network will be required to power the additional public lighting during the operation of the Proposed Road Development, which could also result in service disruption. The connections works will likely result in a **negative**, **temporary**, **low** effect on the existing low/medium voltage electricity network of **low** sensitivity; therefore, the significance of the effect on the existing electricity network will be **not significant**.

See Section 16.5.3.1.1 for potential effects on electricity network as a result of the demands during the operational phase of the Proposed Road Development.

16.5.2.1.2 Water Supply Network

An assessment of the Proposed Road Development with existing water supply infrastructure has revealed the following conflicts:

Cuillagh Group Water Scheme

- There is one underground pipe belonging to the Cuillagh Group Water Scheme which runs parallel to the existing N63 on the north side. This pipe will intersect the western and southern arms of the proposed roundabout (between Ch. 10+070 and 10+300). The same pipe will run parallel to the proposed elongated pond between the proposed N63 and the existing N63 (between Ch. 10+470 and 10+670); and there is another underground pipe belonging to Cuillagh Group Water Scheme which crosses under the existing N63 at approximate Ch. 10+930.

Irish Water

- There is one pipe belonging to Irish Water which runs along the existing N63 (north and west side), from the western-most extents of the Proposed Road Development to the Liss Bridge and then continues northbound along the existing L6159 Old Road;
- There is another pipe belonging to Irish Water which runs along the existing L7138, then continues along the existing N63 across the Liss Bridge (south and east side), crosses over the north side of the existing N63 and runs until the eastern-most extents of the Proposed Road Development; and
- Two other pipes are belonging to Irish Water which runs along the existing L6234 and local access track at eastern-most extents of the Proposed Road Development.

Further information is given in Table 16-10 below.

As a result of these conflicts, necessary service diversions and/or the protection of existing water mains were incorporated into the preliminary designs. During the construction phase, water supply could be suspended temporarily to facilitate the diversions works. In addition, the Contractor could request a new temporary connection to the water network from Irish Water to supply to the construction site compound and construction works; these works could also potentially disrupt services in the local area. The impact will likely result in a **negative**, **temporary**, **low** effect on the existing water supply network of **low** sensitivity; therefore, the significance of the effect on the existing water supply network will be **not significant**.

If the Contractor requests a new temporary connection to the existing water network, it is anticipated the additional demands on the water supply during the construction phase will not be excessive given the scale and type of development, as well as the duration of the works; therefore, the additional demands will likely result in a **neutral, temporary,** and **negligible** effect on an existing environment of **low** sensitivity; therefore, the significance of the effect on the existing water supply will be **imperceptible**.

16.5.2.1.3 Gas Distribution Network

There are no known gas distribution networks in the study area. Therefore, no impacts have been identified.

16.5.2.1.4 Drainage Network

Chapter 09 Water, deals with impacts associated with foul effluent, as well as surface water and stormwater drainage associated with the Proposed Road Development during the construction phase on the receiving water environment. Effects of sedimentation on aquatic habitats and organisms is addressed in Chapter 07 Biodiversity.

There is no known stormwater or sewerage network infrastructure within the study area. Foul effluent during construction phase arising from temporary toilets and sanitary facilities on the Proposed Road Development site will initially be discharged to an onsite receptacle which will be emptied by tanker on a regular basis for disposal. Therefore, there will be no impacts as there is currently no piped drainage network in the study area.

16.5.2.1.5 Telecommunications

Consultation with a number of telecommunication service providers in the area has confirmed there are conflicts between the Proposed Road Development and the existing telecommunication services (Table 16-10).

Works at the proposed junction locations during the construction phase will include raising some existing overhead lines, installation of new poles, transfer of existing cables to new poles or local diversions of overhead cables to underground ducts where conflicts occur; these works could potentially disrupt services in the local area. The impact will likely result in a **negative**, **temporary**, **low** effect on an existing environment of **low** sensitivity; therefore, the significance of effect on the existing telecommunications network is considered **not significant**.

There will be no additional demand on the telecommunications network during the construction phase; therefore, there will be no impacts to the existing telecommunications supply network from the Proposed Road Development.

Table 16-10 Relevant Utility Infrastructure in Study Area

Type of Utility	Company	Mainline Chainage (Ch.)	Collision Type	Description	Proposed Works
Electricity	ESB	0+070	Perpendicular crossing (mainline)	MV Three Phase Underground Line	No Division Needed
Electricity	ESB	2+250 (L6159 South: Ch. 0+050)	Perpendicular crossing (L6159 South)	MV Three Phase Overhead Line	Diversion and/or protection where required.
Electricity	ESB	2+340	Skew crossing (mainline)	MV Three Phase Overhead Line	Diversion and/or protection where required.
Electricity	ESB	2+340	Skew crossing (mainline)	MV Three Phase Overhead Line	Diversion and/or protection where required.
Electricity	ESB	3+050	Skew crossing (mainline)	HV 220V Overhead Wire	No Division Needed
Electricity	ESB	11+170	Skew crossing (existing N63)	MV Three Phase Overhead Line	No Division Needed
Electricity	ESB	11+310 (L7138: Ch. 0+020)	Parallel (east side)	LV Single Phase Overhead Line	Diversion and/or protection where required.
Electricity	ESB	11+800	Perpendicular crossing (existing N63)	MV Three Phase Overhead Line	No Division Needed
Water	Cuillagh GWS	10+070 – 10+300	Skew crossings (mainline and existing N63) Parallel to existing N63 (north side)	Underground Pipes	Diversion and/or protection where required.
Water	Cuillagh GWS	10+470 – 10+670	Parallel to proposed swale Parallel to existing N63 (north side)	Underground Pipes	Diversion and/or protection where required.
Water	Cuillagh GWS	10+930	Skew crossing (existing N63)	Underground Pipes	Diversion and/or protection where required.
Water	Irish Water	10+070 – 10+300	Skew crossings (mainline and existing N63) Parallel to existing N63 (north side)	Water main	Diversion and/or protection where required.
Water	Irish Water	10+470 – 10+670	Parallel to proposed swale Parallel to existing N63 (north side)	Water main	Diversion and/or protection where required.
Water	Irish Water	11+270 – 11+320	Parallel to proposed footpath Parallel to existing N63 (north side)	Water main	No Division Needed
Water	Irish Water	11+320	Perpendicular crossing (existing N63)	Water main	No Division Needed
Water	Irish Water	11+320 – 11+650	Parallel to proposed footpath & skew crossing at Junction 6 Parallel to existing N63 (both sides)	Water main	Diversion and/or protection where required.

Type of Utility	Company	Mainline Chainage (Ch.)	Collision Type	Description	Proposed Works
Water	Irish Water	2+275 (L6159 South: Ch. 0+080 – 0+150)	Parallel to existing L6159 (west side)	Water main	Diversion and/or protection where required.
Water	Irish Water	2+275	Perpendicular crossing (mainline)	Water main	Diversion and/or protection where required.
Water	Irish Water	2+275 (L6159 North: Ch. 0+000 – 0+070)	Parallel to existing L6159 (west side)	Water main	Diversion and/or protection where required.
Water	Irish Water	11+650 – 12+000	Parallel to existing N63 (north sides)	Water main	No Division Needed
Water	Irish Water	2+600 – 3+120	Parallel to existing N63 (north sides)	Water main	Diversion and/or protection where required.
Water	Irish Water	3+000 (L6234: Ch. 0+000 – 0+070)	Parallel to existing L6234 (south sides)	Water main	Diversion and/or protection where required.
Telecommunications	EIR	10+070 – 10+225	Parallel to existing N63 (north side)	Underground Cable	Diversion and/or protection where required.
Telecommunications	EIR	10+225	Perpendicular crossing	Underground Cable	Diversion and/or protection where required.
Telecommunications	EIR	10+225 – 11+450	Parallel to existing N63 (south side)	Underground Cable	Diversion and/or protection where required.
Telecommunications	EIR	11+310 (L7138: Ch. 0+020)	Parallel and Perpendicular crossing	Overhead Line and Underground Cable	Diversion and/or protection where required.
Telecommunications	EIR	11+665	Perpendicular crossing	Overhead Line	No Division Needed
Telecommunications	EIR	11+665 – 11+970	Parallel to existing N63 (north side)	Overhead Line	No Division Needed
Telecommunications	EIR	11+970 – 12+530 (Mainline: 2+550 – 3+120)	Parallel to existing N63 (north side)	Overhead Line	Diversion and/or protection where required.
Telecommunications	EIR	2+275	Perpendicular crossing	Overhead Cable	Diversion and/or protection where required.
Telecommunications	EIR	2+275 (L6159 North: Ch. 0+000 – 0+070) (L6159 South: Ch 0+080 – 0+150)	Parallel to existing L6234 (south sides)	Overhead Cable	Diversion and/or protection where required.
Telecommunications	EIR	3+000 (L6234: Ch. 0+000 – 0070)	Parallel to existing L6234 (south sides)	Overhead Cable	Diversion and/or protection where required.

16.5.2.2 Infrastructure: Land Use and Property

16.5.2.2.1 Permanent Land Acquisition

Full Acquisition

From the outset of the design of the Proposed Road Development, every effort was made to avoid property demolitions. No properties are located within the footprint of the Proposed Road Development. It is proposed to undertake the majority of the online upgrade works within the footprint of the existing N63 line. Therefore, there will be no requirement for demolition of properties or requirement for full acquisition of land.

However, the Proposed Road Development will require the permanent and partial acquisition of land. This is discussed in the following section.

Partial Acquisition

The Proposed Road Development will require the partial acquisition of approximately 12.2 ha of agricultural land. Chapter 17 Material Assets – Agriculture deals with effects associated with the permanent acquisition of this agricultural land.

The Proposed Road Development will require the permanent and partial acquisition of 0.035 ha of residential land; this will result in setting back some boundary walls along the existing N63 to facilitate the proposed new footpaths. With the implementation of embedded control measures as outlined in Section 16.5.1, it is anticipated that the effect from this land take will likely result in a **permanent**, **negative** and **low** effect on the residential land of **medium** sensitivity; therefore, the significance of effect is considered **not significant** as the acquisition will not compromise the overall viability of the residential properties.

The Proposed Road Development will also require the permanent acquisition of 2.94 ha of land over which there is a public right of way which entails the acquisition of roadbed at the front of certain properties. The roadbed comprises that portion of land outside a property's boundary wall to the centre of the public road which is in private ownership but in public use. As the lands are not associated with the property and no access restrictions are expected, it is anticipated that effects on the existing land use will be **permanent**, **neutral** and **negligible** on an existing environment of **low** sensitivity as the viability of future land use will not be compromised; therefore, the significance of effect is considered **imperceptible**.

Table 16-11 Permanent Land Acquisition

CPO ID.	Description	Townland	Electoral Division	Land to be Acquired (ha)	Impact	Description of Effects	Significance of Effects
101	Part of Public Road	Culliagh North	Abbey West	0.008	Permanent acquisition of land	Permanent, Neutral, and negligible	Imperceptible
102	Part of Public Road	Culliagh South	Abbey West	0.056			
103	Part of Public Road	Culliagh North	Abbey West	0.081			
103	Part of Public Road	Culliagh South	Abbey West	0.015			
104	Part of Public Road	Culliagh South	Abbey West	0.016			
104	Part of Residential Land	Culliagh South	Abbey West	0.007	Permanent acquisition of land	Permanent, Negative, and low	Not significant
105	Part of Public Road	Culliagh South	Abbey West	0.022	Permanent acquisition of land	Permanent, Neutral, and negligible	Imperceptible
106	Part of Public Road	Culliagh South	Abbey West	0.016			
107	Part of Public Road	Liss	Abbey East	0.022			
108	Part of Public Road	Liss	Abbey East	0.080			
108	Part of Public Road	Liss	Abbey East	0.022			

CPO ID.	Description	Townland	Electoral Division	Land to be Acquired (ha)	Impact	Description of Effects	Significance of Effects
109	Part of Public Road	Liss	Abbey East	0.024			
109	Part of Public Road	Liss	Abbey East	0.005			
110	Part of Public Road	Liss	Abbey East	0.040			
110	Part of Public Road	Liss	Abbey East	0.009			
110	Part of Public Road	Liss	Abbey East	0.019			
110	Part of Residential Land	Liss	Abbey East	0.002	Permanent acquisition of land	Permanent, Negative, and low	Not significant
110	Part of Residential Land	Liss	Abbey East	0.006			
110	Part of Residential Land	Liss	Abbey East	0.002			
111	Part of Public Road	Liss	Abbey East	0.034	Permanent acquisition of land	Permanent, Neutral, and negligible	Imperceptible
113	Part of Public Road	Liss	Abbey East	0.018			
114	Part of Public Road	Liss	Abbey East	0.025			
116	Part of Public Road	Liss	Abbey East	0.010			
116	Part of Public Road	Liss	Abbey East	0.039			
117	Part of Public Road	Liss	Abbey East	0.004			
121	Part of Public Road	Abbey	Abbey West	0.014			
121	Part of Public Road	Abbey	Abbey West	0.129			
122	Part of Public Road	Abbey	Abbey West	0.005			
122	Part of Public Road	Abbey	Abbey West	0.085			
123	Part of Public Road	Abbey	Abbey West	0.025			
124	Part of Public Road	Abbey	Abbey West	0.072			
124	Part of Public Road	Abbey	Abbey West	0.102			
125	Part of Public Road	Abbey	Abbey West	0.060			
126	Part of Public Road	Clashard	Abbey East	0.321			
127	Part of Public Road	Moyne	Moyne	0.242			
128	Part of Public Road	Newtown	Abbey East	0.087			
128	Part of Public Road	Moyne	Moyne	0.049			
128	Part of Public Road	Clashard	Abbey East	0.079			

CPO ID.	Description	Townland	Electoral Division	Land to be Acquired (ha)	Impact	Description of Effects	Significance of Effects
129	Part of Public Road	Moyne	Moyne	0.030			
129	Part of Residential Land	Moyne	Moyne	0.004	Permanent acquisition of land	Permanent, Negative, and low	Not significant
130	Part of Public Road	Clashard	Abbey East	0.186	Permanent acquisition of land	Permanent, Neutral, and negligible	Imperceptible
131	Part of Public Road	Liss	Abbey East	0.017			
131	Part of Public Road	Liss	Abbey East	0.033			
132	Part of Public Road	Liss	Abbey East	0.018			
132	Part of Residential Land	Liss	Abbey East	0.002	Permanent acquisition of land	Permanent, Negative, and low	Not significant
133	Part of Public Road	Liss	Abbey East	0.024	Permanent acquisition of land	Permanent, Neutral, and negligible	Imperceptible
134	Part of Public Road	Liss	Abbey East	0.003			
134	Part of Public Road	Liss	Abbey East	0.010			
134	Part of Residential Land	Liss	Abbey East	0.001	Permanent acquisition of land	Permanent, Negative, and low	Not significant
135	Part of Residential Land	Liss	Abbey East	0.008			
135	Part of Public Road	Liss	Abbey East	0.029	Permanent acquisition of land	Permanent, Neutral, and negligible	Imperceptible
136	Part of Public Road	Liss	Abbey East	0.063			
137	Part of Public Road	Liss	Abbey East	0.013			
137	Part of Public Road	Liss	Abbey East	0.010			
138	Part of Public Road	Liss	Abbey East	0.012			
139	Part of Public Road	Liss	Abbey East	0.011			
140	Part of Public Road	Liss	Abbey East	0.003			
141	Part of Public Road	Liss	Abbey East	0.027			
142	Part of Public Road	Liss	Abbey East	0.016			
143	Part of Public Road	Liss	Abbey East	0.038			
143	Part of Residential Land	Liss	Abbey East	0.003	Permanent acquisition of land	Permanent, Negative, and low	Not significant
144	Part of Public Road	Liss	Abbey East	0.083	Permanent acquisition of land	Permanent, Neutral, and negligible	Imperceptible
146	Part of Public Road	Liss	Abbey East	0.061			
147	Part of Public Road	Liss	Abbey East	0.051			

CPO ID.	Description	Townland	Electoral Division	Land to be Acquired (ha)	Impact	Description of Effects	Significance of Effects
148	Part of Public Road	Liss	Abbey East	0.189			
148	Part of Public Road	Chapelfield	Abbey East	0.116			
149	Part of Public Road	Chapelfield	Abbey East	0.064			

16.5.2.2.2 Temporary Land Acquisition

Temporary acquisition of land will be required during the construction phase where lands are required to facilitate the construction/demolition of discrete elements of the work. Approximately 0.169 ha of agricultural land will be temporarily acquired to facilitate construction of the Proposed Road Development. Chapter 17 Material Assets – Agriculture deals with effects associated with the temporary and permanent acquisition of this agricultural land during the construction phase.

There will also be temporary acquisition of 0.074 ha of residential lands in order to facilitate construction of the new boundary walls that require permanent set back from their original location. As the acquisition of the public road will only be temporary and there will be no access restrictions to the public road from the acquisition, the effects on existing land use of **low** sensitivity will likely be **temporary, neutral** and **negligible** on the existing land use as the viability of the land use will not be compromised; therefore, the significance of effect is considered **imperceptible**.

However, during the works there could be access restrictions to residential properties as a result of the temporary acquisition of residential lands. It is anticipated that access will not be restricted for long periods of time (< 1 hr). Therefore, it is expected that there will likely be a **temporary**, **negative** and **low** effect on the existing land use (**medium** sensitivity); therefore, the significance of effect will likely be **slight**.

Table 16-12 Temporary Land Acquisition

CPO ID.	Description	Townland	Electoral Division	Land to be Acquired (Ha)	Impact	Description of Effects	Significance of Effects
104	Part of Residential Lands	Culliagh South	Abbey West	0.006			
110	Part of Residential Lands	Liss	Abbey East	0.011			
110	Part of Residential Lands	Liss	Abbey East	0.002			
129	Part of Residential Land	Moyne	Moyne	0.002			
132	Part of Residential Land	Liss	Abbey East	0.004	Temporary acquisition of land.	Temporary, negative and low.	Slight
134	Part of Residential Lands	Liss	Abbey East	0.001			
135	Part of Residential Lands	Liss	Abbey East	0.008			
136	Part of Residential Lands	Liss	Abbey East	0.022			
142	Part of Residential Lands	Liss	Abbey East	0.004			

CPO ID.	Description	Townland	Electoral Division	Land to be Acquired (Ha)	Impact	Description of Effects	Significance of Effects
143	Part of Residential Lands	Liss	Abbey East	0.005			
145	Part of Residential Lands	Liss	Abbey East	0.009			

16.5.2.3 Waste

This section examines the potential environmental effects from the generation and management of solid waste streams arising from the Proposed Road Development during the construction phase, in the context of the existing local and national resource and waste management environment.

During the construction phase, a range of waste materials will be generated; for example, from construction works, site offices and temporary works facilities. Where waste is generated, it is anticipated that the majority of the waste, where reasonably possible, will be reused and recycled, with the remaining waste materials being disposed of by licensed waste contractors in accordance with the relevant national and EU legislation. For the Proposed Road Development, it has been assumed that 15% of construction waste will be sent to landfill and 85% will be recovered, in line with standard permit requirements for an 85% recovery rate for C&D wastes, as described within the Transport Infrastructure Ireland (TII) guidance document on 'The Management of Waste from National Road Construction Projects' (TII, 2017).

An estimated 2000 m^3 of material will be excavated for the Proposed Road Development and as much as possible will be re-used (for example during landscaping and remediation works at the end of the construction phase) in line with waste management principles, legislation and guidance. A Waste Management Plan (WMP) will be prepared for the Proposed Road Development and will be cognisant of EPA guidance 'Best Practice Guidance for the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects'. The Contractor will establish a system for the management of wastes in accordance with the Waste Management Hierarchy. This hierarchy outlines that waste prevention and minimisation are the first priority in managing wastes, followed by waste reuse and recycling. Disposal of waste shall only be considered as a last resort.

- Prevention;
- Minimisation;
- Reuse;
- Recycling; and
- Disposal.

Soil requiring offsite disposal will be managed in accordance with relevant waste legislation (Classification, Labelling and Packaging Regulation (CLP) European Waste Catalogue and Hazardous Waste List (EPA, 2002), EU Council Decision (2003/33/EC) of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of Annex II to Directive 19999/31/EC, Council Directive 1999/31/EC on the landfill of waste, Waste Management Act 1996, the Environment (Miscellaneous Provisions) Act 2011 (No. 20 of 2011).

The amount of site won recycled aggregates and reclaimed asphalt associated with the Proposed Road Development will be specified where practicable during the detailed design phase. The use of recycled and reclaimed material will be subject to testing to ensure material is suitable for its proposed use and will be in line with the European Waste Framework Directive, legal and best practice procedures. Given the volumes of waste materials generated, it is anticipated that the generation of waste from the Proposed Road Development will likely result in a **neutral**, **temporary** and **negligible** effect on waste management infrastructure in the region. The significance of effect from the generation and management of solid waste streams arising from the Proposed Road Development is therefore considered **imperceptible** as no significant reduction or alteration in the capacity of waste infrastructure at a national scale is anticipated.

16.5.3 Operational Phase

16.5.3.1 Utilities

16.5.3.1.1 Electricity Network

As outlined in Section 16.5.2.1.1, during the operational phase power will be required to provide public lighting and junction lighting. Additional lighting will be confined to the N63 roundabout (Junction 1) and immediate approaches, including tie-in with exiting road lighting in the village of Abbeyknockmoy; the existing road lighting in the proximity of the Newtown National School and Abbeyknockmoy Community Centre, between Junction 5 (L7138) and Junction 6 (L3110); and the proposed pedestrian and cycle facility along the existing N63 between the village of Abbeyknockmoy and the Newtown National School/Abbeyknockmoy Community Centre (Volume 03; Figure A4-27 to A4-32).

Given the scale of the and type of development, the additional power demands on the existing network will likely result in a **neutral, long-term** and **negligible** effect on an existing environment of **low** sensitivity as it is anticipated that additional demands can be accommodated with current capacity; therefore, the significance of effect on the existing electricity network supply is considered **imperceptible.**

16.5.3.1.2 Water Supply Network

No water supply is required for the Proposed Road Development during the operational phase; therefore, there will be no impacts on existing water supply networks.

16.5.3.1.3 Gas Distribution Network

No additional gas supply is required for the Proposed Road Development during the operational phase; therefore, there will be no impacts on existing gas distribution supply networks.

16.5.3.1.4 Drainage Network

The Proposed Road Development includes the construction of a new drainage system which comprises the provision of a surface water collection system, earthworks drainage, sub-surface drainage, attenuation and pollution control, and the culverting of existing streams. 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. The drainage design including outfalls and drainage requirements are shown in Volume 03; Figures A4-20 to Figure A4-25 inclusive contained of this EIAR. Further information on the drainage design is provided in Chapter 04 'Description of the Proposed Road Development'.

During operation the drainage network provided by the Proposed Road Development will improve drainage along the alignment of the Proposed Road Development.

See Chapter 09 Water for potential effects from drainage on existing watercourses in the study area during the operational phase.

16.5.3.1.5 Telecommunications

There will be no additional demand on the telecommunications network during the operational phase; therefore, there will be no impacts on existing telecommunications supply networks in the study area.

16.5.3.2 Infrastructure: Land Use and Property

Once operational, there will be no access restrictions to residential and commercial properties within the study area and the viability of existing land use will not be compromised by the presence of the Proposed Road Development. Therefore, effects from the permanent acquisition of land will be as per the construction phase and there will be no additional operational phase impacts to existing non-agricultural land uses and properties in the study area.

16.5.3.3 Waste

Given the type of development, there will be no operational phase waste impacts from the Proposed Road Development.

16.6 Do-Nothing Scenario

If the Proposed Road Development did not proceed, there would be no change to the existing material assets.

16.7 Mitigation and Monitoring Measures

16.7.1 Construction Phase

16.7.1.1 Utilities

Although it has been determined that the significance of effects on the existing utilities network will likely be not significant, the following best practice measures will be implemented during the construction phase:

- Prior to excavation diversion works, the appointed Contractor will be supplied with accurate service drawings and additional site investigations will be carried out if necessary, to ensure services are not damaged during construction works. The Contractor will be obliged to put measures in place during the construction phase to ensure that there are no interruptions to existing services and all services and utilities are maintained unless this has been agreed in advance with the relevant service provider and local authority. When service suspensions are required during the construction phase, reasonable prior notice will be given to the residencies in the area. The disruption to services or outages will be carefully planned so the duration is minimised. The timing of local domestic connections will be addressed between the contractor and the local community at the detailed design stage;
- Works during the construction phase, including service diversions and realignment will be carried out in accordance with relevant guidance documents, including Gas Networks Ireland's publication 'Safety advice for working in the vicinity of natural gas pipelines'; the ESB's Code of Practice for Avoiding Danger from Overhead Electricity Lines', 2008 and the HSA 'Code of Practice for Avoiding Danger from Underground Services', 2010; and
- All potential temporary connections will be agreed in advance with the relevant service provider.

16.7.1.2 Infrastructure: Land Use and Property

All land will be acquired through a CPO process, unless other direct agreement (payment) is reached with individual landowners. However, compensation to be agreed as part of the land acquisition is outside the scope of the Environmental Impact Assessment (EIA) process. With the implementation of the embedded control measures outlined in Section 16.5.1, no additional mitigation measures will be required to mitigate effects from the permanent acquisition of non-agricultural land.

As effects from the temporary land acquisition will be neutral, no mitigation measures will be required during the construction phase of the Proposed Road Development.

16.7.1.3 Waste

Notwithstanding the effect from the generation and management of solid waste streams arising from the Proposed Road Development being assessed as imperceptible during the construction phase, the following best practice measures will be implemented:

- Prior to any demolition, excavation or construction, a Construction Environmental Management Plan (CEMP) and Construction and Demolition Waste Management Plan (WMP) will be produced by the successful Contractor. The Construction and Demolition WMP and CEMP will be implemented by the Contractor for the entirety of the construction and demolition activities, which will ensure that specific control measures contained within these plans are implemented during the construction phase. This CEMP and WMP will be based upon the Outline CEMP (OCEMP) which will be provided as part of the planning application for the Proposed Road Development. The OCEMP will be updated and developed further by the Contractor prior to the start of works. The Contractor will refer to the Environment Protection Agencies 'Best Practice Guidelines for the Preparation of Resource Management Plans for Construction & Demolition Projects' (2021) and all other relevant guidance; and
- The plans will outline procedures for the correct segregation, storage, handling and transport of waste, which will ensure large volumes of waste are not generated at the Proposed Road Development site, and subsequently do not become a nuisance to the public. It will also ensure that the use of non-permitted waste contractors or unlicensed facilities, which could give rise to inappropriate management of waste, will not take place.

Mitigation measures in relation to the removal of soil offsite is outlined in Chapter 08 'Land and Soils'.

16.7.2 Operational Phase

16.7.2.1 Utilities

No mitigation measures will be required during the operational phase.

16.7.2.2 Infrastructure: Land Use and Properties

No mitigation measures will be required during the operational phase.

16.7.2.3 Waste

No mitigation measures will be required during the operational phase.

16.8 Residual Impacts and Effects

Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines (EPA 2017), the effects from the impacts that remain after all assessment and mitigation are referred to as 'Residual Effects'.

16.8.1 Construction Phase

16.8.1.1 Utilities

With the implementation of best practice measures outlined in Section 16.6.1.1, the Proposed Road Development will still require the suspension of services to facilitate the diversion or realignment of existing utilities infrastructure during the construction phase, as well as connection works to existing utilities networks; however, the residual effect on existing utilities network will likely be reduced to **neutral**, **brief**, **negligible** and **imperceptible** during the construction phase as consultation with service providers will ensure the disruption to services or outages will be carefully planned so the duration is minimised.

The effect from the additional demands on existing water supply and electricity network will remain **neutral, temporary, negligible** and **imperceptible** as no mitigation is possible to reduce the significance of the effect during the construction phase.

16.8.1.2 Infrastructure: Land Use and Property

No change in effects is anticipated as a result of the temporary acquisition of lands a no mitigation is possible to reduce the significance of the effect during the construction phase. The effects from the temporary acquisition of public road during the construction phase on existing land use and properties will remain **temporary**, **neutral**, **negligible** and **imperceptible**. The effects from the temporary acquisition of residential land will remain **temporary**, **negative, low** and **slight**.

Effects from the partial acquisition of residential lands will remain **permanent**, **negative** and **low** and **not significant** as no additional mitigation is possible to reduce the significance of effect from the permanent partial land take.

Effects on existing land use from which part of the roadbed will be permanently acquired will remain **neutral**, **permanent**, **negligible** and **imperceptible** as the viability of future land use will not be compromised and no mitigation measures have been proposed.

16.8.1.3 Waste

With the implementation of the best practice measures outlined in Section 16.6.2.3, the Proposed Road Development will still generate solid waste during the construction phase; therefore, the residual effect significance on waste management infrastructure in the region will remain **temporary**, **neutral**, **negligible** and **imperceptible** as no additional mitigation is possible to reduce the effect from the generation of waste during the construction phase.

16.8.2 Operational Phase

16.8.2.1 Utilities

No utilities mitigation measures have been proposed during the operational phase of the Proposed Road Development. The effects on the existing electricity network will remain **neutral**, **long-term**, **negligible** and **imperceptible** during the operational phase as a result of the additional power demands on the existing supply as no mitigation is possible to reduce the significance of effects on the existing electricity network supply.

16.8.2.2 Land Use and Properties

No additional mitigation measures have been proposed. Effects on existing non-agricultural land use and properties as a result of the permanent acquisition of land are as per the construction phase.

16.8.2.3 Waste

No waste mitigation measures have been proposed during the operational phase of the Proposed Road Development as there will be no waste generated.

Table 16-13 Summary of Residual Impacts and Effects

Residual Impact	Description of Effect (Pre-Mitigation)	Mitigation Measures	Residual Effect (Post-Mitigation)
Construction Phase			
Diversion/connection works on existing utility infrastructure.	**Negative**, **temporary**, and **low** effect on the existing low/medium voltage electricity network of **low** sensitivity; therefore, the significance of the effect on the existing electricity network will be **not significant**.	Refer to Section 16.7.1.1.	**Neutral**, **brief**, and **negligible** effect on the existing low/medium voltage electricity network of **low** sensitivity; therefore, the significance of the effect on the existing electricity network will be **imperceptible.**
	Negative, **temporary**, and **low** effect on an existing water supply infrastructure of **low** sensitivity; therefore, the significance of the effect on the existing water supply network will be **not significant**.		**Neutral**, **brief**, and **negligible** effect on an existing water supply infrastructure of **low** sensitivity; therefore, the significance of the effect on the existing water supply network will be **imperceptible**.
	Negative, **temporary**, and **low** effect on an existing telecommunications network of **low** sensitivity; therefore, the significance of the effect on the existing telecommunications network is considered **not significant.**		**Neutral**, **brief**, and **negligible** effect on an existing telecommunications network of **low** sensitivity; therefore, the significance of the effect on the existing telecommunications network is considered **imperceptible**.
Demand on existing supply.	**Neutral**, **temporary**, and **negligible** effect on the existing electricity network of **low** sensitivity; therefore, the significance of the effect on the existing electricity network will be **imperceptible**.	N/A	**Neutral**, **temporary**, and **negligible** effect on the existing electricity network of **low** sensitivity; therefore, the significance of the effect on the existing electricity network will be **imperceptible**.
	Neutral, temporary, and **negligible** effect on an existing environment of **low** sensitivity; therefore, the significance of the effect on the existing water supply will be **imperceptible**.		**Neutral, temporary,** and **negligible** effect on an existing environment of **low** sensitivity; therefore, the significance of the effect on the existing water supply will be **imperceptible**.
Generation of solid waste.	**Neutral, temporary** and **negligible** effect on waste management infrastructure in the region; therefore, the significance of the effect will be **imperceptible**.	Refer to Section 16.7.1.3.	**Neutral, temporary** and **negligible** effect on waste management infrastructure in the region; therefore, the significance of the effect will be **imperceptible**.
Temporary acquisition of land.	**Neutral, temporary** and **negligible** effect on existing land use of **low** sensitivity; therefore, the significance of the effect will be **imperceptible**.	N/A	**Neutral, temporary** and **negligible** effect on existing land use of **low** sensitivity; therefore, the significance of the effect will be **imperceptible**.
Permanent acquisition of land.	**Negative, permanent** and **low** effect on an existing residential land use of **low** sensitivity; therefore, the significance of the effect will be **slight**.	N/A	**Negative, permanent** and **low** effect on an existing residential land use of **low** sensitivity; therefore, the significance of the effect will be **slight**.
	Neutral, permanent and **negligible** on existing public road land use of **low** sensitivity; therefore, the significance of the effect is considered **imperceptible**.		**Neutral, permanent** and **negligible** on existing public road land use of **low** sensitivity; therefore, the significance of the effect is considered **imperceptible**.
Operational Phase			
Demand on existing supply.	**Neutral**, **long-term**, and **negligible** effect on an existing electricity network of **low** sensitivity; therefore, the significance of the effect will be **imperceptible**.	N/A	**Neutral**, **long-term**, and **negligible** effect on an existing electricity network of **low** sensitivity; therefore, the significance of the effect will be **imperceptible**.

16.9 Cumulative Impacts and Effects

16.9.1 Utilities

Anticipated demands from the Proposed Road Development on existing utilities networks during the construction and operational phase will not be excessive, as discussed above, and will not likely result in significant effects. The relevant service providers (ESB and Irish Water) have been consulted in relation to provision of these services for the Proposed Road Development and have not signalled any difficulty with the proposed resources required.

Based on the review of planning applications outlined in Volume 04; Appendix A1-1, there are no notable planning applications that will significantly increase demand on utilities supply networks utilised. Therefore, the cumulative effects of the Proposed Road Development on existing utilities networks with other surrounding permitted, planned and existing developments will not be significant during both the construction and operational phases.

16.9.2 Infrastructure: Land Use and Property

None of the planning applications listed in planning applications outlined in Volume 4; Appendix A1-1 are expected to lead to significant effects on the land use or properties in the study area as the majority of the planning applications refer to developments located approximately 1-4 km from the study area. The impact and effects on land use and properties will therefore be as described in Section 16.5.2.2 and Section 16.5.3.2 and there will be no cumulative impacts on existing land use and properties in the study area.

16.9.3 Waste

It is anticipated that the Proposed Road Development will likely result in a negligible effect on waste management infrastructure in the region during the construction phase. None of the planning applications that could potentially have a construction period likely to coincide with the Proposed Road Development will generate a large quantity of waste as the applications refer mainly to small scale, one-off housing development. Therefore, cumulative effects with other permitted, planned and existing developments from the generation of waste on exiting waste management infrastructure in the region will not be significant.

16.10 Summary

In summary:

- During the construction phase of the Proposed Road Development, some realignment, or replacement of utilities will be required in conjunction with or to accommodate the proposed works. It has been identified that the residual effects from diversion and connections works during the construction phase on the existing utilities networks will likely reduce to **imperceptible** with the implementation of mitigation measures;
- The effects from additional demands on existing utilities network will remain **imperceptible** during the construction phase as no mitigation is possible to reduce the effect from the additional demands on the existing network supply;
- The effects on the existing electricity network will remain **imperceptible** during the operational phase as on the existing supply as no mitigation is possible to reduce the effect from the additional demands on the existing electricity network as a result of the Proposed Road Development;
- There will be temporary acquisition of 0.011 ha of public road and 0.074 ha of residential lands as a result of the Proposed Road Development. It is anticipated that effects from the temporary acquisition of public road during the construction phase will be **temporary**, **neutral, negligible** and **imperceptible** as the viability of the land use will not be compromised. Therefore, no mitigation measures will be required, and the effects will remain the same;
- The effects from the temporary acquisition of residential land will remain **temporary**, **negative, low** and **slight** as no mitigation is possible to reduce the effects due to the potential access restrictions;
- The Proposed Road Development will also require the permanent acquisition of 2.8 ha of land over which there is a public right of way which entails the acquisition of roadbed at the front of certain properties. As the lands are not associated with the property and no access restrictions are anticipated, effects on the existing land use will likely be **permanent**, **neutral** and **negligible** and **imperceptible** as the viability of future land use will not be compromised. Therefore, no mitigation measures will be required;
- The Proposed Road Development will require the permanent acquisition of 0.039 ha of residential land. With the implementation of embedded control measures, effects from the partial acquisition of residential lands impact will remain **permanent**, **negative**, **low** and **slight** as no additional mitigation is possible to reduce the effect from the permanent partial land take;
- The significance of the effect from the generation and management of solid waste streams arising from the Proposed Road Development will remain **imperceptible** with the implementation of the best practice measures as no additional mitigation is possible to reduce the significance of effect from the generation of waste during the construction phase; and
- There will be no operational phase waste impacts from the Proposed Road Development.

16.11 References

- Act No 27/2003. Protection of the Environment Act, 2003 (as amended).
- Act No. 30/2000. Planning and Development Acts 2000 (as amended).
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- Act No. 10/1996. The Waste Management Act 1996 (as amended).
- Act No. 7/1992. Environmental Protection Agency Acts 1992 (as amended).
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- S.I No. 282/2014. Waste Management (Packaging) Regulations 2014 (as amended).
- S.I. No. 508/2009. Waste Management (Food Waste) Regulations 2009 (as amended).
- S.I. No. 820/2007. Waste Management (Collection Permit) Regulations 2007 (as amended).
- S.I. No. 821/2007. Waste Management (Facility Permit and Registration) Regulations 2007 (as amended).
- S.I. No. 419/2007. Waste Management (Shipments of Waste) Regulations 2007 (as amended).
- S.I. No. 395/2004. Waste Management (Licensing) Regulations 2004 (as amended).
- S.I. No. 163/1998. Waste Management (Hazardous Waste) Regulations 1998 (as amended).
- S.I No. 137/1997. Waste Management (Planning) Regulations 1997 (as amended);

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 17: Material Assets- Agriculture

Galway County Council

February 2022

Table of Contents

Figures

No figures entries.

Tables

Appendices

17. Material Assets- Agriculture

17.1 Introduction

This chapter presents an assessment of the impacts of the Proposed Road Development on material assets-agriculture. It defines the study area; the methodology used for developing the baseline and impact assessment; provides a description of the baseline environment in relation to material assets - agriculture; and presents the findings of the impact assessment.

17.2 Legislation, Policy and Guidance

This chapter is prepared having regard to the standard guidelines for environmental assessment published by the Environmental Protection Agency (EPA) in 2002, 2003 and draft guidelines published in 2015 and 2017. The information sources referred to in Section 17.3 below are standard for agricultural impact assessment for new road developments.

The following guidelines were referred to while preparing and writing this chapter:

- Environmental Protection Agency Draft 'Guidelines on the information to be contained in environmental impact assessment reports, (hereafter referred to as the 'EPA draft guidelines') (EPA, Draft, 2017); and
- 'Advice Notes for Preparing Environmental Impact Statements' (EPA, 2003 and Draft, September 2015b).

17.3 Methodology

The assessment of agricultural impacts involves:

1. Evaluation of the baseline environment, the types of farms and the sensitivity of the individual farms along the route of the Proposed Road Development;
2. Evaluation of the nature and magnitude of the impacts on each farm and the effects on farming collectively along the entire route of the Proposed Road Development and within County Galway;
3. Having considered the sensitivity of the baseline agricultural environment and the magnitude of effects, the effect significance is predicted for:
   - Each land parcel affected along the route of the Proposed Road Development;
   - Agriculture collectively along the Proposed Road Development (i.e. locally within the study area); and
   - Agriculture within County Galway (i.e. regionally).

These three elements of the methodology are described in Sections 17.3.5, 17.3.6 and 17.3.7. It is important to note that this agricultural assessment considers the changes that would occur to the agricultural environment and assumes that, because landowners are compensated for attributable financial losses, their financial status would not change.

17.3.1 Study Area

The study area comprises 32 land parcels, as determined with reference to the Property Registration Authority of Ireland (PRAI) database, from which agricultural land is being acquired by the Proposed Road Development. These land parcels comprise a total area of approximately 140 ha. The location of these land parcels (i.e. the study area) is shown in Figure A17-1 in Volume 03 and extends from townlands of Newtown and Moyne in the East, to Culliagh North and Culliagh South in the West of the study area.

17.3.2 Determination of the Baseline Environment

The agricultural baseline environment was determined from observations made of the study area during the windshield survey examining the farm types within the study area and with reference to the Central Statistics Office (CSO) data (Table 17-5).

The information sources which support this impact appraisal are described in Table 17-1.

Table 17-1 Data Sources used for the Agricultural Assessment

Topic	Sources
Agricultural statistics	• Census of Agriculture 2010[1] from the Central Statistics Office (CSO) – used to provide background data on the average size and enterprise mix of farms in County Galway and local electoral divisions[2] (Abbey West, Abbey East and Moyne); and • CSO, Average crop yields[3] from 2008 – 2019 and Teagasc data[4] for grass production at Ballyhaise Agricultural College (2008 – 2017).
Soils	• Teagasc Soils Information System[5]; and • Windshield survey (23/03/2021), orthophotography.
Land use & farm details	• Land registry mapping data[6]; • Windshield survey (March 2021); and • Orthophotography[7] - used as an aid in examining farm layout and land quality.

17.3.3 Determination of Sensitive Receptors

The sensitive receptors within the study area are identified as the land parcels along the Proposed Road Development, as determined from the PRAI database and from a windshield survey of the area in March 2021.

Each land parcel is evaluated to determine its sensitivity based mainly on the criteria shown in Table 17-2.

Table 17-2 Criteria for the categorisation of sensitivity of farms[8]

Farm Enterprise Type	Sensitivity
Stud farm, Equestrian centre	High - Very High
Dairy farm, Intensive equine enterprises	High
Non-dairy grazing livestock enterprises (including beef, sheep and non-intensive equine) and grass cropping enterprise	Medium
Tillage	Medium
Rough Grazing, Bog, Forestry, Woodland (where poor land quality restricts farming practices)	Low - Very low

The size and viability of the land parcel is also considered when assigning sensitivity. For example, small plots adjoining dwelling houses or church are low sensitivity. Each appraisal of sensitivity is subject to professional judgement and evaluation of other site-specific factors such as the land quality and importance of the enterprise.

[1] The Census of Agriculture 2010 is the most up to date survey providing data on farm and enterprise types and size on a per County basis. A census was due in 2020 but delayed due to COVID.
[2] Available through PxStat dissemination database system; Available at https://data.cso.ie/#
[3] Central Statistics Office, 2021, Available at https://www.cso.ie/en/statistics/agriculture/areayieldandproductionofcrops/
[4] Teagasc, 2015, Donal Patton, Irish Grassland Association Presentation and Teagasc, 2018, 'Ballyhaise Open Day – Resilient Dairy Technologies', Available at; https://www.teagasc.ie/publications/2018/ballyhaise-open-day---resilient-dairy-technologies.php
[5] Teagasc, Irish Soil Information System. Available from http://gis.teagasc.ie/soils/ [Accessed: 18th September 2020
[6] Property Registration Authority. Available from https://www.landdirect.ie/index [Accessed: September 2020 and March 2021]
[7] Google Aerial Mapping. Available from: https://www.google.com/maps [Accessed: 18/09/2020 and 07/03/2021]
[8] Criteria based on author's professional judgement

17.3.4 Describing Potential Effects

17.3.4.1 Magnitude of Effects

The magnitude of the potential effects is assessed by predicting the change on the affected land parcel or on agriculture along the route of the Proposed Road Development. For example, if the Proposed Road Development takes 10% of an affected grass land parcel, and provided the farm enterprise can continue after the Proposed Road Development is constructed, it is possible to predict that the yield of grass from the land parcel will be affected by approximately 10%.

In order to quantify the magnitude of the effect, typical baseline trends[9] in the agricultural environment are examined and interpreted using professional judgement. Therefore, impacts which result in a 2.5% to 5% variation in yield are considered to create a low magnitude effect on the farm and are similar to natural baseline trends in yield and is considered low magnitude. Between 5% and 10%, the magnitude of yield loss is starting to exceed the natural baseline trends and is considered medium. Yield effects which exceed 10% are considered to be high magnitude. Other factors affect the magnitude of effects such as, severance or separation of land, the duration of effect, the quality of land affected and impact on farmyards and other facilities on the farm. Table 17-3 shows the criteria which are used to indicate the magnitude of effect and each assessment is subjected to professional judgement.

Table 17-3 Indicative Criteria for the Assessment of Magnitude of Effects

Indicative Criteria	Magnitude of Effects
A high proportion of the land permanently taken (e.g. >10%) A high proportion of farm permanently separated (e.g. > 15 %) Farm buildings or water sources may be affected permanently	High – Very High
A medium proportion of the farm permanently taken (e.g. 5% -10%) A medium proportion of farm permanently separated (e.g. 7 % -15%) Farm buildings or water sources may be affected but can be replaced Temporary (construction) impacts which have long term effects	Medium
A small proportion of the farm permanently taken (e.g. 2.5% - 5%) A small proportion of farm separated or no separation (e.g. 2.5% - 7%) Farm buildings or water sources generally not affected but if affected can be replaced Temporary (construction) impacts which have short – medium term effects	Low
A very small proportion of the farm taken (e.g. <2.5%). A very small proportion of farm separated or no separation (e.g. <2.5% of the farm) Temporary (construction) impacts which do not have residual effects	Negligible – Very Low

Impacts that occur during the construction phase would generally result in low or very low magnitude because of the short duration (e.g. construction noise and vibration). Medium magnitude effects may arise during construction where for example there is a long-term effect on land drainage as a result of the construction activity; however, generally the effect magnitude is low after mitigation.

[9] According to CSO data (2008 – 2019) the yield of spring barley and winter wheat will vary by approximately 7.5% and 8.9% respectively from the average mean yield. Similarly, according to Teagasc data for grass production at Ballyhaise Agricultural College (2008 – 2017), the natural trend is for grass production to vary on average by 7.7% from year to year.

17.3.5 Significance of Effect

Once the description of the effect, including magnitude, character, duration etc. has been identified, this can be cross-referenced with the sensitivity of the receptor to derive the overall significance of effect as per the EPA draft guidelines (EPA, 2017). An effect which affects a farm with a low sensitivity will not be as significant as a similar magnitude of effect which affects a farm with a high sensitivity. The EPA guidelines for assessing significance have been adopted with minor adjustments (as outlined in Table 17-4) that are appropriate for agricultural impact assessment. In general, the effects on agriculture are adverse in nature.

Table 17-4 Comparison of Significance of Effect Criteria Used in this Assessment with the EPA draft guidelines 2017

<table>
<tr><th>Significance of Effects as per EPA draft guidance 2017</th><th>Significance of Effect Used in this Assessment</th></tr>
<tr><td>Imperceptible
An effect capable of measurement but without significant consequences</td><td rowspan="2">Not Significant
An impact which may result in measurable effects and/or noticeable changes but the consequences are not significant.</td></tr>
<tr><td>Not Significant
An effect which causes noticeable changes in the character of the environment without significant consequences</td></tr>
<tr><td>Slight
An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.</td><td>Slight Adverse Effect
An effect which causes noticeable changes in the character and management of a farm in a minor way. The farm enterprise experiences inconvenience as a result of the Proposed Road Development.</td></tr>
<tr><td>Moderate
An effect that alters the character of the environment in a manner that is consistent with existing emerging trends.</td><td>Moderate Adverse Effect
An effect which alters the character of a farm in a manner that requires moderate changes in the management and operation of the farm. The farm enterprise can be continued as before but with increased management or operational difficulties.</td></tr>
<tr><td>Significant
An effect which by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.</td><td rowspan="2">Significant and Very Significant Adverse Effect
An effect which by its character, magnitude, duration or intensity alters a sensitive aspect of the farm.
The farm enterprise can be continued but will require major changes in management and operation of the farm.
This would typically occur where the farm was split in two due to separation but where access between the separated portions and the farm buildings could still be achieved effectively.

Assuming the enterprise can continue the degree of change in the management and operation of the farm will determine whether the effect is Significant or Very Significant.</td></tr>
<tr><td>Very Significant
An effect which by its character, magnitude, duration or intensity alters the majority of a sensitive aspect of the environment.</td></tr>
<tr><td>Profound
An effect which obliterates sensitive characteristics.</td><td>Profound Adverse
An effect which obliterates sensitive characteristics of the farm. The farm enterprise cannot be continued as a result of the Proposed Road Development. This would occur where land-take was of such a scale that the remaining land would not form a viable unit or where separation was of such a nature to make the holding unworkable or where important farm buildings and facilities were removed and could not be replaced. In some situations the farm enterprise may continue but will require dramatic changes in the future management and operation of the farm, such that the scale and operation of the enterprise is changed dramatically.</td></tr>
</table>

Source: Based on Table 3.3. EPA's 'Guidelines on the information to be contained in environmental impact assessment reports' (EPA, 2017)

When assessing significance of effects, the basic principle which applies is as sensitivity increases so also does the significance of effect at any one level of magnitude of effects. This assessment is subject to variation due to professional judgement on a case-by-case basis.

17.4 Limitations and Assumptions

Information regarding individual land parcels was obtained from the PRAI database, examination of aerial photography and windshield survey – no interviews were conducted directly. The 2010 CSO Agricultural Census is the latest CSO data which provides enterprise data relating to enterprise type on a per county and Electoral Division (ED) basis. Some changes will be expected since 2010, for example, since 2015 milk quotas have been abolished and in County Galway cow numbers have increased from 24,928 in 2010 to 38,000 in 2019[10] (+52%). A CSO farm structure survey in 2016 found the average size of farms in the Western Region[11] was 24.6 ha compared to the 2010 CSO data which indicates an average size of 24.8 ha (Table 1 of 2010 CSO Census). The same 2016 report shows that the farm size nationally has changed very little from 2010 to 2016.

The absence of formal guidance on agricultural impact assessments requires the author to adopt professional judgement and experience obtained from more than 20 similar Environmental Impact Assessment Reports (EIAR) and examination of similar assessments in Ireland carried out by other agricultural professionals. The available data was sufficient for the agricultural impact appraisal along the entire Proposed Road Development.

17.5 Baseline Environment

17.5.1 Soil Types

There are two main soil types in the study area;

1. Brown Earths comprised of the Baggotstown series (1150a) to the south of the existing N63 and the Mullabane (1100q) to the north of the N63; and
2. Alluvial soils (05RIV) located along the Abbert River.

The brown earth soils south of the N63 and Abbert River are general free-draining, good quality productive soils. Along the Abbert River the alluvial soils, having restricted drainage potential, are generally poor – medium quality soils and further north the Mullabane Soils are low-lying and are of mixed quality.

17.5.2 Agricultural Enterprise Types

The Census of Agriculture 2010 statistics show that the average farm in County Galway is 25.8 ha in size and has 4.4 separate land-parcels. The local ED data shows the average size to be 21.1[12]ha. This compares to a national average size of 32.7 ha and 3.8 separate land parcels. In 2010, approximately 2.5% of the total cattle for the 3 ED's (Abbey West, Abbey East and Moyne) were dairy cows (i.e. approximately 4 farms). The average size of land parcels along the route of the Proposed Road Development is approximately 4.4 ha. However, some landowners own land too remote from the Proposed Road Development to be considered in this assessment and therefore the average size is assumed to be similar to the ED average i.e. 21 ha.

Table 17-5 below compares land use along the route of the Proposed Road Development to the statistics for County Galway. The Census of Agricultural (2010) Statistics categorises land use into eight agricultural groups: specialist tillage, specialist dairy, specialist beef, specialist sheep, mixed grazing livestock, mixed crops and livestock, mixed field crops (mainly hay & silage) and other. For this assessment, the number of groups is reduced to five for comparison purposes, by grouping similarly sensitive enterprises together, as follows:

- **Group 1** - Mainly Dairy - entirely a dairy farm or the dairy enterprise is the most significant target of the impact). Generally high sensitivity;
- **Group 2** - Beef and/or sheep i.e. non-dairy grazing livestock and mixed field crops – includes specialist beef cattle, specialist sheep, and mixed farms with cattle, sheep and horses. Generally medium sensitivity;
- **Group 3 -** Mainly tillage - tillage cropping. Generally medium sensitivity;
- **Group 4 -** Mixed crops and livestock - various crops and livestock. Medium sensitivity; and
- **Group 5 -** Other (e.g. pigs, poultry, horticultural cropping and equine as the main enterprises). Medium – very high sensitivity.

[10] CSO 2019 Livestock Survey
11 Galway, Mayo, Roscommon
[12] 209 farms with a Utilisable Agricultural Area of 4,422ha (2010 Agri Census, CSO)

Table 17-5 Land Use Statistics along the Proposed Road Development compared to National and Regional Statistics

Farm Enterprise Type	Total Nos of Affected Land Parcels within Each Group	% of Farms/Land Parcels within Each Group		
		Along Proposed Road Development (%)	Within Co Galway (%)	Nationally (%)
Group 1 - Dairy	1	3	3	11
Group 2 – Beef/sheep/grass cropping	31	97	95	82.5
Group 3 – Tillage	0	0	0.5	3.5
Group 4 – Mixed crops and livestock	0	0	1	2
Group 5 - Other	0	0	0.5	1
Total	32	100	100	100

Overall the baseline sensitivity is low - medium because the main farming enterprise is Group 2 (Table 17-5) i.e. mixture of beef, sheep and forage (hay/silage) enterprises, land quality ranges from medium to good quality, land holdings are small (21 ha) and 8 out of the 33 land parcels categorised as low sensitivity due to their size. Within the study area one of the 32 plots (Ref No 127) is being farmed by a dairy farmer.

17.6 Assessment of Impacts

A detailed description of the Proposed Road Development and construction activities are provided in Chapter 04 'Description of Proposed Road Development'. The characteristics of the Proposed Road Development of relevance to material assets – agriculture is the land-take, which is comprises embankments, cut slopes, accommodation works, drainage features and planted/landscaped areas which would traverse agricultural lands. In doing so, agricultural land parcels would be severed/separated and the drainage of land would be impacted. The on-line improvements to the existing N63 would impact mainly on the road verges, edges of fields and accesses to agricultural land. There would be some degree of disturbance caused to agricultural enterprises due to the construction activities and permanent disturbance due to the operation of the road. In the operational phase there would be traffic noise and movement and some degree of on-going works required to maintain the Proposed Road Development. Approximately 12.3 ha of agricultural land would be permanently acquired from 29 affected land parcels for the Proposed Road Development and 0.17 ha of agricultural land will be acquired from 12 of the land parcels (temporary land-take only from 3 land parcels).

17.6.1 Embedded Control Measures

The design of the Proposed Road Development would minimise the potential land-take, would provide access to all affected retained lands and would maintain land drainage across the Proposed Road Development.

17.6.2 Construction Phase Impacts

It is estimated that the construction period would last for approximately 18 months. At the beginning of the construction phase, the land to be acquired (12.3 hectares) would be fenced and access across it restricted. In certain situations, temporary crossing points for livestock and machinery would be allowed until accommodation roads are constructed. Water and power supplies would be disrupted potentially requiring alternative sources and ducting under the Proposed Road Development. Watercourses could be diverted, and the carriageway would be lower and higher than the adjoining farm land at different locations. This would disrupt land drainage requiring the construction of culverts and maintenance of the land drainage along the edge of the earthworks for the Proposed Road Development. There would be approximately 0.17 ha of temporary land-take during the construction period to facilitate the works.

The general construction works and traffic within the fenced off works area would generate noise, dust and movement of machinery which would potentially impact on adjoining lands (ref. Chapter 10 'Air Quality' and Chapter 12 'Noise and Vibration'). The duration of these works would vary. In the worst-case scenario (as assumed in this assessment) this disturbance could last the entire construction period for that location; however, in general it is expected that construction activities at any one location would last for a period of few days up to a few weeks.

There are multiple potential effects which would arise from fencing off the acquired land, construction activity, construction traffic and potential traffic diversions and operation of the completed Proposed Road Development. Collectively these effects are addressed under the headings, land-take, land separation/severance, disturbance (construction and permanent) and injurious affection (to the retained holding).

17.6.2.1 Land- Take

The Proposed Road Development boundary fencing would be erected at the commencement of the construction phase and from this point forward the land inside it is no longer available to the landowner. The land-take would be approximately 12.3 ha of agricultural land on 29 land parcels. Existing cattle handling facilities would be removed (cattle handling pen in plot 111). There would be approximately 0.17 ha of temporary land-take during the construction period to facilitate the works. There would be temporary land-take only (no permanent land-take) in 3 land parcels for the duration of the construction period.

17.6.2.2 Land Separation/Severance

The Proposed Road Development would sever 11[13] land parcels (see Volume 4; Appendix A17-1 for summary of individual land parcel effects), separating approximately 18 ha of land and creating 7[14] new land parcels. In addition to this, the access point of 5[15] land parcels along the N63 would be acquired, and these land parcels would be severed unless alternative access is provided. The on-line works on the existing N63 would cause disturbance and impede access to existing agricultural lands.

17.6.2.3 Construction Disturbance

Construction disturbance would occur during the 18-month construction period. The location and duration of construction impacts and associated effects would vary during the construction period so a worst-case scenario is assumed i.e. the construction disturbance would occur at any one location for the duration of the construction period. Potential construction disturbance is a combination of:

- Interrupted access to retained lands;
- Noise and vibration disturbance;
- Dust and air emissions during construction;
- Increased level of soil/dirt on road pavement and/or land adjoining the works;
- Interruption to services such as water and power causing inconvenience and disturbance;
- Potential impact on land drainage; and
- Increased risks/reduced safety of farming the retained lands.

While construction disturbance can potentially be significant without mitigation, in general the effects are not significant due to short-term duration and standard construction mitigation where landowners are provided access to their retained lands.

[13] Figure 17.1 - Ref Nos 103, 108, 109, 110, 119, 121, 122, 124, 125, 127 and 128
[14] 11 parcels are assessed to be severed by the proposed road development creating 11 severed land parcels but 4 (Ref Nos 103, 109, 110 and 128) of these were already severed by the existing N63.
[15] Figure 17.1 – Ref Nos 109, 110, 112, 113 and 114

17.6.3 Operational Phase Impacts

When the construction phase is complete, and the mitigation measures implemented, the residual effects of the Proposed Road Development would be permanent. These effects would result in a change in the structure and layout of farms along the route of the Proposed Road Development reducing the size and separating parts of farms. A low level of disturbance would be experienced due to traffic; however, because the proposed alignment is close to the existing N63 many of the affected land parcels would experience a similar level of disturbance as exists in the 'Do-Nothing' alternative. Landowners would be compensated to ensure they are not at a financial loss.

17.6.3.1 Land-take

During the operation phase, it is generally not possible to replace the acquired land with replacement land that adjoins the retained land parcel. Therefore, the land-take usually results in a permanent reduction in the size of land parcels directly affected by the Proposed Road Development.

17.6.3.2 Land Separation/Severance

The increased separation/severance which occurred during construction on on-line sections of the Proposed Road Development is a temporary impact and the accesses across the N63 are restored in the operational phase. Where the Proposed Road Development would cross 11 land parcels causing the separation of part of those land parcels, there is a new permanent severance/separation impact. There is increased angulation of fields and the workability of severed land is reduced. Without mitigation the new, additional length of boundary along the Proposed Road Development would be an additional permanent barrier to movement of livestock and machinery. Shelter is altered and it could be temporarily reduced but in the longer term the additional length of boundary along the Proposed Road Development would restore shelter.

17.6.3.3 Permanent Disturbance

Permanent disturbance would occur during the operational period and can potentially be a combination of;

- Maintenance works carried out on the Proposed Road Development can be a source of permanent disturbance;
- Maintenance of the boundary of the new road development may cause permanent disturbance;
- Changed access to retained separated lands requiring additional journey times, increased distances for livestock movements, increased handling of livestock to ensure safe passage to severed lands, opening/closing of gates and additional time and labour required;
- Noise disturbance from traffic;
- Potential air emissions during operational phase;
- Potential impacts on water and power services;
- Potential impact on land drainage and the Flood Risk Assessment (Volume 04; Appendix A9-1) has shown there is a slight increase in flooding upstream and a slight decrease in flooding downstream of the crossing point of the Abbert River;
- Increased risks/reduced safety of farming the retained lands where there is severance/separation or where there is increased boundary length with the new road;
- Loss of shelter;
- Additional risk of trespass; and
- Impacts from vehicle lights.

17.6.3.4 Injurious Affection

This is a term often used to describe the overall adverse effect on the retained land parcel due to the presence of the new road development. It describes both how the combination of the above listed adverse effects affect the on-going operation of the land parcel and how the agricultural potential of the land parcel may be restricted due to the presence of the road. It includes potential adverse effects already mentioned and other potential effects such as loss of privacy, reduced security, visual impact and change of setting associated with farming adjoining a new road development.

17.6.4 Summary

- The reduction in land area would result in a **permanent** effect and the range of effect due to loss of land along the Proposed Road Development ranges from **not significant** to **significant adverse**.
- The separation of parts of farms (often referred to a severance) would result in a **permanent** effect. Without mitigation this would result in reduced access, additional travel distances and additional fixed costs on a farm and the range of effect along the Proposed Road Development would be **moderate adverse to significant adverse**.
- Construction disturbance:
  - Construction of the Proposed Road Development would necessarily interrupt access to retained lands during the construction period. Without mitigation, the effects arising along the Proposed Road Development would be **not significant** or **slight adverse;** having consideration of the short term nature of the effect;
  - Construction noise and vibration would have **not significant** to **slight adverse** effects without mitigation. Rock breaking and piling activities may result in a flight response in livestock but rarely causes a significant impact;
  - Dust and air emissions would arise from excavation works and construction traffic. Without mitigation this effect would be **not significant**;
  - There would be temporary disruption to power and water supplies. Without mitigation the effect would be **not significant** to **slight adverse**; having consideration of the short term nature of the effect;
  - Land drainage would be affected during the construction period where drainage outfalls from agricultural land is intercepted or blocked by the Proposed Road Development. Without mitigation the range effects are **not significant** to **moderate adverse** (e.g. where inadequate drainage results in flooding of land not previously affected by flooding); and
  - Without mitigation the increased risk due to farming adjoining the Proposed Road Development during the construction phase would be **not significant**.
- Maintenance of the Proposed Road Development would continue during the operational phase and in a very small number of cases remedial works could have to be carried out during the operational phase (e.g. maintenance of the fence-line along the mainline of the Proposed Road Development and drainage outlets). Without mitigation these effects would be **not significant**;
- Without mitigation the range of effects on land drainage on adjoining lands due to the impedance of drainage across, and run-off from, the Proposed Road Development during the operational phase are generally **not significant** or **moderate adverse**;
- The increased flooding risk as described in Chapter 09 Water, Section 9.8, Table 9.5 during the operational phase is generally **not significant** due to the low frequency and occurrence mainly during winter periods;
- Without mitigation the permanent disturbance impacts caused by traffic, noise, air emissions and lighting would result in **not significant effects**;
- Without mitigation the increased risk due to farming adjoining the Proposed Road Development during the operational phase would be **not significant**;
- Without mitigation the potential loss of shelter would result in **not significant** effects; and
- The presence of the Proposed Road Development would result in general injuries such as loss of privacy, change in visual impacts, increased security risk, increased risk of trespass and a change in the setting of the affected land parcel. Without mitigation these potential effects would result in **not significant**.

The potential (pre mitigation) effects on land parcels along the route of the Proposed Road Development are summarised in Table 17-6.

The agricultural study area consists of 32 land parcels and 140 ha of land, of which approximately 12.3 ha is permanently within the Proposed Road Development boundary. The sensitivity of the study area is low - medium overall due to intensity of farming, drystock (beef & sheep) enterprises and relatively small agricultural holdings. There is land-take from the edge of one land parcel which is farmed by a dairy farmer (No 127). Before mitigation, the potential effect on the study area would be **moderate adverse** where in addition to approximately 12.3 ha of agricultural land which is acquired, 18 ha of land is separated in 11 land parcels without effective access (13% of the total agricultural area).

17.7 Mitigation and Monitoring Measures

17.7.1 Construction Phase

- A key contact person would be appointed during the construction phase to facilitate communications between affected landowners and to facilitate the re-organisation of farm enterprises by farmers during critical times;
- The landowner would be provided with access to all separated land parcels during the construction of the Proposed Road Development. Where temporary disruptions to this access occur landowners would be notified in advance;
- Where existing water and electricity supplies are disrupted during the construction phase an alternative water source or electricity supply would be made available e.g. water tanker or electric cable ducting. If access to surface drinking water sources are permanently restricted alternative groundwater supplies would be provided (or compensation to allow farmer to drill his own well);
- Suitable boundary fencing would be erected to delineate the line of the Proposed Road Development site boundary and prevent disturbance/trespass to, and containment of livestock within, adjacent land;
- Landowners with lands adjoining sites where either rock breaking, piling takes place would be notified in advance of these activities, and where necessary, this could facilitate in the movement of farm animals to avoid undue disturbance';
- The impacts on water quality would be minimised by way of a programme of mitigation measures for surface and ground water sources as described in Chapters 08 Land and Soils and Chapter 09 Water;
- The spread of dust onto adjoining lands would be minimised by way of mitigation measures set out in Chapter 10 Air Quality. Typically, the effect of dust on agricultural grazing livestock is not significant; and
- Where drainage outfalls are temporarily altered or land drains blocked or damaged an adequate drainage outfall will be maintained and land drains would be repaired.

17.7.2 Operational Phase

- The loss of agricultural land due to the construction of the Proposed Road Development would be a permanent loss which cannot be mitigated except through compensation;
- The separated land parcel would be accessible either via the local road network or via accommodation access roads. Where existing access gates are removed, these would be replaced. Access would be maintained to lands on other side of N63;
- Where existing water and electricity supplies to fields or farm yards are severed, the supply would be reinstated by provision of ducting where possible. Alternatively, where ducting is not feasible a permanent alternative water source or electricity supply would be made available. Compensation payments would enable farmers to replace power and water supplies;
- Water from the Proposed Road Development would be diverted to attenuation ponds before discharging to watercourses or to ground. The drainage design of the Proposed Road Development would intersect existing field drains and carry the drainage water to suitable outfalls. There will be a slight increase in the flood level upstream from the proposed crossing of the Abbert River (please fer to the Flood Risk Assessment in Volume 04 Appendix A9-1). Due to the low frequency and occurrence mainly during winter periods this will not significantly affect agricultural output from these lands;

- The loss of shelter would be addressed by the proposed landscaping plan see Chapter 13 Landscape and Visual;
- The Proposed Road Development boundary would prevent trespass of livestock onto the adjoining road development; and
- Landscaping along the Proposed Road Development would minimise the visual impact on farms along the route of the Proposed Road Development.

17.8 Residual Impacts and Effects

Residual impacts are defined as those impacts that remain following the implementation of mitigation measures. As per the EPA draft guidelines (EPA 2017), the effects from the impacts that remain after all assessment and mitigation are referred to as 'Residual Effects'.

In this assessment the impacts on agriculture along the route of the Proposed Road Development and within County Galway is evaluated and cumulative impacts are considered.

17.8.1 Construction Phase

While landowners would experience temporary disturbance during construction, the effects resulting from the generation of noise, dust and construction traffic are temporary in nature and would generally not result in significant effects. Prior to the provision of access gates land could be separated by the Proposed Road Development. In such situations points of temporary access would be provided to landowners to allow them to access their separated land parcels during the construction phase. Disturbance due to construction activity would be temporary and the effect is expected to be **not significant**. Land drainage effects that are mitigated during the construction phase are **not significant**. The overall construction phase impacts would not result in significant effects because of the proposed mitigation and the short duration of the effects.

Impacts that occur during construction period, such as severance, removal of access to land or impacts on drainage would result in significant effects if these are not mitigated through the design of the Proposed Road Development. Therefore, these potential pre mitigated effects are higher than the mitigated effects.

17.8.2 Operational Phase

The operational phase is considered to be in excess of 30 years and therefore residual effects that occur for this duration are permanent and therefore more significant than the temporary effects that occur during the 18 month construction phase. The separation (severance) of land during the construction phase can be mitigated by the contractor by allowing access across the works area, but permanent separation must be addressed by accommodation roads and access gates. Additional permanent travel time and distance on behalf of affected landowners would be a consequence of the Proposed Road Development. These effects would be **permanent**. The design of the Proposed Road Development would ensure that the land drainage of affected farms is not significantly affected. The residual impacts and associated residual effects on farms along the route of the Proposed Road Development is summarised in Table 17-6 and in Volume 4; Appendix A17-1.

Certain permanent residual disturbance effects arising from the Proposed Road Development cannot be mitigated by the road design or proposed mitigation implemented by the Contractor. For example, landowners could have to build additional farm facilities (e.g. cattle holding and testing pens) on their separated land. Field boundaries and paddock systems could have to be re-organised to take into account the altered shape of fields. Field drainage systems could be amended due to changed layout of field boundaries. These **permanent** effects are assigned to the Proposed Road Development; however, in practise these matters are usually effectively addressed in the compensation settlements which would allow farmers to implement the required mitigation.

Table 17-6 Summary of Pre and Post Mitigation Effect Significance

Significance of Effect	No. of Land Parcels Pre-Mitigation	Mitigation Measures	No. of Land Parcels Post-Mitigation
Not significant	13	Refer to Section 17.7	13
Slight	2		5
Moderate	5		11
Significant	13		3
Very Significant	0		0
Profound	0		0
Total (No. of land parcels)	32		32

17.9 Do-Nothing Scenario

Farmers as members of the local community regularly use the existing road network to access schools and shops and to purchase goods and sell produce. Lorries and goods vehicles deliver and collect goods from farms. In the “Do Nothing” scenario the existing traffic congestion would continue to have a small adverse impact on agriculture which is considered to be not significant.

17.10 Cumulative Impacts and Effects

The cumulative impacts on agriculture within the study area is appraised by assessing local developments (as listed in Tables 2.5 and 2.6 in Chapter 02 ‘Need for the Proposed Road Development and Planning Policy Context’) which require agricultural land. These small developments, comprising mainly of the construction of new dwellings and extensions of existing dwellings, would not have a significant cumulative effect when considered in combination with the Proposed Road Development.

The regional cumulative effects on agriculture is appraised by assessing the recent trends in agricultural productivity in County Galway and developments within the County that require agricultural land. The human population of County Galway has increased by 3% from 2011 to 2016 (2016 Census, CSO). The human population continues to rise and this has increased the land-take of agricultural land for housing. The land-take for road developments has risen due to recently constructed road developments such as improvements along the N63, M17/M18 and M6. Despite this the trend in livestock[16] numbers in County Galway is upward which verifies that these developments are not having a significant effect on agriculture output in County Galway. The Proposed Road Development in combination with planned developments such as Galway City Ring Road (GCRR), N59 Maam Cross to Oughterard, Moycullen Bypass, planned M6 (M17/M18) Motorway Service Area and the GTS measures (Eastern Galway City Park & Ride, Bearna Greenway, Galway to Oughterard Greenway and Galway City to Oranmore Cycleway) would require <1% of the agricultural area of County Galway (346,881 ha). When considered along with upward agricultural productivity trends the cumulative effect on agriculture in County Galway is **not significant**.

[16] From 2010 – 2019 cattle numbers in Co Galway increased by 6% and sheep numbers in the Western region increased 13% (source Agri. Census 2010 Tables 8A and 8b and CSO, 2021, https://www.cso.ie/en/releasesandpublications/er/clsjf/cropsandlivestocksurveyjunefinal2019/

17.11 Summary

In summary:

- The Proposed Road Development would traverse an agricultural area which is predominantly medium sensitivity. The main farming enterprise is beef cattle and/or sheep. One plot is being farmed by a dairy farmer. The effects on individual land parcels would be;
  - 57% of land parcels (18no.) are predicted to have **not significant** and **slight adverse** effects;
  - 34% of land parcels (11no.) are predicted to have **moderate adverse** effects; and
  - 9% of land parcels (3no.) are predicted to have **significant adverse** effects.
- Taking into account the low – medium sensitivity of the study area, the overall effect on agriculture within the study area would be **slight adverse** where approximately 9% of the study area is taken and 13% is severed (with mitigation).
- When cumulative effects from land loss due to other road developments are considered, the effect at a regional level (i.e. County Galway) is not significant.

17.12 References

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N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 18: Interactions of the Foregoing

Galway County Council

February 2022

Table of Contents

Figures

No figures entries.

Tables

18. Interactions

In addition to the assessment of impacts on individual topics presented in the previous chapters of this Environmental Impact Assessment Report (EIAR),this chapter of the EIAR evaluates the potential interaction of impacts, which the Proposed Road Development may have on the receiving environment and sensitive receptors.

As a requirement of the EIA Directive and considering best practice guidelines and advice notes, the inter-relationships between factors must be identified and assessed throughout the EIAR. In accordance with this and to align with the environmental aspects assessed in this EIAR, a summary of the interactions (or inter-relationship) of impacts identified from the Proposed Road Development between the following environmental aspects are outlined in this chapter:

- Traffic Analysis;
- Population and Human Health;
- Biodiversity;
- Land and Soil;
- Water;
- Air Quality;
- Climate;
- Noise and Vibration;
- Landscape and Visual;
- Cultural Heritage;
- Major Accidents and Disasters;
- Material Assets – Non-Agriculture; and
- Material Assets - Agriculture.

All potential impacts and associated effects arising from the interactions were identified early in the design process and in preparation of the EIAR and were therefore addressed in the design of the Proposed Road Development, in addition to the individual impact assessment studies. As a result, many of these potential impacts were either avoided through design measures or have been addressed through specific mitigation measures where possible within respective chapters within this EIAR. No additional mitigation is proposed in this chapter.

18.1 Traffic Analysis

Traffic interactions are summarised under the following sections.

18.1.1Population and Human Health

Traffic management measures during the construction phase could result in temporary community severance effects on local residents in the study area who use the existing N63 to travel in and around the study area to commercial properties, community facilities, places of work and educational facilities. There could be temporary lane closures in place (i.e. by provision of signal control alternate shuttle working) on the existing N63 to facilitate the construction of the Proposed Road Development. However, this will result in an imperceptible effect on local residents in the study area and the facilities which they use during the construction period in the study area.

During the operational phase, the Proposed Road Development will potentially have a positive effect on local residents in the community. For example, traffic assessment (Chapter 05 ‘Traffic Analysis’) indicated that the Proposed Road Development will provide a reduction in total distance travelled (-4.4%), a reduction in travel time (-20.4%) and an increase in average speed (+20.1%) throughout the entire modelled road network. In addition, the proposed pedestrian and cycle facility along the existing N63 has the potential to improve connectivity to the community facilities for local residents in Abbeyknockmoy and along the existing N63.

18.1.2 Biodiversity

During the construction phase there is potential for noise and pollution impacts generated by construction traffic on a range of ecological features for example, Barn Owl, and Otter, have a range of mitigation measures that are outlined within Chapter 07 'Biodiversity' to reduce the significance of effects where possible.

The traffic associated with the Proposed Road Development during the operational phase and the physical presence of the Proposed Road Development during the operational phase has the potential to result in negative effects on biodiversity, potentially resulting in severance, disturbance and mortality impacts. For example, the location of Proposed Road Development in a rural location, including the development of a new watercourse crossing, will permanently increase the risk of road traffic collisions with mammals, including otter and badgers. Furthermore, the traffic associated with the Proposed Road Development during the operational phase (and associated noise and lighting) elevate the risk of pollution or light spill impacts to habitats and mobile species, including bats. These types of impact interactions were identified at a very early stage in the design and environmental assessment process. As a result, the potential impacts were avoided through specific design measures or they were addressed through specific mitigation measures reducing the significance of the effect (such as the addition of large diameter (≥ 600 mm) culverts that will enable mammal passage under the road surface, the clear span bridge to allow mammal passage along the existing riparian corridor, mammal fencing design to prevent road casualties, and a lighting design to prevent light spillage onto sensitive habitat types and prevent disturbance to nocturnal wildlife, as outlined in Chapter 07 'Biodiversity'. Other mitigation, such as phasing of specific works to limit impacts on certain species and species groups, and monitoring to assess and manage the effectiveness of mitigation measures have also been developed to minimise the impact of the Proposed Road Development on surrounding wildlife and habitats. Significant ecological input was also incorporated into the landscape design, to maximise biodiversity benefits in the operational phase.

18.1.3 Land and Soils

Accidental spillage or leakage of oils and fuels from construction machinery or site vehicles could potentially result in an impact on soils and groundwater underlying the Proposed Road Development site if inappropriately handled or stored. In addition to this, there is the potential for accidental spills and leaks to occur from vehicles using the Proposed Road Development during its operation. Potential contaminants could migrate through the subsoils and impact underlying groundwater.

However, with the implementation of mitigation measures outlined in Chapter 08 'Land and Soils' it was determined that the likelihood and magnitude of the potential effects on land and soils occurring during the construction phase will significantly reduce. It was therefore determined that residual effects to soil and groundwater from accidental spillage and leaks will be imperceptible provided that appropriate mitigation/control measures as specified will be applied.

18.1.4 Water

Similar to the above, there is risk of pollution due to accidental spillage and leaks from vehicles using the Proposed Road Development during its operation, as well as fuel spillages from machinery operating close to watercourses during the construction phase.

However, the mitigation measures outlined in Chapter 07 'Biodiversity' and Chapter 09 'Water', in addition to the embedded control measures that have been included in the design, will minimise the potential for any adverse effects to receiving water courses both during the construction and operational phases of the Proposed Road Development. It was therefore determined that residual effects to water from accidental spillage and leaks will be imperceptible provided that appropriate mitigation/control measures as specified are applied. These measures include the use of Sustainable Drainage Systems (SuDS), swales and petrol interceptors, as well as attenuation ponds. This suite of mitigation measures will protect the adjacent receiving environment from hydrocarbons during the operational phase. Attenuation ponds will also provide excellent ecological opportunities for wetland species.

18.1.5 Air Quality

As outlined in Chapter 10 'Air Quality' assessment, the National Roads Authority (now TII) Guidance states that a construction phase assessment of the potential effects from vehicle emissions, is only required for roads with a 10% or more change in annual average daily traffic flow. The Proposed Road Development is unlikely to result in this criterion being met and therefore a construction phase assessment of potential air quality effects associated with vehicle emissions was scoped out of the assessment.

During the operational phase, it was concluded that there will be both increases and decreases in annual mean NO_2 and PM_{10} concentrations at sensitive receptors as a result of the operation of the Proposed Road Development. Overall, it was concluded that the Proposed Road Development is not significant and considered neutral with respect to air quality.

18.1.6 Climate

Chapter 11 'Climate' concluded that there will be Greenhouse Gas (GHG) emissions resulting from both the construction and operational phase of the Proposed Road Development; for example, from the transport of materials and waste on and offsite during the construction phase, and additional vehicles usage during its operation. However, none of the effects will be major and of high significance.

18.1.7 Noise and Vibration

Road traffic noise during both the construction and operational phase could lead to negative noise effects on sensitive receptors in the study area. It was determined that with the implementation of appropriate noise control measures, including the use of screening, residual effects on the noise environment will be negative, moderate, local, and short-term for the majority of locations. However, where construction works are taking place within 25 m of a noise-sensitive location, worst-case noise effects have the potential to be negative and significant during the duration of the works.

During the operational phase, the assessment determined that with the inclusion of the recommended noise mitigation measures, traffic noise levels associated with the Proposed Road Development combined with traffic along the adjacent surrounding roads will be sufficiently reduced. The assessment has determined that once operational, the noise impact associated with the Proposed Road Development will likely result in negative, of slight significance, local, and long-term.

18.1.8 Landscape and Visual

As outlined in Chapter 13 'Landscape and Visual', road closures, traffic management works, and signage will have an effect upon the local landscape and views towards the construction site.

Related to site compounds the movement and activity of heavy plant will have a negative visual presence on a local scale due to size/scale and hazard lighting, this will remain a transient impact, irrespective of where the site compound(s) is located. Heavy plant located at the site compound (between chainage 0+000 and 0+050) will have a temporary local visual effect during the construction phase, however, they will not result in long-term landscape or visual effects.

Machinery, and material movements related to excavations and earthworks will result in temporary landscape and visual effects in available views within the study area where the construction of the new bridge occurs. However, visibility diminishes quickly with distance from the construction site due to intervening vegetation, topography and/or built structures. Removal of road/pavement surfaces, road closures, traffic management works, and signage will have a temporary effect upon the local landscape and views towards the construction site.

During the operational phase, the introduction of vehicle movements on the local landscape character of the Abbert River and its setting, a location where there haven't been any vehicle movements previously, could result in significant effects on the local landscape character. In addition to this, the introduction of vehicles will result in visual effects.

Lighting effects will arise from both the lighting columns proposed to illuminate the roundabout and the glare of cars using the road at night and in low light conditions. The frequency of vehicles will likely not be any greater than currently experienced on the existing N63. The effect of the roundabout lighting will be seen as an extension of the town lighting and not entirely isolated. Planting along the road will reduce the amount of glare from traffic where this has the potential to impact on residences.

Adherence to the proposed landscape mitigation measures, their successful implementation and maintenance will result in a reduction of visual effects over time as the proposed screening vegetation matures. The proposed mitigation planting aims to reduce the impact by introduction of hedgerows and clusters of trees.

18.1.9 Cultural Heritage

There are a number of heritage assets within the 500 m study area which are considered nationally or regionally important that will not be physically impacted by the Proposed Road Development, there is the possibility of adverse effects to the setting of the designated assets by noise, dust and vibration from construction related traffic which could diminish the importance of these assets. However, effects are likely to be short term in duration.

It has been identified that the settings of a number of Protected Structures, including Liss Bridge, will be improved by the removal of the sight and sound of traffic; therefore, creating a slight, long-term and beneficial effect on these assets.

The rural landscape surrounding Knockmoy Abbey (National Monument No. 166) will be permanently changed by the Proposed Road Development as its setting will be affected during the operation phase by noise, pollution and vibration from traffic during its operation. However, this will be off-set by better views of the monument. The residual significance of effect as identified in Chapter 14 ‘Cultural Heritage’ will be significant, long-term and adverse.

18.1.10 Material Assets- Agriculture

During the construction phase, additional traffic using the Proposed Road Development could cause noise disturbance on land parcels along the Proposed Road Development. The Material Assets - Agriculture assessment identified that the effects resulting from the generation of construction traffic will be temporary in nature and will generally not result in significant effects.

18.2 Population and Human Health

Population and Human Health interactions are summarised under the following sections.

18.2.1Traffic Analysis

The Proposed Road Development will impact traffic flows on the existing N63 and regional roads during the construction phase. The Traffic Analysis assessment has concluded that the enforcement of a Construction Traffic Management Plan (CTMP) will ensure that traffic impacts are minimised during the construction phase. The CTMP will ensure that construction traffic impacts are minimised through the control of site access/egress routes and site access locations and any necessary temporary lane closure requirements.

The network statistics, as outlined in Chapter 05 ‘Traffic Analysis’, indicate that the Proposed Road Development will provide a reduction in total distance travelled, a reduction in travel time and an increase in average speed throughout the entire modelled road network during the operational phase.

The Proposed Road Development will be of a higher safety standard than the existing road network and as a result will contribute to a network-wide reduction in collisions.

The provision of new walking and cycling facilities and the removal of regional traffic from the existing road as a result of the Proposed Development will enable a significant increase in the use of active modes. The new facilities will provide a means of access to important community facilities for individuals without access to a car, opportunities for social interaction, enhanced opportunities for independent mobility in older children and will enhance community cohesion and social networks.

18.2.2 Land and Soils

During the construction phase Soil excavation, earthworks and temporary stockpiling could contribute to negative effects on determinants of human health such as air quality.

The implementation of mitigation measures contained within the Outline Construction Environmental Management Plan (OCEMP) and Construction, Erosion and Sediment Control Plan (CESCP) will minimise the movement of material in order to reduce degradation of soil structure and generation of dust. Temporary storage of soil will be carefully managed in such a way as to prevent potential negative impact on the receiving environment.

18.2.3 Water

Construction activities have the potential to release sediment and cause unacceptable sediment levels in the catchment area which could potentially lead to temporary increases in sediment loading of the surface water network. Runoff containing large amounts of suspended solids could potentially adversely impact on surface water. however, as outlined in Chapter 09 'Water', it is considered unlikely large volumes of run off with large amounts of suspended solids will enter watercourses given the scale/phased nature of the development and distance of the majority of the route from the watercourses, and should it occur is likely to be temporary. Chapter 07 'Biodiversity' and Chapter 09 'Water' highlight mitigation and methodologies to ensure the protection of watercourses and aquatic biodiversity from works. Construction and operation phase mitigation measures have been developed in detail, to protect watercourses from the Proposed Road Development.

Any construction activities carried out close to surface waters involve a risk of pollution due to accidental spillage and leaks. Accidental spillage could potentially result in a direct or indirect effect to surface water should contaminants enter surface waters directly or migrate through the subsoils and underlying groundwater to surface waters. As outlined in Chapter 09 'Water' accidental spillages and leaks are considered unlikely to occur and should they occur are likely to be temporary or confined to one-off releases. There is the potential for accidental spills and leaks to occur from vehicles using the Proposed Road Development during its operation. However as outlined in Chapter 09 'Water', the impacts are unlikely to occur due to the embedded control measures that have been incorporated into the Proposed Road Development, including petrol interceptors and attenuation ponds.

Lime and concrete (specifically, the cement component) is highly alkaline and any spillage could enter surface water or migrate though subsoils and groundwater impacting surface water quality or potentially smothering the river bed, given a spill of sufficient volume. However, as outlined in Chapter 09 'Water' impacts associated with the use of concrete and lime are considered unlikely to occur and should they occur are likely to be confined to one-off releases.

The results of hydraulic modelling undertaken as part of the Flood Risk Assessment (FRA) displayed a model output for the Proposed with Mitigation scenario indicated a slight increase (maximum of 33 mm in-channel and 33 mm in the floodplain for the 1% AEP) in flood level upstream of the proposed crossing. The increase is attributed to the impact of the approach embankments and the span of the bridge restricting the overland flow path.

18.2.4Air Quality

During the construction phase approximately 95,000 m^3 of earthworks and pavement material will be moved. The imported fill materials will be brought to the Proposed Road Development site on the public road network. There is therefore potential for effects from the generation of dust up to 50 m from construction activities for dust-soiling, and up to 15 m for PM_{10}.

There will be 19 receptors sensitive to the human health effects of PM_{10} within 15 m of construction activity including residential properties, a school, and a community centre adjacent to the existing N63. As outlined in Chapter 10 'Air Quality' there are low baseline levels of PM_{10} within the study area (background PM_{10} is 11.0 $\mu g/m^3$ against the European Union Limit Values (EULV) of 40 $\mu g/m^3$) and any negative PM_{10} effects will be considered not significant and will be of short term duration (only during the construction period).

Operational phase impacts indicate a decrease in the number of properties exposed to PM_{10} and NO_x than will experience an increase within the study area. This is due to the re-routing of approximately 60% of vehicles from the existing N63 to the Proposed Road Development and thus effectively increasing the distance between the majority of receptors and the source of the emissions as the Proposed Road Development is further away. As a result, there will be an overall reduction in exposure to NO_x and PM_{10}.

As noted in Chapter 10 'Air Quality', following calculation of local scale pollutant concentrations; with reference to the Institute of Air Quality Management (IAQM) significance criteria, the NO_2, PM_{10} and $PM_{2.5}$ changes associated with the Proposed Road Development will be negligible and not significant overall.

As outlined in Chapter 10 'Air Quality', the implementation of standard industry good practice mitigation measures as proposed in Chapter 10 'Air Quality' and within the OCEMP will ensure that potential significant adverse effects from residual dust and vehicle emission impacts during the construction phase will not occur.

18.2.5 Climate

The climate assessment as presented within Chapter 11, has determined both construction and operational emissions to be of minor (Low significance) with the implementation of mitigation measures including for example tree and hedgerow planting, and the implementation of a CTMP and Contractors CEMP.

18.2.6 Noise and Vibration

During construction, there is potential for the noise criterion in the absence of noise mitigation over and above the use of site hoarding to be exceeded within distances of up to 25 m from the works. A small number of properties along the eastern end of the Proposed Road Development occur within 25 m of the proposed works. At these locations localised screening and a range of best practice mitigation measures as set out in Chapter 12 'Noise and Vibration' will be employed to ensure the construction noise limits are not exceeded along the length of the Proposed Road Development.

The noise and vibration assessment has determined that once operational, the noise impact associated with the Proposed Road Development will result in varying degrees of impact, from negligible to major in the long term. While some locations will experience an increase in noise levels (approximately 5 locations), this can be mitigated through measures set out in Chapter 12 'Noise and Vibration'. A number of locations will experience a positive noise impact as the Proposed Road Development is at a greater distance than the existing road.

18.2.7 Landscape and Visual

Visual effects as a result of the Proposed Development will have an effect on receptors including local residents, pedestrians and visitors to Knockmoy Abbey. The Proposed Road Development includes a unique viewing area of the Abbey and will therefore retain and promote views to the Abbey across the unspoilt landscape, albeit with periphery views of the new roundabout.

Receptors to lighting effects include local residents, vehicle drivers and passengers along nearby roads and pedestrians and cyclists on the existing N63. Lighting effects will arise from both, the lighting columns proposed to illuminate the roundabout and the glare of cars using the road at night and in low light conditions. However, the effect of the roundabout lighting will be seen as an extension of the town lighting and not entirely isolated.

Enforcement of the mitigation measures, described in the OCEMP, will ensure good working practices are followed so as to minimise and manage any significant, negative landscape and visual effects arising from construction. Adherence to the proposed landscape mitigation measures, their successful implementation and maintenance will result in a reduction of visual effects over time as the proposed screening vegetation matures.

18.2.8 Cultural Heritage

During the construction and operational phase, the rural landscape surrounding Knockmoy Abbey (National Monument No. 166) will be impacted by the Proposed Road Development. Its setting will be negatively effected by noise, pollution and vibration from traffic which could diminish the special interests or qualities of the Abbey. This will be compensated for by better views of the monument particularly to passing vehicles travelling west towards Abbeyknockmoy.

18.2.9 Major Accidents and Disasters

During the construction phase, there is a low potential for Major Accidents and Disasters. Storms, high winds, severe gales/winds or storm surges could however potentially cause incidents which result in damage to properties and/or serious injury to people. However, the control measures which will be in place during the construction phase such as those outlined in the OCEMP, which would prevent these by suspending working in storm conditions. The Contractors CEMP, risk assessments and safety method statements will reduce the risks from potential hazards such as falling objects and swinging loads from cranes during the construction stage. Further information is available within Chapter 15 'Major Accidents and Disasters'.

During the operational phase the potential for Major Accidents and Disasters remains low. Poor driving conditions during adverse weather caused by significant storms could result in road traffic accidents with the potential for significant harm to road users/pedestrians/cyclists, as well as damage to infrastructure and properties.

The Proposed Road Development will be of a higher safety standard than existing routes, reducing congestion in the area, therefore reducing the risk of accidents. In addition, the design of the Proposed Road Development incorporates a settlement pond that will attenuate peak discharges from storm events by allowing a controlled release of water into the adjacent watercourse. This will reduce the risk of flooding and create safer driving conditions.

Major accidents such as a bridge failure caused by a vehicle strike, impact damage or natural disaster such as seismic event could potentially result in structural collapse and a road traffic accident leading to significant harm to road users/pedestrians/cyclists. Although a bridge failure is extremely unlikely, design to industry codes and standards will reduce the risk of failure. For the Proposed Development, the design of the bridge is in accordance with the Eurocode requirements, a consequence class will be designated for the bridge which shall inform the design and consider the consequence of failure or malfunction of the structure with particular consideration given to the risks to human life, economy, society and the environment. Routine inspections of infrastructure will ensure that any defects can be identified as early as possible and repair works carried out to prevent deterioration and failure of the structure during the 120-year design life.

18.2.10 Material Assets-Non Agriculture

Construction works will result in service disruptions including electricity, water and telecommunications. Additional power demands may also impact the existing network during both construction and operational phases of the Proposed Development; however, no significant effects are anticipated during the construction or operational phases.

The Proposed Road Development will require the permanent acquisition of 2.94 ha of land over which there is a public right of way. As the lands are associated with the acquisition of roadbed at the front of certain properties and not associated with the property and as no access restrictions are anticipated, Chapter 16 'Material Assets - non Agriculture' identified the effects on the existing land use to likely be permanent, neutral and negligible and imperceptible as the viability of future land use will not be compromised. Therefore, no mitigation measures were deemed to be required.

The Proposed Road Development will require the permanent acquisition of 0.035 ha of residential land. With the implementation of embedded control measures, Chapter 16 'Material Assets - non Agriculture' identified effects from the partial acquisition of residential lands impact will remain permanent, negative, low and slight as no additional mitigation is possible to reduce the effect from the permanent partial land take.

18.2.11 Material Assets Agriculture

Land-take during the construction phase would be approximately 12.3 ha of agricultural land on 29 land parcels. The Proposed Road Development would sever 11 land parcels, separating approximately 18 ha of land and creating 7 new land parcels. In addition to this, the access point of 5 land parcels along the N63 would be acquired, and these land parcels would be severed unless alternative access is provided. The on-line works on the existing N63 would cause disturbance and impede access to existing agricultural lands. The increased separation/severance which occurred during construction on on-line sections of the Proposed Road Development is a temporary impact and the accesses across the N63 are restored in the operational phase. Residual effects at the construction phase are considered not significant.

During the operation phase, it is generally not possible to replace the acquired land with replacement land that adjoins the retained land parcel. Therefore, the land-take usually results in a permanent reduction in the size of land parcels directly affected by the Proposed Road Development. Where the Proposed Road Development would cross 11 land parcels causing the separation of part of those land parcels, there is a new permanent severance/separation impact. Without mitigation the new, additional length of boundary along the Proposed Road Development would be an additional permanent barrier to movement of livestock and machinery.

A number of mitigation measures have been outlined within Chapter 17 'Material Assets - Agriculture' such as the implantation of a key contact person during the construction phase, provision of access to land owners, provision of alternative water, electricity supply should disruptions occur.

During the operational phase certain permanent residual disturbance effects arising from the Proposed Road Development cannot be mitigated by the road design or proposed mitigation implemented by the Contractor, however, in practise these matters are usually effectively addressed in the compensation settlements which would allow farmers to implement the required mitigation.

18.3 Biodiversity

Biodiversity interactions are summarised under the following sections.

18.3.1 Land and Soil

Land and soil disturbance in areas outside of the route are to be minimised. There is potential for land and soil works to adversely affect Lough Corrib Special Are of Conservation (SAC) in the absence of mitigation. Implementation of the specific monitoring and mitigation measures in Chapter 07 'Biodiversity' would ensure that habitat damage is minimised and would ensure the protection of adjacent habitats including Lough Corrib SAC.

The Proposed Road Development will go through an Area of Annex I *Molinia* Meadows (As detailed in Chapter 07 'Biodiversity'), which is outside of Lough Corrib SAC, and which is not connected to, and shows no evidence of supporting any of this habitat within Lough Corrib SAC. Mitigation has been developed to translocate the affected habitat within the footprint of the Proposed Road Development, to a suitable, acquired field area that is positioned immediately adjacent to the Proposed Road Development. A stone layer, that permits free flow of water through it, will be laid below the proposed road, and will conserve local hydrological conditions for this habitat on both sides of the Proposed Road Development. A translocation and broad monitoring plan have been developed to ensure this habitat is conserved. Implementation of the specific monitoring and mitigation measures in Chapter 07 would ensure that this habitat is protected from the Proposed Road Development. An operational phase management plan is also required and noted in Chapter 07 'Biodiversity' and will be informed by habitat monitoring findings.

A monitoring plan and mitigation has been developed in Chapter 07 'Biodiversity' to ensure an Annex I petrifying spring within Lough Corrib SAC, that is adjacent to the Proposed Road Development but outside of the immediate road footprint, is protected during the construction and operation phase of the Proposed Road Development. This spring is located immediately adjacent to the existing N63. Implementation of the specific monitoring and mitigation measures in Chapter 07 would ensure that this habitat is protected from the Proposed Road Development. The mitigation measures incorporated in the Proposed Road Development may improve the ecological integrity of this habitat, relative to its current status, through protection from road contaminants and hydrocarbons.

A minor cutting section (0.5 to 1.0 m deep) between chainage (Ch.) 2+725 and 2+875 is included in the Proposed Road Development, approximately 100 m to the east of the Annex 1 petrifying spring. Cut-off drains or channels will be provided at the top of cutting slopes where the adjoining land slopes towards the cutting. These cut-off drains will discharge to existing watercourses where the topography permits and to the road drainage system in areas with no suitable outfall location. De-watering is not anticipated to be required in association with the section of cut. The section of the Proposed Road Development closest to the petrifying springs is also over the footprint of the existing N63 and changes to hardstanding cover will be minimal in this area, associated only with the cycleway. Taking into account the embedded control measures, Chapter 08 'Land and Soil' notes this will represent a negligible effect on the receptor.

18.3.2 Water

During construction, pollution from mobilised suspended solids will generally be the prime concern, but spillage of fuels, lubricants, hydraulic fluids and cement from construction plant may lead to incidents, especially where there are inadequate pollution mitigation measures. Various construction activities have the potential to release sediment and cause unacceptable sediment levels in the catchment area and impacts to the Lough Corrib SAC. Contamination from suspended sediments could be caused by construction of the bridge, culverts, diversions of drains and runoff from material stockpiles. Site stripping and bulk earthworks will leave deposits exposed to temporary erosion by wind or rain potentially leading to temporary increases in sediment loading of the surface water network.

Runoff containing large amounts of suspended solids could potentially adversely impact on surface water resulting in a direct effect of a negative nature and temporary duration. Large volumes of run off containing large amounts of suspended solids entering watercourses is considered unlikely to occur given the scale/phased nature of the development and distance of the majority of the route from the watercourses, and should it occur is likely to be temporary. The effect of sedimentation on aquatic habitats and organisms is addressed in Chapter 07 'Biodiversity'.

Any construction activities carried out close to surface waters involve a risk of pollution due to accidental spillage and leaks. Pollution as a result of accidental spillage could potentially affect fish, aquatic flora and could also have a dramatic effect on invertebrate communities. Accidental spillage could potentially result in a direct or indirect significant effect to surface water should contaminants enter surface waters directly or migrate through the subsoils and underlying groundwater to surface waters. Should accidental spillages or leaks occur, they occur are likely to be temporary or confined to one-off releases. With the appropriate mitigation measures followed and implemented, adverse impacts on water quality from pollutants are considered a small effect.

Any spillage of lime and concrete (specifically, the cement component) could enter surface water or migrate though subsoils and groundwater impacting surface water quality or potentially smothering the river bed, given a spill of sufficient volume. The effects would be considered significant. The activities most likely to result in contamination include concreting during road and bridge construction and concreting for culverts. Impacts associated with the use of concrete and lime are considered unlikely to occur. With the appropriate mitigation measures followed and implemented as noted in Chapter 07 'Biodiversity', adverse impacts on water quality from pollutants is to be deemed to be unlikely but would result in a small effect to an environment of extremely high significance/sensitivity and with a significant effect.

18.3.3 Air Quality

During the construction phase there is potential for effects from the generation of dust up to 50 m from construction activities for dust-soiling. There is one designated ecological site (Lough Corrib SAC) within 15 m of construction activity. There is potential for effects from the generation of dust during the construction phase at this site. The implementation of standard industry good practice mitigation measures as outlined in Chapter 07 – 'Biodiversity' and Section 10.9 of Chapter 10 'Air Quality' and within the OCEMP will mitigate potential significant adverse effects from residual dust and vehicle emission impacts.

During the operational phase, within the local air quality assessment study area, there is one designated ecological site, Lough Corrib SAC. The characteristics of this site with respect to air quality are identified in Chapter 10 'Air Quality'. Air quality impacts at this SAC were assessed at four locations across the site, to account for variations in expected effect at the SAC across the study area. In all cases the absolute concentration of NO_X were predicted to be well below the limit value of 30 µg/m^3 and the effects of the NO_X concentration are considered negligible and not significant. Modelled nitrogen deposition rates at sensitive receptors were found to be negligible and not significant overall (see Chapter 07 'Biodiversity', Section 7.6.4.3).

18.3.4 Noise and Vibration

Noise and vibration can course disturbance to wildlife. Noise from construction operations is not deemed to have a significant impact on species in the adjacent landscape. Of particular note, however, is the noise and vibration impact that sheet-piling for bridge abutments and excavation may have on species that use the Abbert River. Of particular note is the impacts that these works close to the Abbert River could have on protected mammals and potentially protected birds (e.g.) nesting birds including Kingfisher. These impacts can also influence fish and have adverse impacts on fish egg development. These impacts have been considered and specific requirements for sheet-piling for bridge abutment development (including timing of the works) have been devised in Chapter 07 'Biodiversity'. Chapter 07 also highlights the requirement for preconstruction surveys and the requirements for a derogation from National Parks and Wildlife Service (NPWS) if a protected mammal develops a holt (Otter) or sett

(Badger), or a protected bird creates a nest along the river bank in the vicinity of the proposed bridge structure, Therefore, impacts of noise and vibration in the construction phase have been considered and mitigation highlighted. No significant adverse operational impacts of noise and vibration were identified.

18.3.5 Landscape and Visual

Vegetation will be removed to facilitate the construction of the Proposed Road Development. The visual significance of the removal of hedgerows, areas of scrub and treelined hedgerows will range from moderate to significant adverse in the short-term. Changes to the landscape character due to the disruption of hedgerows and the associated field patterns will have an adverse effect ranging from moderate to significant adverse. However, the proposed landscape planting will reduce the effect to slight and neutral as new planting establishes. As the proposed planting matures and becomes established the perceivable change to the landscape character that resulted from the removal of established trees and hedgerows will be neutralised. See also Chapter 07 'Biodiversity' for details of significance of vegetation removal.

Excavation of the attenuation ponds will create exposed earth pits; which will result in short-term significant adverse landscape and visual effects. The proposed planting of marginal plants to the attenuation ponds will ensure naturalised edges and improved species diversity. The creation of new wildlife habitat will bring positive changes to the biodiversity and enhance the local area.

Proposed landscape mitigation measures take into account considerations and recommendations outlined in Chapter 07 'Biodiversity' and will ensure that, species which are locally indigenous are primarily utilised in the proposed planting scheme. A number of remediation measures have also been outlined within Chapter 13 'Landscape and Visual'. These include the use of wildflower mixes along verges, and habitat creation and translocation of *Molinia* grass sods from the affected area to a nearby field. Remediation measures for the *Molinia* meadow will occur as detailed in Chapter 07 'Biodiversity' Section 7.7.1.3.1.2, the area of *Molinia* meadow is identified in Volume 03, Figure A7-2.

18.3.6Major Accidents and Disasters

During the construction and operational phases, there is the potential for an accidental release of polluting material. For example, wet concrete during construction or during operation, fuel from a delivery tanker. If this material were to reach sensitive environmental receptors such as Lough Corrib, this could result in harm. The impact of such a release could potentially affect the Qualifying Interest (QI) species of Lough Corrib SAC and could have a negative effect on prey availability such as invertebrate communities.

A Contractors CEMP will be in place during the construction phase and includes pollution control measures. Mitigation measures are outlined within a number of chapters including Chapter 07 'Biodiversity', Chapter 09 'Water' and the OCEMP such as the use of high performance silt fencing and phasing of earthworks and refuelling of vehicles to occur in designated areas as well as ecological monitoring. Control and mitigation measures will be in place for duration of construction to prevent release of pollutants to the environment.

In addition, features have been included within the design of the Proposed Road Development which will aid with pollution control during the operational phase. These include:

- The provision for cut-off and storage in the event of a road accident causing spillage of harmful materials; and
- Runoff from rainwater that has passed over impermeable surfaces will be prevented from reaching local surface waters by collection in a closed drainage network connected to hydrocarbon interceptors prior to discharge to ponds before entering the Abbert River.

18.4 Land and Soil

Land and soil interactions are summarised under the following sections.

18.4.1Traffic Analysis

Construction traffic will arise from the earthworks stage of development from the removal of waste material offsite and the importation of infill required to raise the Proposed Road Development site. Traffic counts have been estimated for the earthworks stage of construction and have been assessed in Chapter 05 'Traffic Analysis'. The traffic analysis assessment identified no major effects during the construction phase of the Proposed Road Development following the implementation of mitigation measures such as the control of site access/egress routes, control of site access locations, and any necessary temporary lane closure requirements. Further information is available within Chapter 05 'Traffic Analysis'.

18.4.2 Population and Human Health

During construction, excavations and earthworks, temporary stockpiling of potentially dusty materials, cutting and grinding of materials and cement, use of unsurfaced haul roads and construction traffic haul roads could result in some temporary and negative effects on air quality, noise and neighbourhood amenity impacts (a determinant of human health).

Appropriate mitigation measures outlined in Chapter 07 'Biodiversity', Chapter 08 'Land and Soil', Chapter 10 'Air Quality', and Chapter 12 'Noise and Vibration' will likely reduce the significance and likelihood of effects on population and human health sensitive receptors as a result of the aforementioned impacts.

18.4.3 Biodiversity

The release of sediments and suspended solids to surface waters during construction works; for example, from runoff associated with material stockpiles, excavations, site stripping and earthworks, etc. could potentially affect the QI species of Lough Corrib SAC and could have a negative effect on prey availability such as invertebrate communities.

Pollutants have the potential to enter the Abbert River and spread to surrounding land (including QI habitats) during the construction phase. Accidental spillage associated with fuels, chemicals, lime, and concrete (i.e. concreting during road and bridge construction and concreting for culverts) could result in impacts on soils and groundwater underlying the Proposed Road Development if inappropriately handled or stored during the construction phase. Potential contaminants could migrate through the subsoils and impact underlying groundwater.

There will be no active de-watering, of the bedrock aquifer, required during the operation phase but passive de-watering, 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. This impact on the hydrogeological regime has the potential to affect the conservation status of groundwater-dependant aquatic or wetland habitats and species and therefore, has the potential to result in a significant negative impact.

With appropriate mitigation measures identified in Chapter 07 'Biodiversity' and Chapter 08 'Land and Soils', the significance of the effects on sensitive ecological receptors will likely be reduced. Specific mitigation is outlined for Annex I *Molinia* Meadows, and Annex I petrifying springs, which have been discussed in detail above (Section 18.3.1).

18.4.4 Water

Various construction activities have the potential to release sediment and cause unacceptable sediment levels in the catchment area and Lough Corrib SAC; for example, site stripping and bulk earthworks. Contamination from suspended sediments may also be caused by construction of culverts, diversions of drains and runoff from material stockpiles.

The mitigation measures outlined in Chapter 07 'Biodiversity', Chapter 08 'Land and Soil' will minimise the potential for any adverse effects to water features in the area from construction works. It was therefore determined that residual effects from the Proposed Road Development will be imperceptible provided that appropriate mitigation measures as specified are applied.

18.4.5 Air Quality

The excavation, processing and transportation of material on and offsite during the construction phase has the potential to result in adverse air quality impacts from dust. Approximately 95,000 m^3 of earthworks and pavement material will be moved, which is a moderate quantity of potentially dusty material. There is potential for effects from the generation of dust up to 50 m from construction activities for dust-soiling.

It was concluded in Chapter 10 'Air Quality' that with the implementation of standard industry good practice mitigation measures outlined within the OCEMP, a potential significant adverse construction dust effect will not occur, so the residual effect will be negligible.

18.4.6 Climate

Construction activities such as land clearance and land use change can affect GHG emissions resulting from changes in carbon sink potential. However, with embedded control measures and identified mitigation measures, as outlined in Chapter 11 'Climate', none of the potential effects from GHG emissions were identified to be of major or high significance.

18.4.7 Noise and Vibration

The construction phase of the Proposed Road Development will involve earthworks haulage, as well as the movement of machinery and materials within and to and from the construction compounds. Movement of excavated materials onsite could result in noise and vibration impacts on sensitive receptors surrounding the Proposed Road Development site during the construction phase. However, as outlined in Section 18.1.7, with the implementation of identified mitigation measures, residual effects on the noise environment will be negative, moderate, local, and short-term for the majority of locations. However, where construction works are taking place within 25 m of a noise-sensitive location, worst-case noise effects have the potential to be negative and significant during the duration of the works.

18.4.8Landscape and Visual

The Landscape and Visual Impact Assessment (LVIA) identified that material stockpiles, site clearance and earthworks could result in up to very significant temporary landscape and visual effects, on a localised scale, during the construction phase. However, effects will be temporary; therefore, no long-term landscape or visual effects are anticipated. In addition to this, proposed landscape mitigation measures will be implemented as part of the construction works, which will come into effect as the vegetation establishes and matures; this will reduce potential significant landscape and visual effects from site clearance and earthworks activities.

18.4.9 Cultural Heritage

It was identified in Chapter 14 'Cultural Heritage' groundworks will impact upon part of the planned landscape of Newtown (National Inventory of Architectural Heritage (NIAH) Ref: 5365) which is located at the eastern extent of the Proposed Road Development. This planned landscape was originally partly industrial in use with a mill pond (CH3) associated with a flour mill. The Proposed Road Development will impact upon a small part of the planned landscape, while the physical appearance will be impacted, this will not affect understanding of the asset.

The sub-surface remains of the western extent of the mill pond (CH3) including any sluice mechanisms as well as buildings could remain *in situ*. Groundworks associated with the construction of the Proposed Road Development will severely impact upon any such mill pond remains and upstanding building and any sub-surface remains should they exist. The Proposed Road Development will also cross agricultural land that has potential to contain previously unrecorded archaeological features. Groundworks will severely impact upon any such archaeological remains should they exist and will alter the special interests or qualities of an asset.

However, with the implementation of mitigation measures where applicable, in the form of archaeological testing and excavation, if appropriate, the residual effect was assessed to be moderate, adverse and long-term. Further information is available within Chapter 14 'Cultural Heritage'.

18.4.10 Major Accidents and Disasters

During the construction phase, there is a low potential for Major Accidents and Disasters. Storms, high winds, severe gales/winds or storm surges could however potentially cause incidents which result in damage to properties and/or serious injury to people. However, the control measures which will be in place during the construction phase such as a Contractors CEMP, would prevent these by suspending working in storm conditions. The CEMP, risk assessments and safety method statements will reduce the risks from potential hazards such as falling objects and swinging loads from cranes. Further information is available within Chapter 15 'Major Accidents and Disasters'.

During the operational phase the potential for Major Accidents and Disasters remains low. Poor driving conditions during adverse weather caused by significant storms could result in road traffic accidents with the potential for significant harm to road users/pedestrians/cyclists, as well as damage to infrastructure and properties.

The Proposed Road Development will be of a higher safety standard than existing routes, reducing congestion in the area, therefore reducing the risk of accidents. In addition, the design of the Proposed Road Development incorporates a settlement pond that will attenuate peak discharges from storm events by allowing a controlled release of water into the adjacent watercourse. This will reduce the risk of flooding and create safer driving conditions.

Major accidents such as a bridge failure caused by a vehicle strike, impact damage or natural disaster such as seismic event could potentially result in structural collapse and a road traffic accident leading to significant harm to road users/pedestrians/cyclists. Although a bridge failure is extremely unlikely, design to industry codes and standards will reduce the risk of failure. For the Proposed Development, the design of the bridge is in accordance with the Eurocode requirements, a consequence class will be designated for the bridge which shall inform the design and consider the consequence of failure or malfunction of the structure with particular consideration given to the risks to human life, economy, society and the environment. Routine inspections of infrastructure will ensure that any defects can be identified as early as possible and repair works carried out to prevent deterioration and failure of the structure during the 120-year design life.

18.4.11 Material Assets – Non Agriculture

As outlined in Chapter 08 'Land and Soils', there will be a requirement to remove 2,000 m^3 of unacceptable material (U1) offsite, as defined in the Specification for Road Works Series 600 (TII, 2013). As much as possible of acceptable material will be re-used (for example during landscaping and remediation works at the end of the construction phase) in line with waste management principles, legislation and guidance. A Waste Management Plan (WMP) will be prepared for the Proposed Road Development and will be cognisant of EPA guidance 'Best Practice Guidance for the Preparation of Resource and Waste Management Plans for Construction and Demolition Projects'. The Contractor will establish a system for the management of wastes in accordance with the Waste Management Hierarchy.

The material assets assessment identified that overall, the significance of effect from the generation and management of waste streams arising from the Proposed Road Development will likely be imperceptible as no significant reduction or alteration in the capacity of waste infrastructure at a national scale is anticipated.

18.4.12 Material Assets - Agriculture

The construction of embankments and the excavation of cuts in areas of agricultural land will result in the loss of land. As outlined in Chapter 17 'Material Assets- Agriculture', the reduction in land area will result in a permanent effect and the range of effect due to loss of land along the Proposed Road Development ranges from not significant to significant adverse.

The general construction works, traffic and movement of machinery during the construction phase would generate noise and dust which would potentially impact on adjoining lands (also refer to Chapter 10 'Air Quality' and Chapter 12 'Noise and Vibration'). Potential construction disturbance would also include interrupted access to retained lands, increased level of soil/dirt on road pavement and/or land adjoining the works and increased risks/reduced safety of farming the retained lands.

While construction disturbance can potentially be significant without mitigation, in general the effects are not significant due to short-term duration and standard construction mitigation where landowners are provided access to their retained lands.

18.5 Water

Water interactions are summarised under the following sections.

18.5.1 Biodiversity

Silt, and/or contaminants including oils, fuels, paints, lubricants, and/or concrete washings could have potentially significant pollution effects on water quality during both the constriction and operational phase. Pollution could significantly affect spawning habitats for species of the Lough Corrib SAC and reduce available invertebrate prey for QI species. A reduction in water quality due to sedimentation could affect hydrochemistry, impair plant growth and impact on fish spawning habitat downstream. In addition, significant pollution events could occur during a flood event.

Accidental spillage associated with fuels, chemicals, lime, and concrete (i.e. concreting during road and bridge construction and concreting for culverts) could result in impacts on soils and groundwater underlying the Proposed Road Development if inappropriately handled or stored during the construction phase. Potential contaminants could migrate through the subsoils and impact underlying groundwater, eventually migrating to the Abbert River. Applying the Precautionary Principle, during the construction phase pollution of this kind could result in soil and/or groundwater contamination migrating into nearby receiving waters within the Lough Corrib SAC.

The mitigation measures outlined in Chapter 07 ‘Biodiversity’ and Chapter 09 ‘Water’, as well as the implementation of embedded control measures will reduce the likelihood and magnitude of the potential effects on the biodiversity occurring during the construction and operational phase.

18.5.2 Land and Soil

During the construction phase accidental spillage of fuels or chemicals could potentially result in the impact of soils and groundwater underlying the Proposed Road Development site if inappropriately handled or stored. Potential contaminants could migrate through the subsoils and impact underlying groundwater. Stockpiling of unsuitable soils will be undertaken prior to removal from site. In the absence of mitigation, this would have the potential to impact on soil and groundwater, through the leaching of contaminants. In addition, lime and concrete (specifically, the cement component) spillage which migrates through subsoil could impact groundwater quality. A number of mitigation measure to reduce the potential significance of effects are outlined within Chapter 08 ‘Land and Soils’.

During the operational phase there is the potential for accidental spills and leaks to occur from vehicles using the Proposed Road Development. However, the impacts are unlikely to occur due to embedded control measures that have been incorporated into the Proposed Road Development. For example, releases of fuel or chemicals from accidental spills associated with potential road traffic accidents or runoff from rainwater that has passed over impermeable surfaces will be prevented from polluting the local surface waters as all surface water runoff from the paved areas will be collected in a closed drainage network and will pass through petrol interceptors prior to discharge to ponds before entering the Abbert River.

The embedded control measures outlined in Chapter 04 ‘Description of the Proposed Road Development’, including the inclusion of attenuation ponds, will minimise the potential for adverse effects to soils and groundwater from drainage from the Proposed Road Development during the operational phase. As such, likely significant effects on receiving land and soils environment are not anticipated.

18.5.3 Major Accidents and Disasters

During the construction phase, there is a low potential for Major Accidents and Disasters. Storms, high winds, severe gales/winds or storm surges could however potentially cause incidents which result in damage to properties and/or serious injury to people. However, the control measures which will be in place during the construction phase such as a Contractors CEMP, would prevent these by suspending working in storm conditions. The CEMP, risk assessments and safety method statements will reduce the risks from potential hazards such as falling objects and swinging loads from cranes. Further information is available within Chapter 15 ‘Major Accidents and Disasters’.

During the operational phase the potential for Major Accidents and Disasters remains low. Poor driving conditions during adverse weather caused by significant storms could result in road traffic accidents with the potential for significant harm to road users/pedestrians/cyclists, as well as damage to infrastructure and properties.

The Proposed Road Development will be of a higher safety standard than existing routes, reducing congestion in the area, therefore reducing the risk of accidents. In addition, the design of the Proposed Road Development incorporates a settlement pond that will attenuate peak discharges from storm events by allowing a controlled release of water into the adjacent watercourse. This will reduce the risk of flooding and create safer driving conditions.

Major accidents such as a bridge failure caused by a vehicle strike, impact damage or natural disaster such as seismic event could potentially result in structural collapse and a road traffic accident leading to significant harm to road users/pedestrians/cyclists. Although a bridge failure is extremely unlikely, design to industry codes and standards will reduce the risk of failure. For the Proposed Development, the design of the bridge is in accordance with the Eurocode requirements, a consequence class will be designated for the bridge which shall inform the design and consider the consequence of failure or malfunction of the structure with particular consideration given to the risks to human life, economy, society and the environment. Routine inspections of infrastructure will ensure that any defects can be identified as early as possible and repair works carried out to prevent deterioration and failure of the structure during the 120-year design life.

18.6 Air Quality

Air Quality will interact with the following:

18.6.1 Traffic Analysis

The Traffic Analysis chapter assesses the impacts of the Proposed Road Development on traffic. It outlines the development of the traffic models used to analyse the N63 Liss to Abbey Realignment Scheme and the future year traffic growth factors used to generate projected Annual Average Daily Traffic (AADT) on all key roads in the study area as well as the existing and projected traffic figures for both the Do-Minimum and Do-Something scenarios. These figures provide a basis for assessments presented in a number of chapters including Chapter 10 ‘Air Quality’.

As outlined in the Air Quality assessment (Chapter 10), the effect associated with vehicle emissions during the construction phase was scoped out of the assessment. During the operational phase, it was concluded that there will be both increases and decreases in annual mean NO_2 and PM_{10} concentrations at sensitive receptors as a result of the operation of the Proposed Road Development. Overall, it was concluded that the Proposed Road Development is not significant and considered neutral with respect to air quality.

18.6.2 Population and Human Health

During the construction phase, a number of construction activities including excavations and earthworks, temporary stockpiling of potentially dusty materials, waste, cutting and grinding of materials and cement, use of unsurfaced haul roads and construction traffic haul roads could result in temporary and negative air quality and neighbourhood amenity impacts.

However, the air assessment (Chapter 10 Air Quality) concluded that after mitigation the dust impact will be negligible and not significant, and the number of Heavy Goods Vehicles (HGV) used during the construction phase is expected to be small enough that the effect of the construction traffic on air quality will also be negligible and not significant.

During the operational phase, the air quality assessment concluded that overall effects from the Proposed Road Development will be considered negligible and not significant with respect to air quality.

18.6.3 Biodiversity

Road traffic could give rise to emissions from exhausts for oxides of nitrogen. Increased deposition of Nitrogen within the immediate environment of the Proposed Road Development could also occur. Effects on receiving habitats, especially vegetation communities can include influences on plant growth rates, species composition, species abundance and diversity. As discussed in Chapter 07 ‘Biodiversity’, during operation, air quality impacts from the Proposed Road Development on vegetation within Lough Corrib SAC and other habitats within the Zone of Influence (ZoI) of the Proposed Road Development works are not likely to occur and will not result in a likely significant negative effect on sensitive ecological receptors, at any geographic scale.

Deposition of dust from construction-related activities could cause local effects on the diversity or range of plant species and on habitat structure within Lough Corrib SAC and other habitats within the ZoI of the Proposed Road Development works. Dust deposition to the Abbert River from construction activities could also impact on fauna of the SAC (Abbert River).

Standard industry good practice mitigation measures (as outlined in the OCEMP) will be applied to the Proposed Road Development site, including site speed limits, road sweeping, wheel wash facilities and the implementation of a dust management plan. Further information is contained within Chapter 10 ‘Air Quality’.

18.6.4 Climate

Emissions to air could arise from the Proposed Development during both the construction and operational phase, for example, from construction activities, transportation of materials and waste, and traffic using the route during operation. However, it was concluded in Chapter 11 ‘Climate’ that as the GHG emissions associated with the Proposed Road Development do not represent ≥1% of the projected National Emissions Inventories for 2022 and 2040, GHG emissions during construction and operation will be of minor significance.

18.6.5 Cultural Heritage

There are a number of heritage assets within the 500 m study area of national or regional importance. As discussed in Chapter 14 ‘Cultural Heritage’, although these assets will not be physically impacted by the Proposed Road Development, there is the possibility of negative effects to the setting of the designated assets by dust from construction related traffic which could diminish the importance of these assets. However, during the construction phase, procedures will be adopted, as described in the OCEMP, to ensure that archaeological areas and sites are protected during construction.

18.6.6 Material Assets- Agriculture

Potential construction disturbance on farm land parcels could occur from dust and air emissions during construction. Dust and air emissions will arise from excavation works and construction traffic, however the spread of dust onto adjoining lands will be minimised by way of mitigation measures as set out within Chapter 10 ‘Air Quality’ and Chapter 17 ‘Material Assets – Agriculture’.

The material assets- agriculture assessment identified that the effects resulting from dust will be temporary in nature and will generally not result in significant effects.

18.7 Climate

18.7.1 Traffic Analysis

Chapter 11 ‘Climate’ concluded that there will be GHG emissions resulting from both the construction and operational phase of the Proposed Road Development; for example, from the transport of materials and waste on and offsite during the construction phase, and additional vehicles usage during its operation. However, none of the effects will be major and of high significance.

18.7.2 Population and Human Health

Many of the potential population and human health effects of the Proposed Road Development arise from air quality, noise and vibration, visual and traffic effects. Therefore, the human health impact assessment relies on the assessments and draws on the findings of a number of chapters including Chapter 11 ‘Climate’.

The climate assessment determined that during the construction phase, with the mitigation measures as defined in Chapter 11 in place, the Proposed Road Development will result in a minor (low significance) of impact due to emissions being calculated to be less than 1% of the national inventory.

During the operational phase an assessment of the likely climate change effects arising from the operational phase of the Proposed Road Development was assessed within Chapter 11 'Climate'. It was determined within Chapter 11 'Climate' that during the operational phase, in relation to Ireland's national GHG inventory, the impact of GHG emissions have been found to be minor (low significance).

Therefore, given the scale and nature of the Proposed Road Development, the effect of the Proposed Road Development on climate change as a determinant of human health was assessed to be **neutral (0).**

18.7.3 Biodiversity

Bridges, bankside vegetation and trees provide shade along watercourses which promotes thermal regulation that will become increasingly important to Salmonids and other fish species as climate change alters water temperatures in riverine environments. Shading associated with the proposed bridge crossing at the Abbert River is unlikely to result in habitat loss or displacement of QI Atlantic Salmon or other QI species during the operation phase. In the absence of mitigation and appropriate control measures removal of bankside vegetation and bank material could result in significant temporary effects at a Local level. The implementation of mitigation measures, embedded design measures (including a set back of ≥ 5 m for the bridge abutments from the Abbert River), and ecological monitoring outlined in Chapter 07 Biodiversity, will reduce unnecessary vegetation clearance and reduce the magnitude of the potential effects on biodiversity occurring during the operational phase.

18.7.4 Water

Potential climate risks to the Proposed Road Development (climate change resilience) during the operational phase include increased frequency and severity of extreme weather events (such as heavy and/or prolonged precipitation). Increases in winter precipitation could also lead to surface water flooding and standing waters.

However, embedded control measures for the Proposed Road Development, include the design of the attenuation system to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. The drainage networks are designed to include an increase of 20% in rainfall depth to cater for the impact of climate change.

The proposed scheme with mitigation scenario included upsizing of two proposed ditch culverts and the addition of three flood connectivity culverts to improve the conveyance of flow through the proposed approach embankments. Model output for the proposed with mitigation scenario indicated a slight increase (maximum of 33 mm in-channel and 33 mm in the floodplain for the 1% Annual Exceedance Probability (AEP)) in flood level upstream of the proposed crossing.

18.7.5 Major Accidents and Disasters

An increased frequency and severity of extreme weather conditions as a result of climate change, could cause damage to road surface conditions leading increased frequencies of road traffic accidents. For example, flood events can impact the integrity of road structures and the road surface. The effects of potential increases in groundwater levels are significant for road drainage and pavement foundations. However, the control measures outlined in Chapter 15 'Major Accidents and Disasters' which include inherent design features will reduce the severity and consequence of the potential for damage to road surfaces from extreme weather events.

18.7.6 Material Assets

Potential climate risks to the Proposed Road Development (climate change resilience) during the operational phase include increased frequency and severity of extreme weather events (such as heavy and/or prolonged precipitation, storm events and heatwaves) which could lead to damage to drainage systems due to flooding from intense rainfall.

However, as outlined in Chapter 11 'Climate', embedded control measures for the Proposed Road Development, which include the design of the attenuation system to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse. The climate change resilience measures built into the design of the Proposed Road Development (outlined in Chapter 11 Climate) are considered to be appropriate in the context of the climate change projections outlined in the Climate chapter and no additional mitigation measures were deemed required.

18.8 Noise and Vibration

Noise and Vibration will interact with the following:

18.8.1 Traffic Analysis

As noted in Chapter 12 'Noise and Vibration', road traffic noise during both the construction and operational phase could lead to negative noise effects on sensitive receptors in the study area. During the operational phase, the noise and vibration assessment determined that with the inclusion of the recommended noise mitigation measures, traffic noise levels associated with the Proposed Road Development combined with traffic along the adjacent surrounding roads will be sufficiently reduced.

18.8.2 Population and Human Health

During the construction phase, a number of construction activities including excavations and earthworks, cutting and grinding of materials and cement, use of unsurfaced haul roads and construction traffic haul roads could result in temporary and negative effects on noise and neighbourhood amenity, which has been identified as a determinant of human health. It was determined that with the implementation of noise limits, restricted hours of operation, along with implementation of appropriate noise control measures, the construction noise effects will be short term and moderate to major impact (Chapter 12 'Noise and Vibration'). However, where construction works are taking place within 25 m of a noise-sensitive location, worst-case noise effects have the potential to be negative, significant, local and short-term. Therefore, the effect of the Proposed Road Development on noise and neighbourhood amenity was assessed to be negative (-) due to the potential negative moderate and significant noise effects on sensitive receptors in the study area.

18.8.3 Biodiversity

Noise and vibration from construction works could result in disturbance/displacement of protected mammals including otters and badgers, as well as birds. Vibration from construction works could also result in effects to fish embryos and Brook Lamprey eggs.

During the construction phase increased human presence and/or noise and vibration associated with construction works has the potential to displace Badgers from both breeding/resting places and from foraging habitat. Noise and vibration also have the potential to temporarily displace commuting Otters within the river channel.

Both Badgers and Otters are generally nocturnal in habit and construction works will typically be carried out within normal daylight working hours. Displacement of Badgers from foraging areas is considered unlikely to affect the local Badger population and will not result in a likely significant negative effect, at any geographic scale. In addition, disturbance during construction is not likely to have a significant effect on the conservation status of Otter populations at a Local or wider scale.

Noise and vibration disturbance of potential risk of disturbance to birds include sheet piling, excavation and anthropogenic activity (construction). Mitigation measure are detailed within Chapter 07 'Biodiversity'. It is anticipated potential effects will not be significant above Local geographic scale. The duration of these potential effects is estimated will be limited to be short to medium term.

Fish embryos exposed to physical disturbance during epiboly can sustain tears in the perivitelline membrane, causing yolk to leak within the embryo. The potential for significant injury and/or disturbance effects to QI Atlantic Salmon and Brook Lamprey eggs from piling is assumed to be significant within the locality of proposed drilling/piling, during drilling. This will be a localised temporary impact with potentially significant effects in the short-term (1-7 years). Further information can be found in Chapter 07 'Biodiversity'.

Having regard to the preferred migration periods for Atlantic Salmon, it is recommended that works associated with the piling in proximity to the Abbert River will be undertaken within the timeframe of 1 July to 30 September (inclusive) unless otherwise agreed with Inland Fisheries Ireland. To mitigate impacts to QI Brook Lamprey, a 'soft-start' to drilling/piing will also be employed to allow lamprey and other fish to move away before the full intensity of drilling/piling begins.

Further mitigation measures are outlined in Chapter 07 'Biodiversity' and Chapter 12 'Noise and Vibration'. It is anticipated the implantation of mitigation measures as outlined within these chapters would likely reduce potential negative effects. Also see Section 18.3.4 (Noise and Vibration).

18.8.4 Cultural Heritage

There are a number of heritage assets within the 500 m study area of national or regional importance. As discussed in Chapter 14 'Cultural Heritage', although these assets will not be physically impacted by the Proposed Road Development, there is the possibility of adverse effects on the setting of the designated assets by noise and vibration from construction related traffic which could diminish the importance of these assets. During the construction phase, procedures will be adopted, as are described in the OCEMP, to ensure that archaeological areas and sites are protected during construction.

The setting of Liss Bridge (Record of Protected Structures (RPS) No. 3925) may be temporarily impacted by noise dust and vibration from the construction works but this will cease as the road construction progresses and moves away from the asset. The bridge is currently part of a busy road network with high volumes of traffic passing over it. The change to setting will be such that the special interests or qualities of the bridge are slightly affected.

During operation the rural landscape surrounding Knockmoy Abbey (National Monument No. 166) will be negatively effected by noise, pollution and vibration from traffic using the Proposed Road Development. This could diminish the special interests or qualities of the Abbey; however, this will be off-set by better views of the monument afforded to passing vehicles especially travelling west towards Abbeyknockmoy. In addition, embedded control consisting of a viewing area will afford views of the monument. These measures will reduce the magnitude of effect. The significance of effect will be significant, long-term and adverse.

The setting of the Protected Structure, Rose Villa (RPS No. 3923), will be impacted by noise from traffic using the new road. However, the transfer of traffic from the existing N63 to the Proposed Road Development will move traffic away from the asset resulting in a reduction of noise, pollution and vibration to the setting of Rose Villa. The change to setting will be such that the special interests or qualities of the bridge could be better appreciated.

Liss Bridge (RPS No. 3925), and Rose Villa (RPS No. 3923) have been identified as experiencing a low effect to their settings from the Proposed Road Development while the removal of traffic during operation will enhance their settings. The residual significance of effect will be slight, long-term and beneficial. Further information is available in Chapter 14 'Cultural Heritage'.

18.8.5 Material Assets - Agriculture

The Material Assets - Agriculture assessment identified that the Proposed Road Development will cause disturbance to agricultural enterprises during the construction and operational phases.

Disturbance during the construction phase relates to construction activities. Construction works and traffic within the Proposed Road Development site will generate noise, dust and movement of machinery which will potentially impact on adjoining lands. The duration of these works will vary. Rock breaking and piling activities may result in a flight response in livestock but rarely causes a significant impact.

A number of mitigation measures have been outlined within Chapter 17 'Material Assets – Agriculture', including:

- A key contact person will be appointed during the construction phase to facilitate communications between affected landowners and to facilitate the re-organisation of farm enterprises by farmers during critical times; and
- Landowners with lands adjoining sites where either rock breaking, piling takes place will be notified in advance of these activities.

In addition, It Is anticipated communication would occur between the contractor and adjacent landowners during the construction phase, and where necessary, this could facilitate in the movement of farm animals to avoid undue disturbance.

While landowners will experience temporary disturbance during construction, the effects resulting from the generation of noise, dust and construction traffic are temporary in nature and will generally not result in significant effects.

During the operational phase, noise disturbance on farm holdings could occur from traffic noise and movement using the Proposed Road Development. On-going maintenance works will also be required during the operational phase to maintain the Proposed Road Development. Permanent disturbance impacts caused by traffic will result in not significant effects.

18.9 Landscape and Visual

Landscape and Visual will interact with the following:

18.9.1 Traffic Analysis

As mentioned previously Chapter 13 'Landscape and Visual' outlines road closures, traffic management works, and signage will have an effect upon the local landscape and views towards the construction site. The movement and activity of heavy plant will have a negative visual presence on a local scale due to size/scale and hazard lighting. Machinery, and material movements related to excavations and earthworks will result in temporary landscape and visual effects in available views within the study area where the construction of the new bridge occurs.

During the operational phase, the introduction of vehicle movements on the local landscape character of the Abbert River and its setting, could result in significant effects on the local landscape character. In addition to this, the introduction of vehicles will result in visual effects. Lighting effects will arise from both the lighting columns proposed to illuminate the roundabout and the glare of cars using the road at night and in low light conditions.

Adherence to the proposed landscape mitigation measures, their successful implementation and maintenance will result in a reduction of visual effects over time as the proposed screening vegetation matures.

18.9.2 Population and Human Health

As outlined in Chapter 13 'Landscape and Visual', the road design has incorporated a new viewing area for the Knockmoy Abbey for the benefit of users and in particular for the benefit of the local community.

18.9.3 Biodiversity

The landscape mitigation proposals form a strategy for integrating the Proposed Road Development into the existing river valley, by introducing tree and woodland planting and re-connecting the field patterns with new hedgerows. Positive impact will be experienced locally through the planting of non-annex habitats, including species-rich wildflower meadow, wetland habitat reinstatement and the reuse of spoil/vegetated turves. Hedgerow planting of native mixed species will be used to integrate the road in the existing field patterns but will also improve local biodiversity with the substantial planting of native hedgerow mixes containing hawthorn, blackthorn, alder buckthorn, guelder rose and dog rose. When planted along the banks and roadsides the hedgerows will form a physical barrier to encourage Barn Owls to fly up and over the road and avoid potentially high risk of collision with on-coming traffic. Tree planting will be introduced in clusters or copses of native trees within the field patterns, combined with the new hedgerows they will provide both new habitat creation and commuting routes for local species. In addition, the landscape plan will aid in the recovery of habitat types such as treelines and vegetative scrub. The development of ponds is likely to be associated with enhancing the wetland biodiversity of the area, for various species including some ducks and waterfowl, and amphibians, as well as aquatic plants and invertebrates.

18.9.4 Climate

Planned tree and hedgerow planting onsite, as described in Chapter 07 'Biodiversity' and Chapter 13 'Landscape and Visual', will reduce the impact of land use change on GHG emissions.

18.9.5 Cultural Heritage

As outlined in Chapter 14 'Cultural Heritage', landscape design has been used as a key tool through which the impacts of the Proposed Road Development on Protected Structures and historic landscape, which could result in negative effects on their setting, has been mitigated. Throughout the Proposed Road Development, sensitive and appropriate tree and shrub screen planting will be employed to aid the integration of the Proposed Road Development with the surrounding landscape. For example, the effect on the rural setting of Knockmoy Abbey (National Monument No.166) from the presence of the Proposed Road Development will be reduced to some degree by sensitive landscaping and planting; and a new viewing area is incorporated in the design of the Proposed Road Development.

18.9.6 Material Assets- Agriculture

Permanent disturbance on agricultural land holdings included the loss of shelter. However, as outlined in Chapter 17 Material Assets- Agriculture, the loss of shelter will be addressed by the proposed landscaping plan. In addition, landscaping along the Proposed Road Development will minimise the visual impact on farms along the route of the Proposed Road Development during its operation.

18.10 Cultural Heritage

18.10.1 Traffic Assessment

As mentioned previously and as outlined in Chapter 14 'Cultural Heritage' there are a number of heritage assets within the 500 m study area which are considered nationally or regionally important, the setting of which could be effected by noise, dust and vibration from construction related traffic which could diminish the importance of these assets. However, effects are likely to be short term in duration.

It has been identified that the settings of a number of Protected Structures, including Liss Bridge, will be improved by the removal of the sight and sound of traffic; therefore, creating a slight, long-term and beneficial effect on these assets. The rural landscape surrounding Knockmoy Abbey (National Monument No. 166) will be permanently changed by the Proposed Road Development as its setting will be affected during the operation phase by noise, pollution and vibration from traffic during its operation. However, this will be off-set by better views of the monument.

18.10.2 Population and Human Health

The road design has incorporated a new viewing area for the Knockmoy Abbey for the benefit of users and in particular for the benefit of the local community.

18.10.3 Noise and Vibration

As mentioned previously and as outlined in Chapter 14 'Cultural Heritage' there are a number of heritage assets within the 500 m study area of national or regional importance, the setting of which could be effected by noise, dust and vibration from construction related traffic which could diminish the importance of these assets. However, effects are likely to be short term in duration. During the construction phase, procedures will be adopted, as are described in the OCEMP, to ensure that archaeological areas and sites are protected during construction. The setting of Liss Bridge (RPS No. 3925) may be temporarily impacted by noise dust and vibration from the construction works but this will cease as the road construction progresses and moves away from the asset.

During operation the rural landscape surrounding Knockmoy Abbey (National Monument No. 166) will be negatively effected by noise, pollution and vibration from traffic using the Proposed Road Development; however, this will be off-set by better views of the monument afforded to passing vehicles especially travelling west towards Abbeyknockmoy. In addition, embedded control consisting of a viewing area will afford views of the monument. These measures will reduce the magnitude of effect. The setting of the Protected Structure, Rose Villa (RPS No. 3923), will be impacted by noise from traffic using the new road. However, traffic will move away from the asset resulting in a reduction of noise, pollution and vibration to the setting of Rose Villa.

18.10.4 Landscape and Visual

The views from the Abbey are of considerable importance to the setting and are integral to visitor experience. The main effects relate to the views associated with the Knockmoy Abbey and the perception of the road passing through the rural landscape. The Proposed Road Development will be closer to the Abbey than the existing N63, at approximately 300 m distance and elevated on embankments. In particular the new roundabout will be a new feature of views with little intervening existing vegetation, the roundabout will also be illuminated, with lighting columns 8.0 m tall. The main receptor groups are pedestrians and recreational visitors to the Abbey grounds.

Proposed mitigation includes hedgerow planting of the embankments and clusters of trees becoming denser at the roundabout. This will enable partial screening of the roundabout, and it will break up the massing of the linear road form. Views more easterly towards the river and bridge crossing embankments will likewise be broken up by tree clusters and hedge planting, which will screen the road surface. The proposed mitigation cannot entirely screen the Proposed Road Development or camouflage its embankments, but it will substantially reduce the visual effect to Slight and Adverse. Additionally, remediation measures for the Proposed Road Development will include a new viewing area looking towards the Knockmoy Abbey. The viewing area will be elevated to maximise the views, it will include layby space for motorists to pull over and walk to the viewing point and it will have a footpath connecting the viewing area with Abbeyknockmoy village. Planting to screen the proposed roundabout will frame views of the Abbey and restrict views to the new road. For further information see Chapter 13 ‘Landscape and Visual’.

18.11 Major Accidents and Disasters

18.11.1 Water/Land and Soils/Biodiversity

The Proposed Road Development has an inherently low potential for Major Accidents and Disasters which can result in significant harm to people and/or the environment.

During the construction phase, an accidental release of substances such as wet cement, spills from vehicles including road tankers could result in harm to the environment if the quantity was sufficient to cause an impact.

A Contractors CEMP (based upon the OCEMP) will therefore be in place during the construction phase and will include robust pollution prevention and control measures which are detailed within Chapter 07 ‘Biodiversity’, Chapter 08 ‘Land and Soils’, and Chapter 09 ‘Water’. Prevention and mitigation measures include the use of high performance silt fencing, phasing of earthworks and designated areas for refuelling of vehicles. These measures will be in place for duration of construction activities to reduce the potential for a release. A CESCP will also be produced.

The Proposed Road Development will incorporate surface water runoff collection and treatment facilities so that rainfall from all hardstanding areas is effectively removed from the road surface and treated before discharge. This includes the provision for storage in the event of a road accident causing spillage of deleterious materials such as fuels. Taking into consideration the prevention and mitigation measures which are best practice, it has been demonstrated that the risk of a major accident resulting from a release of harmful substances reaching the receiving environment has been reduced to as low as practicable.

18.12 Material Assets – Non-Agriculture

18.12.1 Population and Human Health

The Proposed Road Development will require the permanent acquisition of 0.035 ha of residential land to facilitate the proposed new footpaths. As outlined in Chapter 16 ‘Material Assets Non-Agriculture’, where the partial acquisition of residential land will be required, it is proposed to re-build the existing boundary wall in a different location and restore entrances and accesses to residential properties. With the implementation of these embedded control measures, there will be no access restrictions to the residential properties. Additional information on temporary land acquisition can be found in Chapter 16 ‘Material Assets - Non-Agriculture’.

18.12.2 Biodiversity

It has been identified that potential exists for habitat deterioration within Lough Corrib SAC and within habitats excluding Lough Corrib SAC in the form of habitat removal, water pollution and littering/dumping of waste generated onsite and site access. In the absence of mitigation, potential impacts could result in significant effects. However, the implementation of mitigation, will ensure a reduction in the potential for any long term significant impacts related to habitat damage or deterioration. Potential effect of habitat deterioration in the form of physical damage (outside of the works footprint) release of general waste and construction debris has also been identified. A number of mitigation measure have been outlined within Chapter 07 ‘Biodiversity’, including:

- Clearly demarking the works area;
- Avoidance and marking of sensitive habitats;
- Development of specific refuelling areas positioned away from watercourses;
- Development of an OCEMP (and Contractors CEMP) and CESCP;
- Implementation of emergency response and environmental training to be carried out by the Contractor during the construction phase, this would include procedures to be carried out in the event of the release of fuel or other hazardous wastes; and
- The inclusion of a construction and demolition WMP which clearly sets out the Contractor’s proposals regarding the treatment, storage and recovery or disposal of waste.

18.12.3 Land and Soils/Water

Incorrect storage and management of waste or the use of unauthorised waste hauliers and/or receiving facilities could give rise to inappropriate management or storage of waste and result in negative environmental effects on the soil, hydrogeological and water environments offsite. Implementation of the project specific Construction and Demolition WMP and the use of permitted hauliers and authorised receiving facilities will ensure appropriate management of waste. A Construction, Erosion and Sediment Control Plan (CESCP) will also be produced.

Soil requiring offsite disposal will be managed in accordance with relevant waste legislation (Classification, Labelling and Packaging Regulation (CLP) European Waste Catalogue and Hazardous Waste List (EPA, 2002), EU Council Decision (2003/33/EC) of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of Annex II to Directive 19999/31/EC, Council Directive 1999/31/EC on the landfill of waste, Waste Management Act 1996, the Environment (Miscellaneous Provisions) Act 2011 (No. 20 of 2011). Any used spill kits or other hazardous wastes will be disposed of using a hazardous waste disposal contractor and in accordance with all relevant EU and Irish waste management legislation

18.12.4 Climate

The Lifecycle GHG Impact Assessment identified that during the construction phase land use change accounts for 22.9% the construction emissions while waste disposal accounts for <1%. However, it is noted that planned tree and hedgerow planting onsite, as described in Chapter 07 ‘Biodiversity’ and Chapter 13 ‘Landscape and Visual’, will reduce the impact of land use change on GHG emissions. In relation to Ireland’s national GHG inventory, the effect from GHG emissions during the construction phase of the Proposed Road Development have been found to be minor (low significance).

18.12.5 Major Accident and Disasters

There is a low potential for major accidents and disasters as a consequence of a release of wastes and other materials from the Proposed Road Development. During the construction phase, a CEMP, safety risk assessments and method statements will include control measures for housekeeping, waste management and temporary restrictions to activities during adverse weather. No impacts have been identified during the operational phase.

18.13 Material Assets - Agriculture

18.13.1 Population and Human Health

Potential interactions occur between population and human health and material assets agriculture where land take impacts may occur. Mitigation has been proposed within Chapter 17 ‘Material Assets – Agriculture’ such as

- The landowner will be provided with access to all separated land parcels during the construction of the Proposed Road Development. Where temporary disruptions to this access occur landowners would be notified in advance; and
- During the operation phase the separated land parcel would be accessible either via the local road network or via accommodation access roads. Where existing access gates are removed, these would be replaced.

18.13.2 Biodiversity

The primary land-use in the area surrounding the Proposed Road Development site is agriculture, encompassing hedgerows and areas of woodland. The permanent land take to facilitate the Proposed Road Development will result in a loss of habitat. Land-take outside of the Lough Corrib SAC boundaries during the construction phase will be restricted to the works footprint and habitats of varying ecological importance (including i.e. Improved grasslands (GA1), Wet grassland (GS4), scrub (SW1), Broadleaved Woodland (WD1), Hedgerows (WL1)). Most of the habitats onsite are common and widespread, however; two Annex I habitats are present. These Annex I habitats (Petrifying springs (outside of the site boundary, but within Lough Corrib SAC), and *Molinia* Meadows, (outside Lough Corrib SAC, but within the site boundary) are noted in Section 18.3.1 (Land and Soil). Taking into account implementation of mitigation, and the Landscape Plan, potential impacts from the Proposed Road Development could result in significant effects on some habitat types at Local level for some habitats.

18.13.3 Climate

Construction activities such as land clearance and land use change can affect GHG emissions resulting from changes to carbon sink potential. However, with embedded control measures and identified mitigation measures, as outlined in Chapter 11 'Climate', none of the potential effects from GHG emissions were identified to be of major or high significance.

18.13.4 Landscape and Visual

The permanent land take required to facilitate the construction of the Proposed Road Development will change the landscape character locally where the roadway corridor is situated given that much of the route is through existing agricultural fields, requiring the removal of established trees and hedgerows along with the addition of associated features such as roadside embankments. However, a proposed landscape planting strategy will substantially reduce the majority of the likely adverse visual effects.

18.14 Summary

The interactions between the individual environmental disciplines have been considered and assessed. It is concluded that once relevant mitigation measures are implemented, the majority of effects related to the construction and operational phase of the Proposed Road Development are mitigated to reduce residual effects as much as is possible.

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Table 18-1 Interactions

Interaction	Traffic		Population & Human Health		Biodiversity		Land & Soils		Water		Air Quality		Climate		Noise & Vibration		Landscape & Visual		Cultural Heritage		Major Accidents and Disaster		Material Assets – Non-Agriculture		Material Assets – Agriculture	
	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Traffic			✓	✓	✓	✓	✓	✘	✘	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘	✘
Population & Human Health	✓	✓			✘	✘	✓	✘	✘	✘	✓	✓	✓	✓	✓	✘	✘	✓	✘	✓	✘	✘	✘	✓	✓	✓
Biodiversity	✘	✘	✘	✘			✓	✓	✓	✓	✓	✓	✘	✓	✓	✘	✘	✓	✘	✘	✓	✓	✓	✓	✓	✓
Land & Soils	✓	✓	✓	✘	✓	✘			✓	✓	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✓	✓	✓	✘	✘	✘
Water	✓	✓	✓	✓	✓	✓	✓	✓			✘	✘	✘	✓	✘	✘	✘	✘	✘	✘	✓	✓	✓	✘	✘	✘
Air Quality	✘	✓	✓	✓	✓	✓	✓	✘	✘	✘			✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘	✘
Climate	✓	✓	✓	✓	✘	✘	✓	✘	✘	✘	✓	✓			✘	✘	✘	✓	✘	✘	✘	✘	✓	✘	✓	✓
Noise & Vibration	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘	✘	✘			✘	✘	✓	✓	✘	✘	✘	✘	✘	✘
Landscape & Visual	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘	✘	✘	✘	✘			✘	✓	✘	✘	✘	✘	✘	✓
Cultural Heritage	✓	✓	✓	✓	✘	✘	✓	✘	✘	✘	✓	✘	✘	✘	✓	✓	✘	✓			✘	✘	✘	✘	✘	✘
Major Accidents and Disasters	✘	✘	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘	✘	✓	✘	✘	✘	✘	✘	✘			✘	✘	✘	✘

Interaction	Traffic		Population & Human Health		Biodiversity		Land & Soils		Water		Air Quality		Climate		Noise & Vibration		Landscape & Visual		Cultural Heritage		Major Accidents and Disaster		Material Assets – Non-Agriculture		Material Assets – Agriculture	
	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Material Assets	✘	✘	✓	✓	✘	✘	✓	✘	✘	✘	✘	✘	✘	✓	✘	✘	✘	✘	✘	✘	✘	✘			✘	✘
Material Assets-Agriculture	✓	✘	✓	✓	✘	✘	✓	✘	✘	✘	✓	✘	✘	✘	✓	✓	✘	✓	✘	✘	✘	✘	✓	✘		

Note: Con= Construction Phase; Op.=Operational Phase; ✓= Weak/some/strong interaction; ✘= No interaction

N63 Liss to Abbey Realignment Scheme

Volume 2: Environmental Impact Assessment Report
Chapter 19: Schedule of Mitigation Measures

Galway County Council

February 2022

Table of Contents

Figures

No figures entries.

Tables

19. Schedule of Mitigation Measures

19.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) details all of the mitigation and monitoring measures to be implemented during the construction and operation of the Proposed Road Development. The following environmental mitigation and monitoring measures are an integral element of the planning application. Any further design of the Proposed Road Development will ensure that there is no material change in terms of significant adverse effects on the environment. Opportunities may also be identified to further reduce the significance of adverse impact and, in some cases, improve the residual impact.

Embedded control measures have been incorporated into the design of the Proposed Road Development throughout the design process. The environmental impact assessment of the Proposed Road Development facilitated the identification of additional mitigation and monitoring measures to prevent or reduce likely significant effects identified in relation to the Proposed Road Development. The mitigation and monitoring measures identified within Chapters 05 to 17 of this EIAR are summarised and presented in Table 19-1, however this chapter should be read in conjunction with the individual chapters of this EIAR as the information contained herein is a summary only.

Best practice referred to in this document refer to measures contained in modern guidance documents which set out the practice and procedures for environmental protection during construction and operational phases of a Proposed Road Development. Where legislation, standards or guidance documents are referred to it should be noted that at the time of construction or operation of the Proposed Road Development any amendments to these documents are applicable.

The embedded environmental controls and all mitigation and monitoring measures detailed herein are included in the Outline Construction Environmental Management Plan (OCEMP), see Volume 04; Appendix A4-1. A detailed CEMP will be produced by the successful Contractor prior to the main construction works. The CEMP will detail the Contractor's overall management and administration of the works. The CEMP will also include all mitigation and monitoring measures identified within the individual chapters of this EIAR, those outlined within the Outline CEMP, as well as any commitments included within the statutory approvals.

In addition to the mitigation and monitoring measures outlined in Table 19-1 and throughout the EIAR, the following combination of general measures and good practice will be implemented:

- Close adherence to the CEMP. The CEMP is designed to minimise any perturbations caused during the construction and is designed to meet best practice guidance and latest legislation. Specific roles, such as the Ecological Clerk of Works (ECoW), will be designated in the CEMP. The plan is to be updated a minimum of every 6 months over the duration of the construction process;
- The site compound will be located away from water courses and the storage of all fuels and potential contaminants on site will be done so in adherence to the mitigation measures outlined within this EIAR;
- The contractor will be obliged to put measures in place during the construction phase to ensure that there are no interruptions to existing services. When service suspensions are required during the construction phase, reasonable prior notice will be given to the residents in the area. The disruption to services or outages will be carefully planned so the duration is minimised;
- The CEMP will set out information on the roles and responsibilities of key individuals, including the environmental management and reporting structure;

- An outline communication strategy will be in place, for example for the implementation of toolbox talks (environmental discussion on issues encountered onsite) by the contractor relating to environmental constraints and procedures to be adhered to onsite;
- An outline emergency response plan and procedure for environmental incidents including accidental spills will be in place; and
- The CEMP will set out requirements for inspection and auditing, including a reporting programme and procedure to be updated by the appointed Contractor.

Table 19-1 Schedule of Mitigation Measures Pre-Construction Phase

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			Pre-Construction
Biodiversity (Ecological Specialist and Ecological Clerk of Works (ECoW))	Chapter 07 Biodiversity Section 7.7.1.1.2	Pre-Construction/Construction	A suitably experienced Ecologist will be engaged as part of the Employer's Representative (ER) Team. The Ecologist (referred to throughout this document as 'Ecological Specialist') will be a full member of a relevant professional institute such as the Chartered Institute of Ecology and Environmental Management (CIEEM), have relevant experience in the management of ecological constraints during construction, and hold or have held a protected species licence(s) in the Republic of Ireland. The Ecological Specialist shall be appointed sufficiently in advance of the Proposed Road Development to arrange for any mitigation requirements to be incorporated into the Contractor's site-specific programme. The Ecological Specialist will: • Oversee carrying out of pre-construction surveys to the appropriate TII specifications (TII, 2005-2011); • Supervise and direct construction of the Proposed Road Development as part of the Employer's Site Representative (ESR) Team; • The role of the Ecological Specialist will include communicating and reporting pre-construction survey findings, and associated actions and plans arising to GCC, the Contractor, the National Parks and Wildlife Service (NPWS) and/or the Inland Fisheries Ireland (IFI) as appropriate; • The Ecological Specialist will agree on a water monitoring programme with NPWS and IFI, which will include turbidity, conductivity and pH; • The Ecological Specialist will ensure mitigation addresses any changes in site conditions since completion of surveys that inform this EIAR in 2020 and 2021; • The client / client representative team will ensure the Ecological Specialist has the necessary support in their role to carry out the duties required; • The Ecological Specialist will review Contractor's method statements to ensure compliance with mitigation measures in this EIAR and the Natura Impact Statement (NIS); and • The Ecological Specialist will liaise with the Contractor in regard to ecological requirements and mitigation for works and aspects of non-compliance with ecological requirements, if applicable. A suitably experienced Ecological Clerk of Works will be engaged as part of the Contractor's Team. The ECoW will be a full member of a relevant professional institute such as the Chartered Institute of Ecology and Environmental Management (CIEEM), have relevant experience in the management of ecological constraints during construction. During construction and handover phases, the ECoW will oversee and advise the appointed Contractor(s) on implementation of mitigation. The Contractor will accommodate the ECoW, whose role will be to: • Oversee and advise the appointed Contractor(s) on implementation of mitigation during construction and handover phases; • Communicate relevant matters to the Contractor, the Client, and other stakeholders as required; • Review and aid in the development of Contractor Method Statements for compliance with the mitigation requirements in this EIAR and the NIS; • Conduct site monitoring including surface water monitoring, and monitoring of Annex I habitats as noted in this EIAR;

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• Attend site meetings and give input to Contractor toolbox talks prior to commencement and during construction of the Proposed Road Development; • The ECoW will ensure that the contractor is aware of and adheres to the required mitigation and will liaise with the clients' Ecological Specialist in terms of ecological considerations and mitigation; • The ECoW will determine the potential requirement for licences outside the scope of this EIAR Chapter (e.g. Frogspawn translocation); and • The ECoW would be required to work closely with the Contractor's Site Supervisor to monitor activities and ensure that all relevant environmental legislation is complied with and that the requirements of the EIAR are implemented.
Biodiversity (Pre-Construction Surveys)	Chapter 07 Biodiversity Section 7.7.1.1.3	Pre-Construction	At least six months (and no later than 12 months) in advance of commencing any construction works (including enabling or advance works), the ECoW will oversee the design and implementation of pre-construction surveys having regard for best available scientific knowledge including the specifications in the TII Environmental and Construction Guidelines (2005-2011). The objective of these surveys will be to determine if any new breeding or resting sites of protected species, or new invasive species populations have become established since surveys were completed in 2019, 2020 and 2021. The Client/Client Representative, with guidance from a suitably qualified Ecological Specialist will ensure suitably experienced ecologists complete the pre-construction surveys (as determined by the appointed Ecological Specialist). The Ecological Specialist will coordinate and manage the following surveys (and any others outlined within the EIAR): ▪ Otter breeding or resting sites (within 150 m of proposed piling works and 50 m of all other works); ▪ Kingfisher nesting sites (within 150 m of proposed piling works and 50 m of all other works); ▪ Badger breeding or resting sites (within 150 m of proposed piling works and 50 m of all other works): ▪ Red squirrel dreys (within 50 m of all works); ▪ Other protected mammal species (within 50 m of all works); ▪ Invasive species (within 50 m of all other works); and ▪ Marsh Fritillary and food plant survey will be carried out within the ZOI in suitable habitat including wet grassland areas on both the eastern and western extents of the Proposed Road Development. ▪ Trees with bat roost potential within the works footprint The Ecological Specialist will take necessary steps to mitigate survey limitations including for instance: ▪ Overseeing localised clearance of dense vegetation to search for Badger and Otter where the pre-construction survey window does not overlap winter/early spring (i.e. vegetation die-back); ▪ Survey Kingfisher nest sites where the pre-construction survey window does not overlap with the Kingfisher nesting season, or where areas with potential to contain Otter breeding or resting areas following surveys; and ▪ Maintain observation records of protected species and highlight mitigation/licencing requirements if necessary.
Biodiversity (CEMP)	Chapter 07 Biodiversity Section 7.7.1.1.4		A detailed CEMP will be prepared prior to commencement of construction subject to the approval of GCC, and the appointed Ecological Specialist. The CEMP will remain at all times a live document, subject to amendment of adaptive management throughout construction as required (e.g. in response to extreme weather including flooding and/or alterations to design elements due to the availability of more cost efficient or effective techniques or materials). The following measures will be implemented as a minimum by the appointed Contractor: • Drainage design, incorporating SuDS principals, inherent in the overall design, will prevent emissions to the river during the construction and operational phase of the Proposed Road Development, and facilitate water treatment; • Woodland, scrub, treelines, and hedgerows which lie within, or along the boundary of the Proposed Road Development, that are not directly impacted by the Proposed Road Development or drainage will be retained, thus reducing the area for dust generation and

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			risk of silt entry to watercourses. These areas will be protected for the duration of construction works and fenced off at an appropriate distance. Consideration will be made to ensure minimal disturbance of roots, and sensitive areas (including Root Protection Areas) will be cordoned off with post fencing to ensure no unnecessary damage to these habitats. Works will be done in accordance with 'Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes' (TII, 2006d). • Control measures such as check dams, and silt fencing will be used throughout the construction phase to reduce the risk to Lough Corrib SAC. Regular monitoring and recording of the effectiveness of the control measures will be used and implemented with additional control measures employed if and when required. • Supported silt fencing (supported by wooden posts or suitable alternative) along the route will be installed where watercourses, including drains, are at risk from silt entry. The base of these curtains will be buried into the ground to ensure the fences work effectively. Diversions of surface flows into swales is also envisaged, if necessary, to manage surface waters and prevent pollution incidents; • Minimal hedge removal through 'stepping-in' of proposed fence lines near these habitats; • Installation of cut-off drains, inherent in construction design, will aid in maintaining a drier works area, and limit surface waters within the construction area. This embedded control will prevent risks to surface waters; • Phasing and other silt control measures to be refined by the Contractor into an Erosion and Sediment Control Plan (CESCP), which will be agreed between GCC and the appointed Ecological Specialist; • Phasing of works and other silt control measures to be refined by the CESCP, which will be agreed between the Contractor, ECoW and Client (and Client's Ecological Specialist). The CESCP will conform to requirements within this EIAR; • Construction compounds will be required along in the vicinity of the Proposed Road Development. The current area for proposed compound areas are flat areas, deemed to be of low risk to the Lough Corrib SAC. Mitigation measures noted in this document, in relation to preventing surface water pollution, will be applied to the proposed compound area and conform to the requirements outlined in the CESCP; • Use of a single layer (and three layers if required) of high-performance silt fence around all works or stockpiles that have potential to affect waterbodies (surface or groundwater) or Annex I habitats; and specifically, and exclusively following installation methods outlined in published literature (Caraco, 2000) to maximize the effectiveness of particle filtration by geotextiles. Use of silt fencing to specification of Hy-Tex Terrastop Premium or similar, whose efficacy has been proven by credible evidence (Liddon, 2013) is required. Fencing will be inspected and assessed for its effectiveness and suitability by the ECoW and Client; • Use of additional layers of high-performance silt fence, locally, if necessary, to avoid pollution to watercourses or Lough Corrib SAC/SPA; • Supervision of installation and performance throughout construction of silt fencing and other pollution control measures by the ECoW and ER Team who will advise the Contractor on repairs required to maximize performance; • Procedures for dewatering the working area to include adequate treatment of any resulting silt-laden surface water prior to discharge. Use of silt dewatering bags or tubes in conjunction with filter drains/check dams, and other means necessary to capture, attenuate, and treat surface water generated during construction prior to any discharge to watercourses. If silt is removed from surface/groundwater from mitigation measures, and no contamination is apparent, no adverse impact of the entry of such waters to the environment is envisaged and this practice is deemed satisfactory. No polluted waters/contaminated water is to be released/discharged to a watercourse without a required discharge licence approved by IFI. • All bowsers onsite should be clean on arrival (internally and externally (to ensure that no pollutants were present within, that may otherwise enter the environment during use));

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• Fuel handling and bunding procedures are to be in place during the works, with particular care near rivers, streams, and watercourse (See Chapter 09 Water). Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be located away from surface water gullies or drains, with no refuelling within 30 m of a watercourse; • Stockpiles should have a minimum setback of 20 m and >20 m where possible, from watercourses. Adequate SuDS (e.g. surrounding cut-off drain, settlement ponds) will be installed if required to ensure environmental risks associated with silt are minimised. Seeding of stockpiles (to prevent erosion and dust creation) will be undertaken if deemed necessary by the ECoW or Ecological Specialist. • Contractor to adopt, and provide evidence to GCC and the Ecological Specialist of staff training in Spill Response & Control Plan to minimize the risk of adverse impacts upon surface waters and groundwater in the potential event of accidental spillages, flooding, or other emergencies; • Establishment of contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers, culverts); • Control of mud at entry and exit points to the works area using wheel washes; • Material and machinery/fuel storage to be outside flood-prone areas and removed from such areas in advance of floods to ensure environmental protection; and • Mitigation measures relating to safeguarding water quality during the construction phase are outlined in Chapter 09 Water of this EIAR. The following guidelines should be followed to ensure protection of the environment: • IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, Dublin; • CIRIA Guidelines Control of water pollution from construction sites –Guide to Good Practice (C532); and • Control of water pollution from linear construction projects. Technical Guidance (C648).
Biodiversity (Habitat Mitigation (Petrifying Springs - Pre-Construction Surveys)	Chapter 07 Biodiversity Section 7.7.1.3.1.1	Pre-Construction	Monitoring and protection of Petrifying Springs to ensure protection of this habitat. Ecological monitoring will be undertaken (See Chapter 07 Biodiversity Section 7.7.2. Monitoring).
Biodiversity (Invasive Species)	Chapter 07 Biodiversity Section 7.7.1.3.2.1	Pre-Construction	The pre-construction survey will be carried out during the growing season (i.e. from April to September) prior to construction starting onsite to assess if new populations of invasive species have become established since the original surveys were completed in 2020/2021 to inform this EIAR. An Invasive Species Site Assessment and Management Plan (ISSAMP) will be produced by the appointed Contractor as per the recommendations given by TII (2020a) and encompassing mitigation measures listed in this EIAR for invasive species management. This plan will determine the appropriate methods for treatment, control, and/or removal of the Invasive Species recorded as occurring onsite. The ISSAMP will be informed by a pre-construction survey and will incorporate measures to deal with and ensure no spread of land and river based invasive species from construction activities. The ECoW and Ecological Specialist will review the draft ISSAMP to ensure it has due regard for emerging best scientific knowledge. The ISSAMP will include a biosecurity plan prepared by the appointed Contractor, which will be agreed with GCC. The ISSAMP and the biosecurity plan will consider both terrestrial and aquatic invasive species.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Badger)	Chapter 07 Biodiversity Section 7.7.1.3.4.1	Pre-Construction	As Badger setts may become established following the surveys reported here and the commencement of construction, a dedicated mammal survey will be required. A pre-construction mammal survey will be required within 12 months of the commencement of works.
Biodiversity (Otter- Loss of Breeding/Resting Sites)	Chapter 07 Biodiversity Section 7.7.1.3.5.1	Pre-Construction	Otter could potentially establish new holt or couch sites within the Zone of Influence (ZoI) of the Proposed Road Development, a pre-construction check of all suitable Otter habitat will be required within 12 months of any constructions works commencing.
Cultural Heritage (Archaeological Works)	Chapter 14, Sec.14.7.1.1	Pre - Construction	• Archaeological testing will be carried out at the pre-construction phase in all parts of the Proposed Road Development to a minimum of 15% of the footprint in each area (also see Volume 3; Figure 14-7 of the EIAR). • The detail and scope of all archaeological works will be specified by Transport Infrastructure Ireland (TII) on behalf of Galway County Council (GCC) and carried out in compliance with the National Monuments Acts 1930 – 2004 and Policy and Guidelines on Archaeological Excavation (Department of Arts, Heritage Gaeltacht and the Islands, 1999). • A suitably qualified archaeological contractor will be appointed to carry out the archaeological fieldwork as per the specification supplied by TII. Galway County Council will be the consent holder for the archaeological works. • It is anticipated that all archaeological works will be completed pre-construction. This is in accordance with the Code of Practice between the TII and the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (formerly Arts, Heritage, Gaeltacht and Islands), 2017.
Cultural Heritage ((Archaeological Mitigation Programme)	Ch.14, Sec.14.7.1.1.1	Pre – Construction/Construction	• During Phase 1 (during the enabling works or as soon as access is available) – a programme of extensive test trenching, and if appropriate, test pit evaluation will be undertaken along the entire Proposed Road Development, including within the Compulsory Purchase boundary. • Sample-based mechanical or hand excavated trenches will be used to assess and record the character of archaeological remains. • Targeted trenching will be used where remains have been identified through non-intrusive survey (geophysical survey/assessment of historic cartographic sources such as CH1 former islands and CH3 former mill pond) or where there is potential for archaeological remains to be discovered. • The results of these intrusive trenching or test pit investigation works will inform decision-making on further mitigation recording that may be appropriate. • Geo-archaeological assessment will also be carried out and the upstanding building at CH2 will be subject to a simple building survey involving photography and a written description.
Cultural Heritage (Archaeological Mitigation Programme)	Ch.14, Sec.14.7.1.1.1	Pre – Construction/Construction	• Phase 2 (during enabling works) – areas or sites that require preservation by record and that were identified at Phase 1 for detailed excavation, will be investigated. This will also determine the scope of further mitigation works. If additional detailed geo-archaeological investigations are required, these will also be carried out. • A General Watching Brief (GWB) will be carried out for ground works, such as utility diversions, road diversions, ecology works, and woodland clearance at certain locations. • Investigation of important small-scale historic landscape features, such as land boundaries and townland boundaries, will be carried out, including topographic survey of earthwork features and historic building recording. • Detailed design work for preservation in-situ will be developed if required.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Cultural Heritage (Archaeological Mitigation Programme)	Chapter 14, Section 14.7.1.1.1	Construction	Phase 3 (during later enabling works and in advance of and concurrent with construction) – at the start of the construction period, a Targeted Watching Brief (TWB) will be undertaken before or concurrent with the main topsoil strip at selected locations. The GWB will be undertaken in all other areas where it is required.
Material Assets (Non-Agriculture)	Ch.16, Sec.16.6.1.2	Pre - Construction	All the land would be acquired through a CPO process, unless other direct agreement (payment) are reached with individual landowners.

Table 19-2 Schedule of Mitigation Measures Construction Phase

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			Construction
Traffic	Chapter 05 Traffic Analysis	Construction	A Construction Traffic Management Plan (CTMP) will be prepared and enforced by the appointed contractor. The CTMP will incorporate any specific additional requirements of statutory authorities and any conditions imposed by An Bord Pleanála. The CTMP will clearly set out any temporary traffic restrictions and will be prepared during the detailed design phase. The CTMP will include the following measures: • Traffic control would be in place for all vehicles entering and exiting the site; • Parking would be allowed only in designated parking areas onsite; • Segregated pedestrian walkways would be introduced; • Public pedestrian access would be restricted throughout the proposed works; • Access to the site would be strictly controlled with all personnel being required to have a Solas Safe Pass and to have undergone a specific Sisk Site Safety Induction before being allowed into the site; • Traffic on the Proposed Development site would remain on hardcore areas wherever possible. Where this is unavoidable, traffic exiting the site would go through a wheel wash; • All plant and equipment would be fitted with flashing amber warning lamps and hazard lights and would be required to have reversing alarms for operations within the work site; • The need for reversing vehicles, would be reduced by introduction of one way system; • Speed limit of 15 km/h would be put in place on the construction site; • Safe working procedures would be followed by plant and vehicles required to enter and leave the construction site into trafficked lanes; • All workers would be required to wear high visibility reflective protective clothing; and • Site foreman and supervisors would be in two-way communication with each other and the traffic controllers for the duration of the work shift.
Population and Health	Chapter 06 Population and Human Health Section 6.7	Construction	Mitigation measures during construction to reduce impacts on population and human health should be written into the construction Environmental Management Plan (CEMP) and CTMP and include: • Clear signage of any temporarily diversions to existing motorised and non-motorised routes (including pedestrians and cyclists); • Road surfaces in proximity to the construction site are to be kept clear of mud and debris as much as is possible; and • All temporary lane closures, one-way systems, signage, and temporary safety measures will be carried out in accordance with Section 8 of the Traffic Signs Manual (2010). The traffic management plans and diversions will be implemented at the interface between the works and traffic will be the contractor's responsibility. Issues relating to temporary diversions will be defined in traffic management plans produced by selected contractors.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (General Mitigation)	Chapter 07 Biodiversity Section 7.7.1.1.1	Construction	• Precedence of mitigation protecting European sites over mitigation protecting other features where conflict arises; • Commission a suitably experienced Ecological Clerk of Works (ECoW) during construction and handover phases to oversee and advise the appointed Contractor(s) on implementation of mitigation; • Pre-construction surveys to ensure mitigation addresses any changes in site conditions since completion of surveys to inform this EIAR in 2020 and 2021; • Appropriate timing of works by location within the Proposed Road Development footprint to minimise disturbance of nesting birds (being cognisant of bird nesting season) and other fauna (e.g. period for frogspawn, piling works); • Use of monitoring by a suitably experienced ECoW to determine the effectiveness of mitigation in agreement with NPWS; and • Ecological surveying during the pre-construction, construction, and operational phases, to assess impacts on ecological receptors including selected habitats and species.
Biodiversity (Pollution Control)	Chapter 07 Biodiversity Section 7.7.1.1.4	Construction	The measures described in this section will be further refined and expanded by the appointed Contractor into a CEMP as more information becomes available in the course of detailed road design (e.g. including but not limited to construction methods and work schedule). The detailed CEMP will be prepared prior to commencement of construction subject to the approval of GCC, and the appointed ECoW. The CEMP will remain at all times a live document, subject to amendment of adaptive management throughout construction as required (e.g. in response to extreme weather including flooding and/or alterations to design elements due to the availability of more cost efficient or effective techniques or materials). The following measures will be implemented as a minimum by the appointed Contractor: • Drainage design, incorporating SuDS principals, inherent in the overall design, will prevent emissions to the river during the construction and operational phase of the Proposed Road Development, and facilitate water treatment; • Control measures such as check dams, and silt fencing will be used throughout the construction phase to reduce the risk to Lough Corrib SAC. Regular monitoring and recording of the effectiveness of the control measures will be used and implemented with additional control measures employed if and when required. • Supported silt fencing (supported by wooden posts or suitable alternative) along the route will be installed where watercourses, including drains, are at risk from silt entry. The base of these curtains will be buried into the ground to ensure the fences work effectively. Diversions of surface flows into swales is also envisaged, if necessary, to manage surface waters and prevent pollution incidents; • Minimal hedge removal through 'stepping-in' of proposed fence lines near these habitats; • Installation of cut-off drains, inherent in construction design, will aid in maintaining a drier works area, and limit surface waters within the construction area. This embedded control will prevent risks to surface waters; • Phasing and other silt control measures to be refined by the Contractor into an Erosion and Sediment Control Plan (CESCP), which will be agreed between GCC and the appointed ECoW; • Phasing of works and other silt control measures to be refined by the CESCP, which will be agreed between GCC and the appointed ECoW; • Construction compounds will be required along in the vicinity of the Proposed Road Development. The current area for proposed compound areas are flat areas, deemed to be of low risk to the Lough Corrib SAC. Mitigation measures noted in this document, in relation to preventing surface water pollution, will be applied to the proposed compound area and conform to the requirements outlined in the CESCP; • Use of a single layer of high-performance silt fence around all works or stockpiles that have potential to affect waterbodies (surface or groundwater); and specifically, and exclusively following installation methods outlined in published literature (Caraco, 2000) to maximize the effectiveness of particle filtration by geotextiles. Use of silt fencing to specification of Hy-Tex Terrastop Premium or similar, whose efficacy has been proven by credible evidence (Liddon, 2013). Fencing will be inspected and approved by the ECoW;

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• Use of additional layers of high-performance silt fence, locally, if necessary, to avoid pollution to watercourses or Lough Corrib SAC/SPA; • Supervision of installation and performance throughout construction of silt fencing and other pollution control measures by the ECoW and ER Team who will advise the Contractor on repairs required to maximize performance; • Procedures for dewatering the working area to include adequate treatment of any resulting silt-laden surface water prior to discharge. Use of silt dewatering bags or tubes in conjunction with filter drains/check dams, and other means necessary to capture, attenuate, and treat surface water generated during construction prior to any discharge to watercourses. If silt is removed from surface/groundwater from mitigation measures, and no contamination is apparent, no adverse impact of the entry of such waters to the environment is envisaged and this practice is deemed satisfactory. No polluted waters/contaminated water is to be released/discharged to a watercourse without a required discharge licence approved by IFI. • All bowsers onsite should be clean on arrival (internally and externally (to ensure that no pollutants were present within, that may otherwise enter the environment during use)); • Fuel handling and bunding procedures are to be in place during the works, with particular care near rivers, streams, and watercourse (See Chapter 09 Water). Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be located away from surface water gullies or drains, with no refuelling within 30 m of a watercourse; • Stockpiles should have a minimum setback of 10 m and >10 m where possible, from watercourses. Adequate SuDS (e.g. surrounding cut-off drain, settlement ponds) will be installed if required to ensure environmental risks associated with silt are minimised. Seeding of stockpiles (to prevent erosion and dust creation) will be undertaken if deemed necessary by the ECoW. • Contractor to adopt, and provide evidence to GCC and the ECoW of staff training in Spill Response & Control Plan to minimize the risk of adverse impacts upon surface waters and groundwater in the potential event of accidental spillages, flooding, or other emergencies; • Establishment of contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers, culverts); • Control of mud at entry and exit points to the works area using wheel washes; • Material and machinery/fuel storage to be outside flood-prone areas and removed from such areas in advance of floods to ensure environmental protection; and • Mitigation measures relating to safeguarding water quality during the construction phase are outlined in Chapter 09 Water of this EIAR. The following guidelines should be followed to ensure protection of the environment: • IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, Dublin; • CIRIA Guidelines Control of water pollution from construction sites –Guide to Good Practice (C532); and • Control of water pollution from linear construction projects. Technical Guidance (C648).
Biodiversity (Emergency Response and Environmental Training)	Chapter 07 Biodiversity Section 7.7.1.1.5	Construction	The Contractor will produce an Emergency Response Plan (ERP) based on the Contractor's own Risk Assessment, which will be reviewed by the Employer's Representative Team, including the ECoW. The ERP will include: • The Contractor's proposed training of relevant staff, including cover staff, in the implementation of the ERP and the use of spill kits; • Details of procedures to be carried out by the Contractor in the event of the release of any sediment into a watercourse, or any spillage of chemicals, fuel or other hazardous wastes, non-compliance incidents with any permit or licence, or other such risks that could lead to a pollution incident, including flood risks; • Confirmation of the number and specification of spill kits which will be carried by the Contractor; and

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			Information on spill control procedures as specified in Chapter 07, Section 7.5.2 or Chapter 09 Water of the EIAR.
Biodiversity (Construction Environmental Management Plan)	Chapter 07 Biodiversity Section 7.7.1.1.6	Construction	The Contractor will be required to implement the measures outlined in the CEMP in accordance with the TII Guidelines for the 'Creation and Maintenance of an Environmental Operating Plan'. The CEMP will set out the Contractor's approach to managing environmental issues associated with the construction of the road and provide a documented account to the implementation of the environmental commitments set out in the EIAR and NIS and measures stipulated in the planning conditions. Details within the plan will include: • All Environmental commitments and mitigation measures included as part of the planning approval process and any requirements of statutory bodies such as the NPWS as well as a method documenting compliance with the measures; • A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements; and • Outline methods by which construction work will be managed to avoid, reduce, or remedy potential adverse impacts on the environment. To oversee the implementation of the CEMP, the Contractor will be required to appoint a responsible manager to ensure that the mitigation measures included in the NIS, EIAR and the CEMP are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.
Biodiversity (Construction and Demolition Waste Management Plan)	Chapter 07 Biodiversity Section 7.7.1.1.6.1	Construction	Included within the CEMP will be the Waste Management Plan (WMP) which clearly sets out the Contractor's proposals regarding the treatment, storage and recovery or disposal of waste. The plan itself will contain (but not be limited to) the following measures: • Details of waste storage (e.g. skips, bins, containers) to be provided for different waste and collection times; • Details of where and how materials are to be disposed of - landfill or other appropriately licensed waste management facility; • Details of storage areas for waste materials and containers; • Details of how unsuitable excess materials will be disposed of where necessary; • Details of how and where hazardous wastes such as oils, diesel and other hydrocarbon or other chemical waste are to be stored and disposed of in a suitable manner; • Any waste/litter generated onsite will be removed offsite to a waste licensed facility and litter will be collected if seen; and • Staff will be made aware of a zero-litter policy.
Biodiversity (Construction Erosion and Sediment Control Plan)	Chapter 07 Biodiversity Section 7.7.1.1.6.2	Construction	• A CESCP will be prepared at detail design stage for the Proposed Road Development. All of the measures, mitigations, controls, requirements, procedures, etc. will be developed from industry environmental best practice to ensure that there are no significant adverse effects on the receiving environment during the construction of the Proposed Road Development. These mitigation measures will be implemented in full and will aim to ensure that sediment laden runoff from the construction site does not pollute watercourses or water bodies with an emphasis on the Lough Corrib SAC. • The contract documents for the Proposed Road Development will place an obligation on the construction contractor to further develop this plan to include any additional requirements stipulated by the consenting authority. The exact details of the plan, particularly in relation to construction phasing, sequence or layout, may be amended by the Contractor to reflect different construction approaches but shall, as an absolute minimum, include all the measures, mitigations, controls, requirements, procedures, etc. included the plan.
Biodiversity (Phasing of Earthworks)	Chapter 07 Biodiversity Section 7.7.1.1.6.3	Construction	Construction works will avoid vegetation removal/destruction where possible. There will be no requirement for vegetation removal of riparian habitats within 5 m of the Abbert River, given the setback distances associated with the bridge abutments In the event where the Contractor identifies a potential future flood event, the Contractor will communicate the details to GCC, the ER Team, and the ECoW who will agree the appropriate response to protect the working area. Works area will be strictly adhered to for the duration of works.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Phasing of Piling (Disturbance to Fisheries))	Chapter 07 Biodiversity Section 7.7.1.1.6.4	Construction	• Having regard to the preferred migration periods for Atlantic Salmon, works associated with the piling in proximity to the Abbert River will be undertaken within the timeframe of 1 July to 30 September (inclusive) unless otherwise agreed with IFI. • The IFI guidance document (Guidelines on Protection of Fisheries During Construction Works and Adjacent to Waters (2016)) advocates undertaking works in proximity to watercourses during the period July-September inclusive to minimise adverse impacts on the fisheries resource. It is envisaged that such works will be scheduled to coincide with periods of dry weather primarily during summer months and outside the core migration period for Atlantic Salmon. • To mitigate impacts to QI Brook Lamprey, a 'soft-start' to drilling/piing will also be employed to allow lamprey and other fish to move away before the full intensity of drilling/piling begins. The soft start will involve a gradual ramping up of drill head rotation speed, incrementally over a set time period to be agreed with the ER Team, until full operational power is achieved. • Works giving rise to noise emissions are restricted to and permitted by GCC to 07.00 – 19.00 Hrs Monday – Friday; and 07.00 - 13.00 Hrs on Saturdays. Work outside of normal hours shall only take place where written permissions have been sought and received from GCC.
Biodiversity (Artificial Lighting)	Chapter 07 Biodiversity Section 7.7.1.1.6.5	Construction	• Turning off lights during periods of darkness throughout the construction phase will eliminate any risk of impacts to sensitive ecological receptors outside of work hours. • The risk of impacts associated with artificial lighting on the Abbert River will be minimised by restricting lighting to the footprint of the Proposed Road Development works and avoiding any unnecessary light spill (i.e. turning lights off outside working hours) onto the surrounding area. • Light spill from construction onto the Abbert River should not exceed 1 lux (equivalent to moonlight). In all cases, the Contractor will make retrospective amendments to light cowls to restrict light spillage. • The appointed ECoW will ensure that these measures are adhered to during the construction phase.

Biodiversity (Air Quality and Dust)	Chapter 07 Biodiversity Section 7.7.1.1.7	Construction	• A schedule of mitigation measures will be put in place in order to mitigate the impacts of dust deposition on Lough Corrib SAC and other habitat areas within the ZoI of the Proposed Road Development. Best practice construction methodologies (e.g. watering of the construction site/access roads and road cleaning) and mitigation measures (including regulating vehicle speed, through implementation of speed limits) will minimise construction activity-related dust and aid in containing it within the boundary of the Proposed Road Development.
			• Dust emissions control and mitigation measures during construction works will include:
			  ▪ The wetting of exposed earthworks areas and site haul roads during dry and/or windy conditions;
			  ▪ The provision and maintenance of wheel washes at site exit points;
			  ▪ Restriction of site plant and other vehicle speeds (e.g. 10-20 km/h on un-surfaced site road),
			  ▪ The adequate covering of haulage vehicles and the sweeping of hard surface roads within/accessing the site.
			• These procedures will be set out in a CEMP which will include a schedule of monitoring, maintenance, and review of site dust management measures. Dust screens are to be used in areas of highest sensitivity which is to include the works areas within 20 m of the Abbert River and Lough Corrib SAC, where a 2 m dust screen will be employed.
			• Where possible, woodland, scrub, treelines, and hedgerows which lie within, or along the boundary of the Proposed Road Development, that are not directly impacted by the Proposed Road Development or drainage will be retained, thus reducing the area for dust generation. These areas will be protected for the duration of construction works and fenced off at an appropriate distance.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Habitat Mitigation - Annex I *Molinia* Meadows)	Chapter 07 Biodiversity Section 7.7.1.3.1.2	Construction	• The footprint of construction activities in the area should be minimised. The area should be clearly marked and areas to be retained/protected should be cordoned off in advance of works; • The ECoW will supervise setting out of the works area to avoid the potential for disturbing Annex I *Molinia* Meadows during works; ▪ Temporary signage will be installed to highlight the location of Annex I *Molinia* Meadows to construction personnel accessing the site; ▪ Any requirement for stockpiling, re-fuelling of machinery, etc. during the construction phase will be sited >20 m away from Annex I *Molinia* Meadows; ▪ There will be no interference with areas of Annex I *Molinia* Meadows during site works, outside of the proposed works footprint. The quantity of material to be translocated will be minimized through careful marking of the route footprint; ▪ A detailed translocation plan will be prepared by the suitably qualified ecologist with input from NPWS. ▪ To complement partial translocation and habitat protection, works will be undertaken to protect remaining areas of this habitat (including translocated sods) and the hydrology of the area either side of the development through installation of suitably free-draining, clean, large, rounded, locally derived limestone under the road embankment; ▪ Hydrological impacts of the Proposed Road Development will be considered, retention of hydrological characteristics of retained areas will be accounted for in design, and the area will be monitored and managed as outlined in the *Molinia* translocation management plan. ▪ Some Annex I *Molinia* Meadows will be disturbed by the Proposed Road development as they are within the footprint of works. Care will be taken to translocate the area of this habitat that exists within the works footprint. The field adjacent to the southwest of the Annex I *Molinia* Meadow is an area with similar hydrological and soil conditions that is ideal for sod translocation, provided it was appropriately prepared (Also see Volume 03; Figure A7-2 & Volume 04; Appendix 7-8 of the EIAR). ▪ Translocation will only be undertaken under supervision of a suitably qualified ecologist/botanist to ensure translocation success; ▪ Translocation should occur at a time (i.e. season) that will optimise the successful establishment of Annex I *Molinia* Meadow at the translocation area. ▪ Sods will be carefully cut, and handled with care, prior to being translocated to the compensation area; ▪ The field for translocation will require advance consultation with and inspection by a suitably qualified botanist, to ensure it has been prepared appropriately in advance of translocation of sods; and • The ECoW will verify that the Contractor has left the site of the Proposed Road Development in a satisfactory condition, and where relevant direct the Contractor to remove any materials offsite.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Habitat Mitigation (Petrifying Springs))	Chapter 07 Biodiversity Section 7.7.1.3.1.2	Construction	Works will avoid impacting upon this priority habitat by: **Mitigation by Avoidance** • Strictly de-lineating the works area; • Limiting any vegetation clearance required at outset of works; • Minimising any additional hard-surfaced areas to avoid increase of runoff; • Re-fuelling minimum of 20 m from the Petrifying Spring; • Minimising the compaction of soils and other substrates within the ZoI of this habitat type; and • In order to avoid any alteration to groundwater pH, only locally derived limestone shall be used in the construction within the ZoI of this habitat. This limestone for base fill will be of a size that permits flow of waters through it, if required. This mitigation measure may ensure no changes to the alkalinity of the Petrifying Spring and will support hydrological connectivity between the north and south side of the Proposed Road Development. • The ZoI will be confirmed by the hydrogeologist following risk assessment to inform appropriate mitigation during the construction phase. **Pollution Prevention** • Best practice protocols in construction will be followed for the duration of the works. These include the measures to protect water and prevent water pollution, avoid, and prevent the spread of invasive species, dust and air emissions, and prevention of unnecessary clearance. • If ecological monitoring determines that flow rates are being influenced within the spring, additional mitigation measures may be required to ensure the protection of the spring.

Biodiversity (Non-Annex I Habitats)	Chapter 07 Biodiversity Section 7.7.1.3.1.2	Construction	• An exclusion zone will be established to safeguard areas outside the Proposed Road Development to avoid any unnecessary disturbance or intrusion during site works. The ECoW/suitably experiences ecologist will supervise setting out of all works and instruct the contractor on areas of other sensitive habitats to avoid;
			• Where possible, woodland, scrub, treelines, and hedgerows which lie within, or along the boundary of the Proposed Road Development, that are not directly impacted by the Proposed Road Development or drainage will be retained. These areas will be protected for the duration of construction works and fenced off at an appropriate distance.
			• Tree roots near works should be considered along the development and damage to roots should be prevented within the Root Protection Area of trees to be retained as per BS 5837-2012.
			• Any vegetation (including trees, hedgerows or scrub adjacent to, or within, the Proposed Road Development boundary) which is to be retained shall be afforded adequate protection during the construction phase in accordance with the Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes (TII, 2006d), as follows:
			  ▪ All trees along the Proposed Road Development boundary that are to be retained, both within and adjacent to the Proposed Road Development boundary (where the root protection area of the tree extends into the Proposed Road Development boundary), will be fenced off at the outset of works and for the duration of construction to avoid structural damage to the trunk, branches or root systems of the trees. Temporary fencing will be erected at a sufficient distance from the tree so as to enclose the Root Protection Area (RPA) of the tree. The RPA will be defined based upon the recommendation of a qualified arborist.
			  ▪ Where fencing is not feasible due to insufficient space, protection for the tree/hedgerow will be afforded by wrapping hessian sacking (or suitable equivalent) around the trunk of the tree and strapping stout buffer timbers around it
			  ▪ The area within the RPA will not be used for vehicle parking or the storage of materials (including soils, oils, and chemicals).

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			▪ A qualified arborist shall assess the condition of, and advise on any repair works necessary to, any trees which are to be retained or that lie outside of the Proposed Road Development boundary but whose RPA is impacted by the works. Any remedial works required will be carried out by a qualified arborist. ▪ A buffer zone of at least 5 m will be maintained where possible between construction works and retained hedgerows to ensure that the root protection areas are not damaged • Losses of higher value habitat will be compensated for in the landscaping plan, which will encompass the development of ponds, treelines of native species and hedgerow creation. • The landscape planting plan includes embedded control, which includes native, species-rich wildflower meadow, wetland habitats reinstatement and reuse of spoil/vegetated turves and hedgerow communities. • Settlement ponds will be retained post development (as part of embedded control), these compensate for loss of ponds and drains. • Mitigation noted for Barn Owl has been incorporated into the landscaping plan, including planting of native Hawthorn and Blackthorn and other native species on banks adjacent to the road, to avoid attraction of this species to the road area, where collision risk may otherwise be high (Volume 03; Figure 13-2 to 13-7); and • Machinery access will be restricted to the confines of the Proposed Road Development footprint and the Contractor will agree locations of all access routes, temporary storage areas, site compound etc. with the appointed ECoW.
Biodiversity (Invasive Species)	Chapter 07 Biodiversity Section 7.7.1.3.2.2	Construction	The Proposed Road Development will adopt best practice control measures to avoid the potential for cross-contamination with infested areas. The project and ISSAMP will have due regard to the relevant biosecurity measures throughout all phases of the project: • Clearly identify and mark out the infested areas of invasive species to inform construction personnel and operating machinery. Infested areas of invasive species will be fenced off (where possible) and signage will be installed to highlight the location of invasive species; • All earthworks machinery will be thoroughly pressure-washed prior to arrival onsite and prior to their use elsewhere. • Care will be taken not to disturb or cause the movement of fragments of invasive species, either intentionally or accidentally; • Should any new species become established in the interim, stands will be clearly demarcated by temporary fencing and machinery tracking or otherwise within infested areas will be strictly avoided. A minimum buffer of 7 m will be applied to avoid disturbance of lateral rhizomes; • Machinery working in an infested area must be thoroughly pressure-washed in a designated area at least 25 m from any watercourse before moving on to an area that is not yet infected; • All contractors and staff will be briefed about the presence, identification, and significance of invasive species before commencement of works; • For any material entering the Proposed Road Development site, the supplier must provide an assurance that it is free of invasive species. • Good construction site hygiene will be employed to prevent the spread of such species with vehicles thoroughly washed prior to leaving any site with the potential to have supported invasive species. All plant and equipment employed on the construction site (e.g. excavator, footwear, etc.) will be thoroughly cleaned down using a power washer unit prior to arrival onsite to prevent the spread of invasive plant species such as Japanese knotweed; and • The treatment and control of invasive alien species will follow guidelines issued by the Property Care Association– 'Practical Management of Invasive Non-Native Weeds in Britain and Ireland'. And with reference to the TII guidelines on 'The Management of Invasive Alien Plant Species on National Roads – Technical Guidance' and on 'The Management of Invasive Alien Plant Species on National Roads – Standard'.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Bats - Lighting)	Chapter 07 Biodiversity Section 7.7.1.3.3.1	Construction	During the construction phase, an experienced bat ecologist will visit the Proposed Road Development site at regular intervals (nocturnal visits) throughout the construction phase to review, using a suitably calibrated light meter, potential light spill of construction lighting onto vegetated areas. The bat ecologist will make recommendations to minimise impacts of construction lighting to bats. As a minimum: • Light spill from construction onto bat habitats known to be used by highly light sensitive species will not exceed 1 lux; and • Light spill from construction onto bat habitats known to be used by other bats will not exceed 3 lux. • In all cases, the Contractor will make retrospective amendments to light cowls, until the target lux level is reached.
Biodiversity (Bats – Tree Felling)	Chapter 07 Biodiversity Section 7.7.1.3.3.1	Construction	• Trees should be resurveyed for bat roost potential prior to felling. Any tree identified with bat roost potential will be surveyed visually. An emergence survey using visual observation and bat detectors will be carried out on the night immediately preceding the felling operation to determine if bats are present. NPWS will be consulted of any planned works on trees with a confirmed bat roost. If a bat roost is subsequently identified, tree removal will be undertaken in accordance with NPWS recommendations and relevant licencing requirements relevant to bat roost protection. • Trees, hedge, and scrub should be felled at an appropriate time of year, ideally outside of bird nesting season (March 1st to August 31st) (to prevent impacts to nesting birds). Felling of any potential tree roosts will be undertaken during the period September – October. • Immediately prior to felling, trees should be shaken by a machine a number of times, with 30 second intervals, to alert any bats or other wildlife that may be in the tree. The tree should then be pushed to the ground slowly and should remain in place until it is inspected by a bat specialist. Felled trees should be left intact where they fall on the ground for 24 hours before sectioning and/or mulching unless pre-surveyed by an ecologist and deemed bat-free.
Biodiversity (Badger)	Chapter 07 Biodiversity Section 7.7.1.3.4.2	Construction	If setts are found to have become established and require exclusion and removal, or temporary exclusion for the duration of the construction period, these measures will be undertaken in accordance with the methodology detailed in the 'Guidelines for the Treatment of Badgers during the Construction of National Road Schemes' (TII, 2006b) as follows: • In order to prevent any disturbance to Badger setts not directly affected by the Proposed Road Development no heavy machinery shall be used within 30 m of Badger setts at any time. No works shall be undertaken within 50 m of active setts during the breeding season. Lighter machinery (generally wheeled vehicles) shall not be used within 20 m of a sett entrance. Neither blasting nor pile driving shall be undertaken within 150 m of active setts during the breeding season (December to June inclusive). • Prior to works commencing, a non-interference zone of 30 m will be established around each of the new Badger setts (if they are developed) within the ZoI of the Proposed Road Development. If the sett is active, a non-interference zone will be extended to 50 m during the breeding season (December to June inclusive). The fencing shall be of a sufficient durability to maintain the exclusion zone throughout the construction period or, if required, until such time as the sett in question is excluded/removed. NPWS will be informed of any new setts in the area and works in the vicinity of setts will only be undertaken under a licence from NPWS. • In the unlikely event of the establishment of a Main Sett, an artificial sett will be required to mitigate for the loss of this sett. Any Badger setts requiring exclusion and removal will require a monitoring period of at least five days to confirm activity status in advance of any construction works commencing: • If the sett is active, then it shall not be removed within the Badger breeding season (December to June inclusive). To exclude or remove an active Badger sett outside of this period, inactive entrances shall be soft and hard-blocked with one-way gates installed on active entrances. One-way gates will be tied open for three days before being set to exclude, and then monitored for a period of at least 21 days before the sett is deemed inactive and destroyed. If at any time during the monitoring period the sett becomes active, the exclusion process/programme must commence again from day 1 of the 21-day monitoring period; and

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• For inactive setts, entrances will be soft-blocked (lightly blocked with vegetation and soil) and if all entrances remain undisturbed for a period of five days the sett should be destroyed immediately. This can be undertaken at any time of the year for inactive setts.
Biodiversity (Otter)	Chapter 07 Biodiversity Section 7.7.1.3.5.1	Construction	The mitigation measures relating to the protection of water quality in receiving watercourses during construction are outlined in Section 7.7 and detailed in Chapter 09 Water of the EIAR. Water Quality and Earthworks (Section 7.7.1.1.4 of Chapter 07 Biodiversity and Section 9.7.1 of Chapter 09 Water) The measures described in this section will be further refined and expanded by the appointed Contractor into a CEMP as more information becomes available in the course of detailed road design (e.g. including but not limited to construction methods and work schedule). The detailed CEMP will be prepared prior to commencement of construction subject to the approval of GCC, and the appointed ECoW. The CEMP will remain at all times a live document, subject to amendment of adaptive management throughout construction as required (e.g. in response to extreme weather including flooding and/or alterations to design elements due to the availability of more cost efficient or effective techniques or materials). The following measures will be implemented as a minimum by the appointed Contractor: • Drainage design, incorporating SuDS principals, inherent in the overall design, will prevent emissions to the river during the construction and operational phase of the Proposed Road Development, and facilitate water treatment; • Woodland, scrub, treelines, and hedgerows which lie within, or along the boundary of the Proposed Road Development, that are not directly impacted by the Proposed Road Development or drainage will be retained, thus reducing the area for dust generation and risk of silt entry to watercourses. These areas will be protected for the duration of construction works and fenced off at an appropriate distance. Consideration will be made to ensure minimal disturbance of roots, and sensitive areas (including Root Protection Areas) will be cordoned off with post fencing to ensure no unnecessary damage to these habitats. Works will be done in accordance with 'Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post Construction of National Road Schemes' (TII, 2006d). • Control measures such as check dams, and silt fencing will be used throughout the construction phase to reduce the risk to Lough Corrib SAC. Regular monitoring and recording of the effectiveness of the control measures will be used and implemented with additional control measures employed if and when required. • Supported silt fencing (supported by wooden posts or suitable alternative) along the route will be installed where watercourses, including drains, are at risk from silt entry. The base of these curtains will be buried into the ground to ensure the fences work effectively. Diversions of surface flows into swales is also envisaged, if necessary, to manage surface waters and prevent pollution incidents; • Minimal hedge removal through 'stepping-in' of proposed fence lines near these habitats; • Installation of cut-off drains, inherent in construction design, will aid in maintaining a drier works area, and limit surface waters within the construction area. This embedded control will prevent risks to surface waters; • Phasing and other silt control measures to be refined by the Contractor into an Erosion and Sediment Control Plan (CESCP), which will be agreed between GCC and the appointed ECoW; • Phasing of works and other silt control measures to be refined by the CESCP, which will be agreed between GCC and the appointed ECoW; • Construction compounds will be required along in the vicinity of the Proposed Road Development. The current area for proposed compound areas are flat areas, deemed to be of low risk to the Lough Corrib SAC. Mitigation measures noted in this document, in relation to preventing surface water pollution, will be applied to the proposed compound area and conform to the requirements outlined in the CESCP;

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• Use of a single layer of high-performance silt fence around all works or stockpiles that have potential to affect waterbodies (surface or groundwater); and specifically, and exclusively following installation methods outlined in published literature (Caraco, 2000) to maximize the effectiveness of particle filtration by geotextiles. Use of silt fencing to specification of Hy-Tex Terrastop Premium or similar, whose efficacy has been proven by credible evidence (Liddon, 2013). Fencing will be inspected and approved by the ECoW; • Use of additional layers of high-performance silt fence, locally, if necessary, to avoid pollution to watercourses or Lough Corrib SAC/SPA; • Supervision of installation and performance throughout construction of silt fencing and other pollution control measures by the ECoW and ER Team who will advise the Contractor on repairs required to maximize performance; • Procedures for dewatering the working area to include adequate treatment of any resulting silt-laden surface water prior to discharge. Use of silt dewatering bags or tubes in conjunction with filter drains/check dams, and other means necessary to capture, attenuate, and treat surface water generated during construction prior to any discharge to watercourses. If silt is removed from surface/groundwater from mitigation measures, and no contamination is apparent, no adverse impact of the entry of such waters to the environment is envisaged and this practice is deemed satisfactory. No polluted waters/contaminated water is to be released/discharged to a watercourse without a required discharge licence approved by IFI. • All bowsers onsite should be clean on arrival (internally and externally (to ensure that no pollutants were present within, that may otherwise enter the environment during use)); • Fuel handling and bunding procedures are to be in place during the works, with particular care near rivers, streams, and watercourse (See Chapter 09 Water). Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be located away from surface water gullies or drains, with no refuelling within 30 m of a watercourse; • Stockpiles should have a minimum setback of 10 m and >10 m where possible, from watercourses. Adequate SuDS(e.g. surrounding cut-off drain, settlement ponds) will be installed if required to ensure environmental risks associated with silt are minimised. Seeding of stockpiles (to prevent erosion and dust creation) will be undertaken if deemed necessary by the ECoW. • Contractor to adopt, and provide evidence to GCC and the ECoW of staff training in Spill Response & Control Plan to minimize the risk of adverse impacts upon surface waters and groundwater in the potential event of accidental spillages, flooding, or other emergencies; • Establishment of contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers, culverts); and • Control of mud at entry and exit points to the works area using wheel washes; • Material and machinery/fuel storage to be outside flood-prone areas and removed from such areas in advance of floods to ensure environmental protection. The CEMP will also include a CESCP and a Construction and Demolition WMP, to be prepared in accordance with Department of Environment, Community & Local Government guidelines[1] and any construction-related requirements imposed as conditions of any planning permission granted. It will also include details of proposed environmental monitoring for the duration of the construction works, be this good practice or as a planning condition requirement. The CEMP will be developed based on the Outline CEMP prepared by AECOM. Works to proposed structures over existing watercourses will be undertaken following approval by the OPW under Section 50 of the Arterial Drainage Act. Details of required stream partial realignments in the vicinity of the structures have also been submitted and approved.

[1] Department of the Environment, Heritage and Local Government "*Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*" July 2006

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			The following guidelines should be followed to ensure protection of the environment: • IFI (2016) Guidelines on Protection of Fisheries during Construction Works in and Adjacent to Waters. Inland Fisheries Ireland, Dublin; • CIRIA Guidelines Control of water pollution from construction sites –Guide to Good Practice (C532); and • Control of water pollution from linear construction projects. Technical Guidance (C648). • CIRIA C532 Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors; • CIRIA C648 Control of Water Pollution from Linear Construction Projects, technical guidance; • CIRIA C649 Control of Water Pollution from Linear Construction Projects, site guide; • CIRIA C793 The SuDS Manual; and • Guidelines on Protection of Fisheries During Construction Works (IFI, 2016). **Section 9.7.1 of Chapter 09 Water of the EIAR** **Sedimentation (Suspended Solids)** A CESCP will be prepared as part of the CEMP, which will be based on the sedimentation control measures in the Outline CEMP prepared by AECOM. During the construction phase, the following mitigation measures will ensure that no sediment contamination, contaminated runoff or untreated wastewater will enter watercourses on or near the Proposed Road Development site. • Excavations will only remain open for limited time periods to reduce groundwater and surface water ingress and water containing silt will be passed through a settlement tank or adequate filtration system prior to discharge. A discharge consent will be obtained as necessary for disposal of water arising from pumping (if any) or such water may be disposed of as construction site run off where appropriate. Spoil and temporary stockpiles including stone stockpile areas will be positioned in locations which are distant from drainage systems and retained drainage channels, away from areas subject to flooding. They will be appropriately graded and kept to maximum heights to reduce the potential for sediment run-off. Runoff from spoil heaps will be prevented from entering watercourses by diverting it through onsite settlement ponds and removing material as soon as possible to designated storage areas. • Drainage channels and streams will be clearly identified onsite and shown on method statements and site plans. Construction compounds will be located at least 25 m from watercourses and 10 m from field drains. • Drains carrying high sediment load will be diverted through settlement ponds, located between the construction area and the nearest surface water drain. Surface water runoff from working areas will not be allowed to discharge directly to the local watercourses. To achieve this, the drainage systems will be constructed prior to the commencement of major site works or the Contractor will provide an alternative means of silt management. Discharge from settlement/treatment ponds will be controlled and maintained at greenfield runoff rates to avoid impacting existing surface water flow rates. • Silt traps will be placed across the works boundary in any areas adjacent to watercourses to avoid siltation of watercourses. These will be maintained and cleaned regularly throughout the construction phase. Attention will also be paid to preventing the build-up of dirt on road surfaces, caused by trucks and other plant entering and exiting the Proposed Road Development site. • During the construction activities, there will be a requirement for diverting rainwater away from the construction areas, into nearby drainage channels and streams. Water will be filtered to prevent sediment from entering drainage channels and water streams. • A monthly water sampling regime for the Abbert River will be put in place by the Contractor during construction activity onsite, to include sampling for pH and total suspended solids. Parameters will be agreed with GCC and Inland Fisheries Ireland (IFI) ahead of works. The frequency of monitoring will be increased to weekly during works over the river, including bridge construction. In addition, daily visual checks of the Abbert River will be in place for the duration of the Proposed Road Development

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• A temporary cut-off wall will be installed, in order to reduce the risk of sediments generated during bridge construction works mobilising to the Abbert River. • As per Chapter 07 Biodiversity, works will, where possible, be phased taking into account sensitive periods for aquatic ecology, such as spawning seasons. • The drainage system has also been designed to offset risks to the *Molinia* meadows, by allowing drainage beneath the carriageway at Chainage 1+950 to 2+050.In order to mitigate the impact of the Proposed Road Development it is proposed to provide a layer of free-draining granular material at the base of the embankment to maintain the hydraulic connectivity across the embankment. It is also proposed to omit any pre-earthworks drainage/interceptor ditches within the area of the *Molinia* Meadow to prevent over drainage of the area. **Accidental Spills and Leaks** In order to prevent spillages to ground of fuels, and to prevent any consequent migration through the subsurface to surface waters or direct spillages to watercourses, it will be necessary to adopt mitigation measures during the construction phase, which include: • Designating a bunded storage area at the Contractor's compound for all oils, solvents and chemicals used during construction. Oil and fuel storage tanks will be bunded to the greater volume of either 110% of the capacity of the largest tank/container within the bunded area or to a volume of 25% of the total capacity of all the containers. Drainage from the bunded area will be diverted for collection and safe disposal. All containers within the storage area will be clearly labelled so that appropriate remedial action can be taken in the event of a spillage. When moving drums from the bunded storage area to locations along the Proposed Road Development site a suitably sized spill pallet will be used for containing any spillages during transit; • Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be away from surface water gullies or drains. Spill kit facilities will be provided at the fuelling areas in order to provide for accidental releases or spillages in and around the area. Any used spill kit materials will be disposed of using a hazardous waste contractor; and • Drip trays will be used during refuelling operations if performed outside of a contained area and spill kits will be carried in the fuel bowser vehicle. Any used spill kits will be disposed of using a hazardous waste disposal contractor and in accordance with all relevant EU and Irish waste management legislation; • Where mobile fuel bowsers are used on the Proposed Road Development site, in the event of a machine requiring refuelling outside of the designated area, fuel will be transported in a mobile double-skinned tank. Any flexible pipe tap, or valve will be fitted with a lock where it leaves the container and locked shut when not in use. The pump will also be locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training. • All water runoff from designated refuelling areas shall be channelled to an oil interceptor or an alternative treatment system prior to discharge; • Leaking or empty fuel drums shall be removed from Site immediately and disposed of via an appropriately licensed waste disposal contractor; • The Contractor will develop an emergency response plan to be followed in the event of spills and leaks; • Where use of herbicides, pesticides or artificial fertilisers is required, this will be done in accordance with legislation. The use of plant protection products (PPPs) will be in accordance with TII's guidance document *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance*.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			Use of Concrete and Lime As detailed in Chapter 08 Land and Soils, the following measures will be implemented: • Ready-mixed concrete will be brought to the Proposed Road Development site by truck; • A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated water to the underlying subsoil and groundwater, from which it could migrate to surface water; • The pouring of concrete will take place within a designated area protected to prevent concrete runoff into surface water; • Washout of concrete transporting vehicles will take place at an appropriate facility, offsite where possible, alternatively, where wash out takes place onsite, it will be carried out in carefully managed onsite wash out areas; • In order to minimize potential impacts to the river SAC from the bridge construction works, abutments and embankments will be outside the SAC and abutments will be set back from the river by a minimum of 5 m; and • During construction works suitable drainage, settlement and silt control measures will be implemented to mitigate disturbance to the SAC. The bridge span will be constructed using precast beams.
Biodiversity (Other Mammal Species- Mortality Risk (During Clearance))	Chapter 07 Biodiversity Section 7.7.1.3.6.1	Construction	There is no known or established methodology for the excluding of mammal species such as Hedgehog, Pygmy Shrew, Stoat, Red Squirrel, Pine Marten, Irish Hare from nest/hibernation sites and therefore the seasonal clearance of vegetation for breeding birds will be implemented. Vegetation clearance will avoid March-August inclusive as far as practicable, avoiding the majority of the main breeding season for most small mammal species.
Biodiversity (Birds- Pre-clearance Mitigation)	Chapter 07 Biodiversity Section 7.7.1.3.7.1	Construction	• The ECoW or other suitably experienced ecologist and Client will advise the Contractor on timing of vegetation clearance to protect nesting birds while having regard for other protected features present, such as breeding frogs and their spawn, and invasive species. • Vegetation clearance for most areas will be restricted to the period from March to August (inclusive) during the 'nesting season'. The exception of this is to facilitate earthworks required from the period July to September inclusive, at the proposed bridge abutments, in line with Inland Fisheries Ireland Guidelines. For the avoidance of doubt, it should be noted that birds may nest in grass and low scrub, in addition to hedgerows and trees. • Where unforeseen essential works require removal of vegetation during the breeding season, such works could be approved by the ECoW, who will (with reference to standard guidance on nest findings including Ferguson-Lees et al., (2011)) make a detailed check of any suitable vegetation for nests prior to removal and advise the Contractor of any species-specific exclusion zones around potential or confirmed nests. Minor local area clearance, with appropriate equipment (handheld cutting tools) outside of the bird breeding season, should be conducted within 24 hours of bird surveys during the breeding season if no active nests were identified. The ECoW will advise the Contractor on any licensing implications for removing vegetation during the nesting season, in consultation with the NPWS. • The need to remove vegetation during the breeding season could arise if for instance, clearance works are delayed unexpectedly. To protect against this risk, an advance clearance contract, completed from September to February inclusive, could be carried out to greatly reduce the risk of birds nesting within the Proposed Road Development for much of that breeding season. The footprint for clearance is to be clearly marked in advance of clearance operations. Best efforts to retain habitat, and trees, where possible, and minimise disturbance, should be made. • Clearance of the bankside area, outside of the bird nesting season, where bridge development is planned, is advised, to avoid impacts or delays relating to Grey Wagtail and Kingfisher nesting within the bank. • Bank surveys should be undertaken prior to sheet-piling to ensure that no active nests will be disturbed from works.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Birds- Habitat Disturbance)	Chapter 07 Biodiversity Section 7.7.1.3.7.1	Construction	• The works will need to be executed in such a manner as to minimise the noise and vibration nuisance arising from the works activities. Activities should be programmed to prevent unnecessary clearance, tracking, movements, and habitat disturbance.
Biodiversity (Fish)	Chapter 07 Biodiversity Section 7.7.1.3.8.1	Construction	The project will adopt a number of construction measures that avoid the potential for any adverse impacts on the fisheries QI of the Lough Corrib SAC. The following measures will be incorporated into the works schedule: • Control measures such as silt fencing will be used throughout the construction phase to reduce the risk to the Abbert River. Regular monitoring and recording of the effectiveness of the control measures will be implemented with additional control measures employed if and when required; • Sheet piling will be required for abutment construction within 10 m of the riverbank. Piling of the proposed bridge abutments adjacent to the Abbert River should be programmed so as to avoid sensitive lifecycle periods for QI Atlantic Salmon and Brook Lamprey. Piling is advised to be scheduled from July to September inclusive, unless otherwise agreed with IFI; • Light spill onto the river channel during hours of darkness has the potential to affect QI Atlantic Salmon. Turning off lights during periods of darkness whilst the construction phase is in close proximity to the river is recommended. Light spill from construction onto the Abbert River will not exceed 1 lux (equivalent to moonlight); • Dewatering of open trenches requires silt mitigation. This could include the use of silt bags, settlement tanks and/or attenuation ponds. Excavation of drains will require waters to be over-pumped/piped/diverted and silt mitigation installed where necessary. Drain works should be undertaken in a manner, and in a timeframe to be agreed with IFI. It is noteworthy that some drain works are classified as ‘instream works’ and therefore time restrictions for these works may apply. Drain works could require the use of silt bags, settlement tanks and/or attenuation ponds to ensure no pollution to watercourses; • To minimise the effects of habitat loss on fish species, all sections of river/stream channel within the Proposed Road Development boundary, but not within the footprint of the Proposed Road Development and associated infrastructure, will be protected from site clearance and construction works. Rivers/streams will be fenced off at a minimum distance of 10 m from the river bank (unless otherwise agreed with the ECoW to within 5 m for specific circumstances (bridge development) and within this zone the natural riparian vegetation will be retained. • All temporary crossing structures used to cross watercourses during construction will be designed in accordance with the Guidelines on Protection of Fisheries During Construction Works in and Adjacent to Waters and Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes to maintain fish and macroinvertebrate passage, and to prevent sedimentation and erosion. • No abstraction of water for dust suppression from the Abbert River will occur unless agreed with IFI and GCC and if it is agreed, the suction head shall be screened with a fish proof mesh to make sure fish are not removed or damaged during the abstraction process. • The drain identified as having fishery potential will need to have fish captured and removed, under licence, in a manner to be agreed with IFI (e.g. by 1. electrofishing and netting/2. dewatering with a pump (with a mesh suitable to stop fish suction into the pump) and netting. Live fish will need to be captured and released to the Abbert River. De-fishing will need to be undertaken under licence from IFI. No fishing will be required if the drain has dried out of natural causes and there is no fish potential in the drain; and • No discharge of pollutants to the adjacent river, should occur.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Amphibians)	Chapter 07 Biodiversity Section 7.7.1.3.9.1	Construction	• Habitat loss can be limited during clearance phase. • Avoidance of most sensitive times (February to July, inclusive) will reduce likelihood of impacts on amphibians. • A preconstruction survey of areas identified by this survey and other wetland sites suitable for supporting breeding amphibians should be carried out in order to determine whether breeding amphibians are present. In the case of Common frog, any frog spawn, tadpoles, juvenile or adult frogs present will be captured under licence from NPWS and removed from affected habitat by hand net and translocated to the nearest area of available suitable habitat, beyond the ZoI of the Proposed Road Development. • In the case of Smooth newt, individuals will be captured and removed from affected habitat either by hand net or by trapping and translocated to the nearest area of available suitable habitat, beyond the ZoI of the Proposed Road Development. If used, the type and design of traps shall be approved by the NPWS. This is a standard and proven method of catching and translocating Smooth Newt. • If the size or depth of the habitat feature is such that it cannot be determined whether all amphibians have been captured, it will be drained under the supervision of a suitably experienced ecologist to confirm that no amphibian species remain before it is destroyed or infilled. Any mechanical pumps used to drain the habitat feature will have a screen fitted, and be sited, such that no amphibian species can be sucked into the pump mechanism, or damaged by pumping. Any capture and translocation works will be undertaken immediately in advance of site clearance/construction works commencing, under licence from NPWS. • Suitable passage for aquatic species will be enabled through appropriate positioning of any culvert installation in any watercourse through an embedded placement with no barriers to migration (IFI, 2016).
Biodiversity (Lepidoptera)	Chapter 07 Biodiversity Section 7.7.1.3.10.1	Construction	• Clear delineation of clearance areas and works areas will prevent unnecessary removal of habitat for these species.
Biodiversity (Other Protected and Notable Species)	Chapter 07 Biodiversity Section 7.7.1.3.12.1	Construction	In order to minimise the risk of site clearance and construction works disturbing, or causing the mortality of, Common Lizard the following schedule of site clearance works will be followed: • Grassland or scrub vegetation will be removed during the winter period, where possible, avoiding potential common lizard hibernacula sites (dry sites which provide frost-free conditions e.g. stone walls, underground small mammal burrows, piles of dead wood or rubble); • Where this is not possible and clearance will be undertaken during the active season (March through to September, inclusive), vegetation will be cut first to approximately 15 cm, and then to the ground, under supervision of an ecologist. This will allow the opportunity for lizards to be displaced by the disturbance and leave the affected area; and • Stone walls (or other potential hibernacula sites) will be removed during the active season (March through to September, inclusive) under the supervision of an ecologist, when they are less likely to be in use by torpid lizards.
White Clawed Cray Fish	Chapter07 Biodiversity Section 7.7.1.3.11.1	Construction	A schedule of mitigation measures set out to ensure protection of surface water quality has been developed in Section 7.7 of the EIAR. The proper implementation of these and the CEMP will ensure adequate sufficient protection for Crayfish.
Biodiversity (Monitoring)	Chapter 07 Biodiversity Section 7.7.2.1.1	Construction	• The Contractor will carry out a continuous programme of water quality monitoring during the construction phase, whose parameters and requirements will be agreed with the NPWS, IFI and the Client's Ecological Specialist (Refer to Chapter 09 Water). This monitoring programme will require, at a minimum, the deployment of an upstream and downstream continuous recording meter in the Abbert River between 250m -1km upstream and downstream of the works area). These meters will monitor water quality and upload results, so that water parameters can be read in real time by the contractor and client.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Monitoring-Ecological Monitoring Strategy)	Chapter 07 Biodiversity Section 7.7.2.1.2	Construction	The ECoW will be appointed to oversee, advise, and facilitate the proper implementation of all ecological mitigation measures by the Contractor, and fulfil the requirements of the Ecological Monitoring Strategy (EcMS) (See 7.7.2.1.2.1: Ecological Monitoring Strategy), to include consultation input from the NPWS and IFI. **Section 7.7.2.1.2.1 of the EIAR** • The Ecological Specialist will review this EIAR, the NIS, planning conditions, post-consent consultations with statutory bodies, and the results of pre-construction surveys, to inform production of an 'Ecological Monitoring Strategy". The EcMS will be followed by the contractor, through their ECoW. • The function of the Ecological Monitoring Strategy (EcMS) will be to: ▪ Monitor and chronicle installation of mitigation, effectiveness of mitigation, results of mitigation and plan mitigation. ▪ Inform adaptive management measures to be agreed with GCC and advised to the Contractor; and, ▪ Provide an evidence-base to be communicated to the NPWS and IFI, on the effectiveness of mitigation measures proposed, to inform improvements to industry practice. • Track contractor performance in relation to implementation of the ISSAMP; CEMP, WMP, CESCP. • The specific aims of the EcMS will be to monitor and oversee the correct implementation of mitigation from this EIAR, and instruct the Contractor on how to adapt mitigation as required, with particular regard to (but not limited to): ▪ Results of pre-construction surveys which may identify new ecological constraints within the ZoI of the Proposed Road Development; ▪ Implementation of the ISSAMP; CEMP, WMP, CESCP and water quality monitoring; ▪ Phasing of works including piling, earthworks, and vegetation clearance in response to potentially unforeseen weather conditions or programme changes; ▪ Phasing of works in accordance with habitat and species-specific ecological recommendations i.e. bird nesting season, Common Lizard mitigation, amphibian mitigation, bat mitigation and the season for instream/drain works and piling and any other relevant considerations highlighted in this EIAR; ▪ Assessing condition and performance of silt fencing, silt de-watering sacs and other aspects of the CESCP, as informed by site observations by the ECoW, and the results of the Contractor's water quality monitoring; ▪ Assessing and advising on working methodologies for activities onsite; ▪ Ensuring directional lighting is used to minimise light spillage on the QI of the Lough Corrib SAC and the Abbert River; ▪ Ensuring construction and installation of mammal fencing (including lead-in planting, and access ramps); ▪ Ensuring appropriate installation of culverts and pipe crossings (to ensure and enable mammal, amphibian, and fish passage (TII (2005), IFI (2006)); ▪ Ensuring the drafting and implementation of a habitat translocation, monitoring and maintenance plan, to translocate, maintain and enhance the Annex 1 *Molinia* Meadows; ▪ Implementation of Annex I *Molinia* Meadows and Petrifying Spring monitoring and conservation plan. • The appointed ECoW will report the actions taken under the EcMS to GCC, and the NPWS and IFI in agreement with GCC. The Ecological Specialist may also report on actions to NPWS and IFI.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Land & Soils (General)	Chapter08 Section 8.7.1	Construction	• A CEMP will be prepared for the Proposed Road Development which will incorporate relevant environmental avoidance or mitigation measures to reduce potential environmental impact. The CEMP will include: ▪ A Construction, Erosion and Sediment Control Plan (CESCP), ▪ A Soil Management Plan (SMP) and ▪ A Construction and Demolition Waste Management Plan (WMP). • The CEMP will be drafted by the Contractor and updated as necessary in accordance with Department of Environment, Community & Local Government guidelines and any construction-related requirements imposed as conditions of any planning permission granted. It will also include details of proposed environmental monitoring for the duration of the construction works, be this good practice or as a planning condition requirement. The CEMP will be produced based on AECOM's Outline CEMP.
Land & Soils (Soil Excavation & Filling)	Chapter 08, Section 8.7.1.1	Construction	• Temporary storage of soil will be carefully managed in such a way as to prevent potential negative impact on the receiving environment. Spoil and temporary stockpiles including stone stockpile areas will be positioned in locations which are distant from drainage systems and retained drainage channels and away from areas subject to flooding so as not to cause potential run off to soil and groundwater. • The CEMP will outline proposals for the excavation and management of excavated material. Movement of material will be minimised in order to reduce degradation of soil structure and generation of dust. In order to minimise the potential environmental impact of stockpiles, the CEMP will contain the following mitigation measures that will be implemented during the construction phase: ▪ Position spoil and temporary stockpiles in locations which are distant from drainage systems; ▪ Defined maximum stockpile heights; and ▪ To help shed rainwater and prevent ponding and infiltration, the sides and top of the stockpiles will be regraded to form a smooth gradient with compacted sides reducing infiltration and silt runoff.
Land & Soils (Soil Excavation & Filling)	Chapter 08 Section 8.7.1.1	Construction	Soil requiring offsite disposal will be managed in accordance with relevant waste legislation (Classification, Labelling and Packaging Regulation (CLP) European Waste Catalogue and Hazardous Waste List (EPA, 2002), EU Council Decision (2003/33/EC) of 19 December 2002 establishing criteria and procedures for the acceptance of waste at landfills pursuant to Article 16 of Annex II to Directive 19999/31/EC, Council Directive 1999/31/EC on the landfill of waste, Waste Management Act 1996, the Environment (Miscellaneous Provisions) Act 2011 (No. 20 of 2011).
Land & Soils (Soil Excavation & Filling)	Chapter 08 Section 8.7.1.1	Construction	Some localised construction stage access routes will be needed close to the bridge abutment to cater for beam lifting; these will represent minor elements in terms of earthworks volumes.
Land & Soils (Soil Excavation & Filling)	Chapter 08 Section 8.7.1.1	Construction	Temporary drainage during construction stage will be addressed in the CEMP and will be managed so as to reduce the direct runoff to ground and water.
Land & Soils (Accidental Spills and Leaks) **Water**	Chapter 08, Section 8.7.1.2 Chapter 09, Section 9.7.1.3	Construction	• Designated bunded storage area at the Contractor's compound for all oils, solvents and chemicals used during construction. Oil and fuel storage tanks will be bunded to the greater volume of either 110% of the capacity of the largest tank/container within the bunded area or to a volume of 25% of the total capacity of all the containers. Drainage from the bunded area will be diverted for collection and safe disposal. • All containers within the storage area will be clearly labelled so that appropriate remedial action can be taken in the event of a spillage. • When moving drums from the bunded storage area to locations along the Proposed Road Development site a suitably sized spill pallet would be used for containing any spillages during transit.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Land & Soils (Accidental Spills and Leaks) **Water**	Chapter 08, Section 8.7.1.2 Chapter 09, Section 9.7.1.3	Construction	• Refuelling of construction vehicles and the addition of hydraulic oils or lubricants to vehicles, will take place in designated areas which will be away from surface water gullies or drains. • Spill kit facilities will be provided at the fuelling areas in order to provide for accidental releases or spillages in and around the area. Any used spill kit materials will be disposed of using a licenced hazardous waste contractor in accordance with relevant legalisation.
Land & Soils (Accidental Spills and Leaks) **Water**	Chapter 08, Section 8.7.1.2 Chapter 09, Section 9.7.1.3	Construction	Where mobile fuel bowsers are used on the Proposed Road Development, in the event of a machine requiring refuelling outside of the designated area, fuel will be transported in a mobile double skinned tank. Any flexible pipe tap, or valve will be fitted with a lock where it leaves the container and locked shut when not in use. The pump or valve would be locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training.
Land & Soils (Use of Concrete and Lime) **Water**	Chapter 08, Section 8.7.1.3 Chapter 09, Section 9.7.1.4	Construction	• Ready-mixed concrete will be brought to the Proposed Road Development site by truck. • A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated water to the underlying subsoil and groundwater, from which it could migrate to surface water.
Land & Soils (Use of Concrete and Lime) **Water**	Chapter 08, Section 8.7.1.3 Chapter 09, Section 9.7.1.4	Construction	• The pouring of concrete will take place within a designated area protected to prevent concrete runoff into the soil/groundwater media, surface water. • Washout of concrete transporting vehicles will take place at an appropriate facility, offsite where possible, alternatively, where wash out takes place onsite, it will be carried out in carefully managed and monitored onsite wash out areas.
Land & Soils (Monitoring and Protection of *Molinia* Meadows and Petrifying Springs)	Chapter 08. Section 8.7.1.4	Construction	***Molinia* Meadows** Works will be undertaken to protect areas of Annex I *Molinia* Meadow habitat (including translocated sods) and the hydrology of the area either side of the development through installation of suitably free-draining, clean, large, rounded, locally derived stone under the road embankment and minimising the works footprint in this area. Other relevant mitigation is described in Chapter 07 Biodiversity. **Petrifying Springs** The minor cutting approximately 100 m to the east is only 0.5-1.0 m deep and is unlikely to impact upon the spring's flow regime. During site investigation, the trial pits closest to the cutting and spring (TP06, to 2.5 m bgl and TP07 to 3.0 m bgl) were noted in logs to be dry. The borehole closest to the cutting and springs (BH10A/RC10) was noted to have slow water ingress at 1.3 m bgl, which is beneath the proposed cut level. However, as a precautionary measure, the following will be implemented. • A quarterly sampling programme of the petrifying spring will be undertaken for 6-12 months before, during and two years after construction works. This will include recording descriptions of flows, and scheduling samples for an inorganic suite of analysis, to include pH, electrical conductivity, ammonium, nitrate, fluoride, chloride and sulphate. Monitoring data from the pre-construction phase and construction phase will be reviewed to determine whether any additional mitigation requirements are required (see Chapter 07 Biodiversity). • Weekly visual checks will be undertaken of the spring during construction works, with photographs taken and written descriptions of flow recorded.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• Clearance of topsoil/substrate is to be kept to an absolute minimum within 50 meters of this habitat area. • In order to avoid any alteration to groundwater pH, only locally derived limestone shall be used in the construction within 100 m of this habitat. This limestone for base fill will be of a size that permits flow of waters through it, if required. This mitigation measure would ensure no changes to the alkalinity of the Petrifying Spring and will support hydrological connectivity between the north and south side of the Proposed Road Development (Other specific mitigation is outlined in Chapter 07 Biodiversity).
Land & Soils (Use of Natural Resources)	Chapter 08, Section 8.7.1.5	Construction	• Fill material requirement will be sourced where possible from local quarries, providers of recycled aggregates or suitable donor sites under Article 27 of the European Communities (Waste Directive) Regulations 2011. A number of local quarries have been identified, and prior to construction, these shall be reviewed and only those quarries that conform to all necessary statutory consents will be used in the construction phase. • Soils/fill material to be brought to the Proposed Road Development site will be vetted with chemical soil testing if necessary, in order to check that it is of a reputable origin and that it is 'clean' (i.e. would not introduce contamination to the environment; soil and groundwater). • All potential suppliers would be vetted for the following criteria: ▪ Environmental management status; and ▪ Regulatory and legal compliance status of the company. • 'Clean' fill material will be sourced from suppliers which comply with the above requirements. If recycled aggregate is used as imported fill, chemical testing will be undertaken to confirm that it is 'clean' (i.e. would not introduce contamination to the environment).
Water	Chapter 09 Section 9.7.1.1	Construction	• A CEMP will be prepared for the Proposed Road Development which incorporates relevant environmental avoidance or mitigation measures to reduce potential environmental impact. The CEMP will include a CESCP and a Construction and Demolition WMP, to be prepared in accordance with Department of Environment, Community & Local Government guidelines and any construction related requirements imposed as conditions of any planning permission granted. It will also include details of proposed environmental monitoring for the duration of the construction works, be this good practice or as a planning condition requirement. The CEMP will be developed based on the Outline CEMP prepared by AECOM. • Works to proposed structures over existing watercourses will be undertaken following approval by the OPW under Section 50 of the Arterial Drainage Act. Details of required stream partial realignments in the vicinity of the structures have also been submitted and approved. • Ongoing consultation would be undertaken with relevant statutory bodies, including IFI and NPWS. Construction works over/near watercourses will be undertaken with cognisance of the relevant guidance, including: ▪ CIRIA C532 Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors; ▪ CIRIA C648 Control of Water Pollution from Linear Construction Projects, technical guidance; ▪ CIRIA C649 Control of Water Pollution from Linear Construction Projects, site guide; ▪ CIRIA C793 The SuDS Manual; and ▪ Guidelines on Protection of Fisheries During Construction Works (IFI, 2016).

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	• A CESCP will be prepared as part of the CEMP, which will be based on the sedimentation control measures in the Outline CEMP prepared by AECOM. ▪ The Contractor will construct elements of the permanent drainage system as early as practicable, such as the interceptor drains, to facilitate earthworks haul routes and control drainage from the works, to avoid flows onto adjacent land and/or untreated discharges to watercourses. ▪ Excavations will only remain open for limited time periods to reduce groundwater and surface water ingress and water containing silt will be passed through a settlement tank or adequate filtration system prior to discharge. ▪ A discharge consent will be obtained as necessary for disposal of water arising from pumping (if any) or such water may be disposed of as construction site run off where appropriate. ▪ Spoil and temporary stockpiles including stone stockpile areas will be positioned in locations which are distant from drainage systems and retained drainage channels, away from areas subject to flooding. They will be appropriately graded and kept to maximum heights to reduce the potential for sediment run-off. ▪ Runoff from spoil heaps will be prevented from entering watercourses by diverting it through onsite settlement ponds and removing material as soon as possible to designated storage areas.
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	• Drainage channels and streams will be clearly identified onsite and shown on method statements and site plans. • Construction compounds will be located at a minimum distance of 25 m from watercourses.
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	• Drains carrying high sediment load will be diverted through settlement ponds, located between the construction area and the nearest surface water drain. • Surface water runoff from working areas will not be allowed to discharge directly to the local watercourses. To achieve this, the drainage systems will be constructed prior to the commencement of major site works or the Contractor will provide an alternative means of silt management. Discharge from settlement/treatment ponds will be controlled and maintained at Greenfield runoff rates to avoid impacting existing surface water flow rates.
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	Silt traps will be placed across the works boundary in any areas adjacent to watercourses to avoid siltation of watercourses. These will be maintained and cleaned regularly throughout the construction phase. Attention will also be paid to preventing the build-up of dirt on road surfaces, caused by trucks and other plant entering and exiting the Proposed Road Development site.
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	During the construction activities there will be a requirement for diverting rainwater away from the construction areas, into nearby drainage channels and streams. Water will be filtered to prevent sediment from entering drainage channels and water streams.
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	A monthly water sampling regime for the Abbert River will be put in place by the Contractor during construction activity onsite. to include sampling for pH and total suspended solids. Parameters will be agreed with GCC and Inland Fisheries Ireland (IFI) ahead of works. The frequency of monitoring will be increased to weekly during works over the river, including bridge construction. In addition, daily visual checks of the Abbert River will be in place for the duration of the Proposed Road Development
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	A temporary cut-off wall will be installed, in order to reduce the risk of sediments generated during bridge construction works mobilising to the Abbert River.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	Works will where possible, be phased taking into account sensitive periods for aquatic ecology, such as spawning seasons (Also see Chapter 07 Biodiversity of the EIAR).
Water Sedimentation (Suspended Solids)	Chapter 09, Section 9.7.1.2	Construction	The drainage system has also been designed to offset risks to the *Molinia* meadows, by allowing drainage beneath the carriageway at Chainage 1+950 to 2+050.In order to mitigate the impact of the Proposed Road Development it is proposed to provide a layer of free-draining granular material at the base of the embankment to maintain the hydraulic connectivity across the embankment. It is also proposed to omit any pre-earthworks drainage/interceptor ditches within the area of the *Molinia* Meadow to prevent over drainage of the area.
Water (Accidental spills and leaks)	Chapter 09, Section 9.7.1.3	Construction	Drip trays will be used during refuelling operations if performed outside of a contained area and spill kits will be carried in the fuel bowser vehicle. Any used spill kits will be disposed of using a hazardous waste disposal contractor and in accordance with all relevant EU and Irish waste management legislation;
Water (Accidental spills and leaks)	Chapter 09, Section 9.7.1.3	Construction	Where mobile fuel bowsers are used on the Proposed Road Development site, in the event of a machine requiring refuelling outside of the designated area, fuel will be transported in a mobile double-skinned tank. Any flexible pipe tap, or valve will be fitted with a lock where it leaves the container and locked shut when not in use. The pump will also be locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training.
Water (Accidental spills and leaks)	Chapter 09, Section 9.7.1.3	Construction	All water runoff from designated refuelling areas shall be channelled to an oil interceptor or an alternative treatment system prior to discharge;
Water (Accidental spills and leaks)	Chapter 09, Section 9.7.1.3	Construction	Leaking or empty fuel drums shall be removed from Proposed Road Development site immediately and disposed of via an appropriately licensed waste disposal contractor;
Water (Accidental spills and leaks)	Chapter 09, Section 9.7.1.3	Construction	The Contractor will develop an emergency response plan to be followed in the event of spills and leaks.
Water (Accidental spills and leaks)	Chapter 09, Section 9.7.1.3	Construction	Where use of herbicides, pesticides or artificial fertilisers is required, this will be done in accordance with legislation. The use of plant protection products (PPPs) will be in accordance with TII's guidance document *The Management of Invasive Alien Plant Species on National Roads – Technical Guidance*.
Water (Use Concrete and Lime)	Chapter 09, Section 9.7.1.4	Construction	• Ready-mixed concrete will be brought to the Proposed Road Development site by truck; • A suitable risk assessment for wet concreting will be completed prior to works being carried out which will include measures to prevent discharge of alkaline wastewaters or contaminated water to the underlying subsoil and groundwater, from which it could migrate to surface water; • The pouring of concrete will take place within a designated area protected to prevent concrete runoff into surface water; • Washout of concrete transporting vehicles will take place at an appropriate facility, offsite where possible, alternatively, where wash out takes place onsite, it will be carried out in carefully managed onsite wash out areas; • In order to minimize potential impacts to the river SAC from the bridge construction works, abutments and embankments will be outside the SAC and abutments will be set back from the river by a minimum of 5 m; and

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• During construction works suitable drainage, settlement and silt control measures will be implemented to mitigate disturbance to the SAC. The bridge span will be constructed using precast beams.
Air Quality	Chapter 10, Section 10.9.1	Construction	Standard industry good practice mitigation measures should be applied to the Proposed Road Development site, such as that described in: • 'Control of dust from construction and demolition activities' (Kukadia et al., 2003), • 'Best Practice Guidance: The control of dust and emissions from demolition and construction' (GLA, 2006), and • 'Guidance on the assessment of dust from demolition and construction' (IAQM, 2014).
Air Quality	Chapter 10, Section 10.9.1	Construction	• Standard dust mitigation measures will manage any associated contaminates in soils such as fungal spores, although in this location no specific sources of spores are known. • Air quality mitigation measures will be incorporated into a Dust Management Plan that will form part of the contractor's CEMP. • Some example mitigation measures from the TII guidance (TII, 2011), are: ▪ Wind breaks and barriers; ▪ Frequent cleaning and watering of the construction site and associated access roads; ▪ Control of vehicle access; ▪ Vehicle speed restrictions; ▪ Covering of piles; ▪ Use of gravel at site exit points to remove caked on dirt from tyres and tracks; and ▪ Washing of equipment at the end of each work day and prevention of onsite burning.; ▪ Where appropriate and practicable, hard surface roads should be wet swept to remove any deposited materials; ▪ Un-surfaced roads should be restricted to essential site traffic only; and ▪ Wheel-washing facilities should be located at all exits from the construction site. • Air quality mitigation measures would be incorporated into a Dust Management Plan that would form part of the contractor's CEMP.
Climate (Lifecycle GHG Impact Assessment)	Chapter 11, Section 11.7.1.1.	Construction	Planned tree and hedgerow planting onsite, as described in Chapter 07 Biodiversity and Chapter 13 Landscape and Visual of the EIAR, will reduce the impact of land use change on GHG emissions.
Climate (Lifecycle GHG Impact Assessment)	Chapter 11, Section 11.7.1.1.	Construction	A CTMP will be produced prior to construction and implemented in full, minimising congestion and encouraging car sharing and the use of public transport.
Climate (Lifecycle GHG Impact Assessment)	Chapter 11, Section 11.7.1.1.	Construction	It is a requirement that a CEMP will be prepared by the appointed Contractor prior to construction and would include various measures to reduce GHG emissions, including: • Specification of locally-sourced construction materials where possible, including re-use of site-won materials in line with circular economy principles; • Handling materials efficiently onsite to minimise the waiting time for loading and unloading, thereby reducing potential emissions; • Turning off machinery engines when not in use; • Ensuring regular maintenance of plant and machinery;

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• Specification of materials with lower embodied carbon where possible, such as recycled steel and concrete with cement replacements (e.g. Ground Granulated Blast Furnace Slag (GGBS) and Pulverised Fly Ash (PFA)); and • A requirement for the contractor to implement an Energy Management System for the duration of the works.
Climate (Climate Change Resilience Review)	Chapter 11, Section 11.7.2.1	Construction	• Climate change impacts will be considered within maintenance plans and final detailed drainage system design. • The construction stage CEMP will include a requirement to plan for additional mitigation measures to avoid wind-blown dust issues during potential extended periods of dry weather during construction.
Climate (Climate Change Resilience Review)	Chapter 11, Section 11.7.2.1	Construction	Climate change projections will be considered when determining appropriate materials (e.g. consideration of materials with increased tolerance to high temperatures).
Noise and Vibration (General)	Chapter 12, Section 12.7.1	Construction	The contract documents will clearly specify the construction noise criteria included in this chapter which the construction works must operate within. The Contractor undertaking the construction of the works would be obliged to take specific noise abatement measures and comply with the recommendations of BS 5228-2009 +A1:2014 Code of Practice for Noise and Vibration Control on Construction and Open Sites, Parts 1 and 2 and the Noise and the European Communities (Noise Emission by Equipment for Use Outdoors) Regulations, 2001. These measures will ensure that: • No plant used onsite will be permitted to cause an ongoing public nuisance due to noise; • The best means practicable, including proper maintenance of plant, will be employed to minimise the noise produced by onsite operations; • All vehicles and mechanical plant will be fitted with effective exhaust silencers and maintained in good working order for the duration of the contract; • Compressors will be attenuated models fitted with properly lined and sealed acoustic covers which will be kept closed whenever the machines are in use and all ancillary pneumatic tools shall be fitted with suitable silencers; and • Machinery that is used intermittently will be shut down or throttled back to a minimum during periods when not in use.
Noise and Vibration (Selection of Quiet Plant)	Chapter 12, Section 12.7.1.1	Construction	• The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the Proposed Road Development site. The least noisy item of plant will be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action will be to identify whether or not said item can be replaced with a quieter alternative. • For static plant such as compressors and generators used at work areas such as construction compounds etc., the units would be supplied with manufacturers' proprietary acoustic enclosures where possible. • The Contractor will evaluate the choice of excavation, breaking or other working method taking into account various ground conditions and site constraints. Where possible, where alternative lower noise generating equipment that will economically achieve, in the given ground conditions, equivalent structural/excavation/breaking results, these will be selected to minimise potential disturbance.
Noise and Vibration (General Comments on Noise Control at Source)	Chapter 12, Section 12.7.1.2	Construction	• If replacing a noisy item of plant is not a viable or practical option, consideration will be given to noise control 'at source'. This refers to the modification of an item of plant, or the application of improved sound reduction methods in consultation with the supplier or the best practice use of equipment and materials handling to reduce noise. • Proposed techniques will also be evaluated in light of their potential effect on occupational health and safety. The following outline guidance relates to practical noise control at source techniques which relate to specific site considerations:

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			▪ For mobile plant items such as cranes, dump trucks, excavators and loaders, the installation of an acoustic exhaust and/or maintaining enclosure panels closed during operation can reduce noise levels by up to 10 dB. Mobile plant will be switched off when not in use and not left idling; ▪ For percussive tools such as pneumatic concrete breakers or tools a number of noise control measures include fitting a muffler or sound reducing equipment to the breaker 'tool' and ensuring any leaks in the air lines are sealed and erection of localised screens around breaker or drill bit when in operation in close proximity to noise sensitive boundaries are other suitable forms of noise reduction; ▪ For all materials handling, the contractor would ensure that best practice site noise control measures are implemented including ensuring that materials are not dropped from excessive heights; ▪ Where compressors, generators and pumps are located in areas in close proximity to noise sensitive properties/areas and have potential to exceed noise criterion, these will be surrounded by acoustic lagging or enclosed within acoustic enclosures providing air ventilation; ▪ Resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding noises can be controlled by fixing resilient materials in between the surfaces in contact; ▪ Demountable enclosures could also be used to screen operatives using hand tools and could be moved around site as necessary, and ▪ All items of plant will be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and can serve to prolong the effectiveness of noise control measures.
Noise and Vibration (Screening)	Chapter 12, Section 12.7.1.3	Construction	• The length of the screen should in practice be at least five times the height, however, if shorter sections are necessary then the ends of the screen will be wrapped around the source. • BS 5228 -1:2009+A1 2014 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier would be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 10 kg/m^2 will give adequate sound insulation performance. As an example, the use of a standard 2.4 m high construction site hoarding would provide a sufficient level of noise screening once it is installed at a suitable position between the source and receiver.
Noise and Vibration (Working Hours)	Chapter 12, Section 12.7.1.4	Construction	• Normal working times will be 07:00 to 19:00hrs Monday to Friday and 08:00 to 13:00hrs Saturday. Works other than the pumping out of excavations, security and emergency works will not be undertaken outside these working hours without the written permission of the Contracting Authority. • Works other than the pumping out of excavations, security and emergency works will not be undertaken at night and on Sundays without the written permission of the GCC.
Landscape and Visual Impact Assessment	Chapter 13 Section 13.7.3	Construction	Adherence to the CEMP will be a contract requirement and will ensure good working practices are followed so as to minimise and manage any significant, negative environmental impacts arising from construction.
Landscape and Visual Impact Assessment (Reduction Measures)	Chapter 13 Section 13.7.3.1	Construction	• Disturbance of existing vegetation will be minimised where possible and proposed planting will help integrate the Proposed Road Development into the surrounding landscape, provide screening where needed, reflect vegetation patterns of local habitats, re-connect hedgerows to re-establish field patterns, and minimise the effect on the landscape character of the area. • Road boundaries will be planted to reduce headlight glare intrusion into adjacent properties. • Signage will be located sensitively so that it does not increase the visual effect upon dwellings.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• Rounding of the top and bottom of cut and fill slopes to tie in smoothly with existing adjacent landform • Provision of sufficient protection for trees to be retained in areas close to construction works (as described in BS 5837:2005).
Landscape and Visual Impact Assessment (Remediation Measures)	Chapter 13 Section 13.7.4	Construction	• The Proposed Road Development will include a new viewing area looking towards Knockmoy Abbey. The viewing area will be elevated to maximise the views, it will include layby space for motorists to pull over and walk to the viewing point and it will have a footpath connecting the viewing area with Abbeyknockmoy village. Planting to screen the proposed roundabout will frame views of the Abbey and restrict views to the new road. • Mainly native screen planting will be provided where the road will have an adverse visual effect on adjacent properties or views (further details about the species mix is included in the planting schedule in the landscape mitigation drawings accompanying the EIAR, refer to Volume 03 & Volume 04; Appendix A07 of the EIAR) • Hedgerow planting of native mixed species will be used to integrate the road in the existing field patterns • Wildflower mixes would be used on verges to maximise biodiversity. • To mitigate the loss of protected habitat (Annex I *Molinia* Meadows) habitat creation and translocate of grass sods from the affected area to a nearby field will occur. These works will require specialist design, monitoring and maintenance to ensure the correct hydrological characteristics and soil conditions are retained as described in greater detail in Chapter 07 Biodiversity of the EIAR. • Construction compounds and former areas of material stockpiles will be fully reinstated and landscaped, matching the vegetation and land use in the vicinity, following completion of the works. • Attenuation ponds will be naturalized with planting of marginal wetland species to the edges • Tree planting to provide screening will be introduced in clusters or copses of native trees in order to avoid an unnatural appearing tree belt dissecting the open farmland.
Cultural Heritage (General)	Chapter 14, Section 14.7.1	Construction	• During the construction phase, procedures will be adopted, as would be described in the CEMP, to ensure that archaeological areas and sites are protected during construction. This would involve temporary fencing where appropriate and clear notices onsite fences. • Toolbox talks will be undertaken when necessary to inform construction supervision staff and site operatives of archaeologically sensitive areas. • A procedure to agree a minimum period of time to undertake mitigation actions for unforeseen finds during the construction process will be agreed with the Employer and will be recorded in the CEMP.
Cultural Heritage (Archaeological Mitigation Programme)	Chapter 14, Section 14.7.1.1.1	Construction	• Phase 3 (during later enabling works and in advance of and concurrent with construction) – at the start of the construction period, a Targeted Watching Brief (TWB) will be undertaken before or concurrent with the main topsoil strip at selected locations. The GWB will be undertaken in all other areas where it is required. • Phase 4 – a post-excavation assessment will be undertaken in accordance with DoHLGH/NMS advice, followed by detailed analysis and reporting. Phase 4 will commence as soon as practicable following completion of the main investigative works. Galway County Council will also require that the results of any archaeological discoveries will be disseminated in the form of printed publications, web-based information and public presentations by the archaeological contractor.
Major Accidents and Disasters (MADs)	Chapter 15, Section 15.8	Construction	The design of the Proposed Road Development includes inherent features to improve safety and reduce risks such as the incorporation of surface water attenuation to collect spills and surface water runoff. The Proposed Road Development will comply with all applicable legislation and best practices and will include mitigation measures such as adherence to a CEMP during the construction phase as identified throughout the EIAR.
Material Assets (Non-Agriculture)	Chapter 16, Section 16.7.1.1.	Construction	• Prior to excavation diversion works, the appointed Contractor will be supplied with accurate service drawings and additional site investigations will be carried out if necessary, to ensure services are not damaged during construction works.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Utilities			• The Contractor will be obliged to put measures in place during the construction phase to ensure that there are no interruptions to existing services and all services and utilities are maintained unless this has been agreed in advance with the relevant service provider and local authority. • When service suspensions are required during the construction phase, reasonable prior notice will be given to the residencies in the area. The disruption to services or outages will be carefully planned so the duration is minimised. • The timing of local domestic connections will be addressed between the contractor and the local community at the detailed design stage. • Works during the construction phase, including service diversions and realignment will be carried out in accordance with relevant guidance documents, including Gas Networks Ireland's publication 'Safety advice for working in the vicinity of natural gas pipelines'; the ESB's Code of Practice for Avoiding Danger from Overhead Electricity Lines', 2008 and the HSA 'Code of Practice for Avoiding Danger from Underground Services', 2010. • All potential temporary connections will be agreed in advance with the relevant service provider.
Material Assets (Non-Agriculture) Waste	Chapter 16, Section 16.7.1.3	Construction	The following best practice measures would be implemented: • Prior to any demolition, excavation or construction, a CEMP and Construction and Demolition WMP will be produced by the successful Contractor. The Construction and Demolition WMP and CEMP will be implemented by the Contractor for the entirety of the construction and demolition activities, which will ensure that specific control measures contained within these plans are implemented during the construction phase; and • The plans will outline procedures for the correct segregation, storage, handling and transport of waste, which will ensure large volumes of waste are not generated at the Proposed Road Development site, and subsequently do not become a nuisance to the public. It will also ensure that the use of non-permitted waste contractors or unlicensed facilities, which could give rise to inappropriate management of waste, will not take place.
Material Assets (Agriculture)	Chapter 17 Section 17.7.1	Construction	• A key contact person will be appointed during the construction phase to facilitate communications between affected landowners and to facilitate the re-organisation of farm enterprises by farmers during critical times • The landowner will be provided with access to all separated land parcels during the construction of the Proposed Road Development. Where temporary disruptions to this access occur landowners will be notified in advance • Where existing water and electricity supplies are disrupted during the construction phase an alternative water source or electricity supply will be made available e.g. water tanker or electric cable ducting. If access to surface drinking water sources are permanently restricted alternative groundwater supplies will be provided (or compensation to allow farmer to drill his own well) • Suitable boundary fencing will be erected to delineate the line of the Proposed Road Development site boundary and prevent disturbance/trespass to, and containment of livestock within, adjacent land • Landowners with lands adjoining sites where either rock breaking, blasting or piling takes place will be notified in advance of these activities; • The impacts on water quality will be minimised by way of a programme of mitigation measures for surface and ground water sources as described in Chapters 08 Land and Soils and Chapter 09 Water of the EIAR • The spread of dust onto adjoining lands will be minimised by way of mitigation measures set out in Chapter 10 Air Quality of the EIAR. Typically, the effect of dust on agricultural grazing livestock is not significant • Where drainage outfalls are temporarily altered, or land drains blocked or damaged an adequate drainage outfall will be maintained and land drains will be repaired.

Table 19-3 Schedule of Mitigation Measures Operational Phase

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			Operation
Biodiversity (Artificial Lighting)	Chapter 07 Biodiversity Section 7.7.1.2.1	Operation	Embedded control measures have been incorporated into the design of the Proposed Road Development as outlined in Chapter 07, Section 7.6.1 of the EIAR. A suitably experienced bat ecologist will visit the site during operation to measure, using a suitably calibrated light meter, light spill onto habitat within 100 m of the Abbert River. Where additive light spill does exceed 1 lux, the Contractor will make retrospective amendments to light cowls, to the satisfaction of and in agreement with the suitably experienced bat ecologist.
Biodiversity (Habitat Mitigation - Annex I *Molinia* Meadows)	Chapter 07 Biodiversity Section 7.7.1.3.1.3	Operation	Ecological monitoring will be ongoing, and some actions such as grazing, mowing, or invasive species treatment may be required to be acted upon.
Biodiversity (Non-Annex I Habitats)	Chapter 07 Biodiversity Section 7.7.1.3.1.3	Operation	Some of the grassland verge adjacent to the cycleway will be planted with native wild flowers suitable for pollinating species. A management plan to optimise mowing management of verges for pollinators will be developed and implemented.
Biodiversity (Invasive Species)	Chapter 07 Biodiversity Section 7.7.1.3.2.3	Operation	• Treatment of invasive species onsite will occur up until two years post construction, and signage for invasive species will be left in situ. • Biosecurity measure will be put in place for any investigatory surveys on bridge structures or works that require personnel to enter a watercourse and signage for invasive species will be left in situ.
Biodiversity (Bats - Lighting)	Chapter 07 Biodiversity Section 7.7.1.3.3.2	Operation	• A suitably experienced bat ecologist, with experience of input to light designs, will be consulted during the detailed design of the operational lighting plan. As a minimum, having regard for best scientific knowledge (including BCT and ILP) and the design will minimise impacts to bat habitats, particularly at and surrounding the proposed Abbert River crossing. Cowled lighting is required throughout the Proposed Road Development to direct light spill away from both retained and created habitats; • In the current design, no lighting is provided at the bridge location and the approach to bridge. The risk of impacts associated with artificial lighting on the Abbert River will therefore be minimised by the adoption of the following design requirements: ▪ The location of lighting columns along the rest of the Proposed Road Development will be designed to maximise the setback distance from the proposed bridge taking into account the ecological sensitivities associated with the Abbert River; ▪ If bridge lighting is subsequently installed, the use of specialist bollard or low-level downward directional luminaires and red-light Emitting Diode (LED) fittings on the proposed bridge crossing should be fitted. Any proposed lighting system should have regard for the research indicating that light-sensitive bat species are equally active in such light, as in darkness (Spoelstra et al., 2017); ▪ In all other areas, luminaires will be installed with warm white spectrum LEDs (ideally<2700 Kelvin), featuring peak wavelengths higher than 550 mm to avoid the component of light most disturbing to bats, where luminaires are mounted with no upward tilt, and with an upward light ratio of 0% with good optical control; and The separation distance between light mast locations and vegetated features will be maximised wherever possible. Additive light spill (i.e. from the Proposed Road Development alone) onto any bat habitats known to be used by highly light sensitive species should not exceed 1 lux.
Biodiversity (Bats -Bat Roosting)	Chapter 07 Biodiversity Section 7.7.1.3.3.2	Operation	10 x Schwelger woodcrete maternity roost bat boxes will be installed locally, at suitable locations, as deemed appropriate, by a suitably qualified ecologist.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Badger- Habitat Severance/Range Restriction)	Chapter 07 Biodiversity Section 7.7.1.3.4.3	Operation	Given that Badger activity was low within the footprint of the Proposed Road Development (Volume 03), no specific Badger underpasses are required. 600 mm pipe crossings will be installed for specific watercourses and could function as underpasses for Badger depending on flow condition. These crossings/structures will also allow mammal passage as none of these are substantial watercourses.
Biodiversity (Badger- Mortality Risk)	Chapter 07 Biodiversity Section 7.7.1.3.4.3	Operation	Mammal-resistant fencing will be required to guide Badgers to the underpasses and will be installed in accordance with the specification outlined in 'Guidelines for the Treatment of Badgers prior to the Construction of National Road Schemes', and TII's mammal resistant fencing specification (currently CC-SCD-00320/00319), and will include Badger proofing of emergency access roads and other similar access points, in areas where mammal-resistant fencing is to be installed. The locations where mammal-resistant fencing should be installed are shown in Volume 03; Figure 7-11 of the EIAR.
Biodiversity (Otter- Mortality Risk)	Chapter 07 Biodiversity Section 7.7.1.3.5.2	Operation	Mammal resistant fencing is proposed for Badger, that will also provide protection for Otter from road collision risk (See Badger mitigation). An assessment of the effectiveness of mitigation measures for Otter is proposed, such that use of pipe crossings by Otter, and habitat upstream of pipe crossings is used by Otter. The use of areas by Otter will be identified through field surveys for Otter sign and deployment of trail cams within the ZoI.
Biodiversity (Habitat Severance, Range Restriction and Barrier Effects)	Chapter 07 Biodiversity Section 7.7.1.3.5.2	Operation	To avoid Otter road casualties, Otter passage will be enabled under the clear-span bridge structure. Otter passage will also generally be enabled via the pipes (minimum diameter 600 mm) used on crossing drainage ditches, which have been designed primarily for drainage purposes.
Biodiversity (Water Quality)	Chapter 07 Biodiversity Section 7.7.1.3.5.2	Operation	The Proposed Road Development will incorporate an embedded drainage system design that will allow storm-water management. This will include petrol interceptors when outfalling to the Abbert River and attenuation ponds that will ensure adequate sufficient protection for Crayfish.
Biodiversity (Other Mammal Species- Habitat Severance, Range Restriction and Barrier Effects))	Chapter 07 Biodiversity Section 7.7.1.3.6.2	Operation	• Underpasses prescribed for Badger and Otter commuting could also be used by some of these other mammal species in dry weather conditions. The clear-span structure proposed for crossing the Abbert River will also potentially allow movement of these species across the river. Measures to mitigate for Habitat Loss such as the planting of native tree and hedgerow species will allow both habitat creation and commuting routes for these other mammal species. • The landscape plan will provide dead wood piles locally, that will enhance the area for prey species of some mammals during the operation phase.
Biodiversity (Birds- Lighting)	Chapter 07 Biodiversity Section 7.7.1.3.7.2	Operation	Efforts will be made at design stage to reduce light pollution and prevent overspill. The lighting design will reflect this. This includes the incorporation of cowls, hoods, or louvres to prevent light pollution. Avoiding the lighting of the river area, will reduce the overall ecological impact on riverine bird communities, including Kingfisher, through ensuring reduced light overspill, and reduced light pollution of the local riverine and riparian environment.
Biodiversity (Birds- Barn Owl Mitigation)	Chapter 07 Biodiversity Section 7.7.1.3.7.2	Operation	Landscaping has been considered, with awareness that wide grassland verge habitat developed adjacent to roads is unsuitable for Barn Owl. The following mitigation is incorporated into the landscape plan: • In order to obstruct low-level flight across carriageways, continuous hedges and/or lines of closely spaced trees (>3 m high) should, wherever possible, be created adjacent to the metalled surface along both sides of the Proposed Road Development. This is especially important where the road is level with, or raised above, the adjacent terrain; • Areas of grassland, which are likely to support small mammals, should only be allowed near the road if they can be sited behind continuous screens;

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			• In areas where continuous screens are not provided and the loss of verge grassland is acceptable, permanent ground cover such as dense bramble or gorse should be maintained across the entire width of both verges, in order to reduce the attractiveness of the verge to Barn Owls. This is especially important where roads are level with, or raised above, the adjacent terrain; and • Landscaping immediately adjacent to the road should primarily consist of woodland as opposed to meadow to reduce the suitability of this verge for Barn Owl. Woodland comprising native species will have the most benefits for biodiversity.
Biodiversity (Habitat Compensation and Nest Box Installation)	Chapter 07 Biodiversity Section 7.7.1.3.7.2	Operation	• As part of the habitat compensation works, lost hedgerows and woodland will be compensated for through the landscaping master plan. Installation of a variety of suitable bird boxes (n=30) for cavity nesting and other woodland associated birds is proposed to offset temporary losses of nesting habitat and enhance areas for birds. Swift boxes could be included, within this selection, at suitable locations. Locations for nest box installation will be decided and approved by the ECoW. Care should be taken to ensure boxes are installed to a high standard, to ensure stability and maximize likelihood of use by nesting birds through appropriate positioning. • The landscape plan will provide some dead wood piles (following site clearance) close to field boundaries locally, that will enhance the area for prey species of some birds during the operation phase.
Biodiversity (Fish)	Chapter 07 Biodiversity Section 7.7.1.3.8.2	Operation	• The Proposed Road Development will incorporate an embedded drainage system design that will allow storm-water management. This will include petrol interceptors when outfalling to the Abbert River and attenuation ponds.
Biodiversity (Amphibians)	Chapter 07 Biodiversity Section 7.7.1.3.9.2	Operation	• Range-restriction or barrier effects will be prevented by the embedded design which includes for the installation and maintenance of drainage culverts at the sites of existing drains. The combination of the network of wildlife passage possible via culverts, the clear-span bridge structures and mammal underpasses will provide a high degree of landscape scale permeability along the Proposed Road Development. The locations of the wildlife passage facilities are shown in Volume 04; Appendix A7-10 of the EIAR. • The landscape plan will provide dead wood piles locally close to field boundaries, that will enhance the area for amphibians during the operation phase. • In addition, the retention of settlement/roadside ponds will have a positive impact on amphibian species and are likely to present overall benefits to these species in the area, relative to the pre-construction environment.
Biodiversity (Lepidoptera)	Chapter 07 Biodiversity Section 7.7.1.3.10.2	Operation	• No mitigation is proposed in addition to that inherent in the landscape planting plan, which will include native, species-rich wildflower meadow, wetland habitats reinstatement and reuse of spoil/vegetated turves and hedgerow communities. • Landscaping will retain native plant species and vegetation as much as possible by reusing spoil and vegetated turves in addition to planting native species.
Biodiversity (White-clawed Crayfish)	Chapter 07 Biodiversity Section 7.7.1.3.11.2	Operation	• The Proposed Road Development will incorporate an embedded drainage system design that will allow storm-water management. This will include petrol interceptors when outfalling to the Abbert River and attenuation ponds that will ensure adequate sufficient protection for Crayfish.
Biodiversity (Common Lizard)	Chapter 07 Biodiversity Section 7.7.1.3.12.2	Operation	• The landscape plan will provide dead wood piles locally and close to field boundaries, that will enhance the area for Common Lizard during the operation phase.
Biodiversity	Chapter 07 Biodiversity	Operation	• GCC will be responsible, during operation, for the commission of a suitably experienced ecologist(s) to monitor effectiveness of; and make recommendations, where required, to adapt the measures set out in relation to specific species and habitats.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
(Monitoring)	Section 7.7.2.2		
Biodiversity (Monitoring-Annex I *Molinia* Meadows)	Chapter 07 Biodiversity Section 7.7.2.2.1	Operation	• An appropriate management plan will be developed and implemented, such as extensive grazing and/or a sensitive mowing regime. Annual monitoring, for a five-year period will be required. The frequency of monitoring will be agreed with NPWS. This monitoring programme will assess the success of the translocation through ground water assessment using a piezometer and habitat surveying. The success of the management regime will be assessed through habitat surveying. These findings will inform recommendations for any changes or alterations to the management that are needed.
Biodiversity (Monitoring-Annex I Petrifying Springs)	Chapter 07 Biodiversity Section 7.7.2.2.2	Operation	• Following the programme of monitoring of the pH of the Petrifying Spring for the duration of the construction phase, a pH monitoring programme should be undertaken for one year following commencement of operation. The frequency of monitoring should be agreed with NPWS, but it is considered that quarterly monitoring events will be undertaken as a minimum. This will include physical chemistry as well as groundwater volumes.
Biodiversity (Monitoring-Bat Monitoring and Lighting)	Chapter 07 Biodiversity Section 7.7.2.2.3	Operation	• Additive light spill (i.e. from the Proposed Road Development alone) onto any bat habitats known to be used by highly light sensitive species will not exceed 1 lux. A suitably experienced bat ecologist will visit the Proposed Road Development site during operation to measure, using a suitably calibrated light meter, light spill onto habitat within 100 m of the Abbert River. Where additive light spill does exceed 1 lux, the Contractor will make retrospective amendments to light cowls, to the satisfaction of and in agreement with the suitably experienced bat ecologist. • In accordance with CEDAR (2016) guidance it is proposed that this post-construction monitoring will involve a minimum of two separate surveys in the breeding season and two separate (in time) surveys in mid-August to late-September, to reflect periods of landscape-scale movements, and that these surveys take place for two bat activity seasons (May-August) following completion of the construction of the Proposed Road Development. Monitoring will comprise acoustic detector recording at a minimum, along the river, pond areas and woodland areas adjacent to the Proposed Road Development. Particular emphasis will be placed on assessing bat activity at the location of the proposed new bridge.
Biodiversity (Monitoring-Badger)	Chapter 07 Biodiversity Section 7.7.2.2.4	Operation	• In accordance with the recommendations described in the 'Guidelines for the Treatment of Badgers during the Construction of National Road Schemes' quarterly monitoring of the effectiveness of the mitigation measures will be undertaken in the first year after the completion of construction works (e.g. inspection for Badger activity, fencing integrity and mammal underpass/>600 mm pipe condition). The use of areas by Badger will be identified through field surveys for Badger sign and deployment of trail cams within the ZoI.
Biodiversity (Monitoring-Otter)	Chapter 07 Biodiversity Section 7.7.2.2.5	Operation	• A monitoring programme will be undertaken post construction for a minimum of one year with quarterly surveys undertaken to assess habitat use by Otter and the effectiveness of pipe crossings for enabling Otter movement. An assessment of the effectiveness of mitigation measures for Otter is proposed, such that use of pipe crossings by Otter, and habitat upstream of pipe crossings is used by Otter. The use of areas by Otter will be identified through field surveys for Otter sign and deployment of trail cams within the ZoI.
Biodiversity (Monitoring-Barn Owl)	Chapter 07 Biodiversity Section 7.7.2.2.6	Operation	• As per TII Barn Owl Surveying Standards for National Road Projects, resurveying of the ZoI for Barn Owls is required intermittently in order to assess the site for Barn Owl activity during construction and operation of the Proposed Road Development. It is recommended that dedicated surveys are conducted for Barn Owl within the ZoI during the construction and operational phase and for potential mitigation measures for Barn Owl should be implemented if necessary, based on survey outcomes over this period. • Post-construction monitoring is a requirement on all National Road Projects where Barn Owl mitigation measures are applied in the landscape treatment. Post-construction monitoring must include a road casualty survey to assess Barn Owl mortality rates and locations on the scheme and in relation to the mitigation measures. The methods for designing and undertaking the road casualty survey are specified in REENV-07004 'The interactions between Barn Owls and major roads: informing management and mitigation' (Lusby et al. 2021). Where post-construction monitoring of sections of road without mitigation measures identifies Barn Owl hotspots, or in areas where there is a high risk of vehicle collisions occurring, options for the installation of mitigation measures shall be considered where beneficial. Any post-construction measures shall be limited to minor works.

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Monitoring-Marsh Fritillary)	Chapter 07 Biodiversity Section 7.7.2.2.7	Operation	• Monitoring of Marsh fritillary and food plants will be undertaken for three years post construction within suitable habitat types along the Proposed Road Development.
Noise and Vibration	Chapter 12, Section 12.7.2	Operation	In order to reduce operational noise levels along the length of the Proposed Road Development mitigation measures through the use of a low-noise road surface have been included. Low-noise road surface in the context of the guidance under which this assessment is prepared refers to a road surface which provides a reduction in noise levels of 2.5 dB(A) when compared to hot rolled asphalt. The low-noise road surface should extend from the roundabout at the west end of the Proposed Road Development to the eastern end.
Landscape and Visual	Chapter 13 Section 13.7.5	Operation	**Ch. 0+000 – 0+500** • As the new road veers north towards the proposed viewing area and the roundabout, the existing footpath will be extended to converge with the old road. It is proposed to add a cluster of tree planting to the space between the new and the old roads to create a visual break and reduce the cumulative effect from the two roads in close proximity. • The proposed viewing area looking north towards Knockmoy Abbey provides a benefit to the local community, it is important therefore to maintain uninterrupted views to the Abbey, while providing some screening of the roundabout. Landscape mitigation will introduce field hedges to the southern road boundary with some native woodland copses east of the viewing area and on the embankments of the roundabout. • Any areas retained open for improved views will be seeded in species rich grasslands suitable for pollinators. However, while retaining views to the Abbey is important, the view from the Abbey is considered to be highly sensitive to change and the screening of the roundabout and embankments from the Abbey is equally important. The clusters of trees will also provide screening from the south.
Landscape and Visual	Chapter 13 Section 13.7.5	Operation	**Ch. 0+500 – 0+1000** The proposed roundabout has been identified as a significant landscape effect, resulting in the loss of trees and being visually dominant to residents on the fringes of the village. The opportunity to introduce woodland copses at this location will break up views of the Proposed Road Development without attempting to screen it entirely and will also allow distant views to the Abbey. The central median of the roundabout will allow direct replacement of the lost tree by planting of a small cluster of 3no. semi-mature trees.
Landscape and Visual	Chapter 13 Section 13.7.5	Operation	**Ch. 0+1000 – 0+1500** Between the roundabout and the river crossing, the Proposed Road Development is raised on an embankment. Roadside boundary treatments will comprise clusters of feature trees and hedgerow planting, it will avoid creating a linear belt of woodland. Grass verges will be seeded in species rich grasslands suitable for pollinators. The introduction of woodland clusters will visually break up the embankment and reflect the character of established tree lined hedgerows and riverbanks in the near vicinity.
Landscape and Visual	Chapter 13 Section 13.7.5	Operation	**Ch 0+1500 to 1600 (bridge crossing)** The bridge will be highly visible and a new dominant feature of the landscape, in particular when considering the rear views from a property due south of the proposed route with clear uninterrupted views north to the bridge. While it is not possible or appropriate to entirely screen the bridge, introduction of denser tree planting along the riverbanks will reflect the character of riverbanks at the existing N63 bridge crossing. As the proposed bridge crosses the river at an oblique angle planting of the roadside embankments north and south will allow a partial overlap of tree planting, thus in time the trees will be higher than the bridge parapets viewed from most angles and effects will be substantially reduced.
Landscape and Visual	Chapter 13 Section 13.7.5	Operation	**Ch. 0+1600 – 0+2500** East of the Abbert River, the Proposed Road Development drops down to existing levels and continues through flat low-lying pasture lands, crossing a minor road and associated stone ditches. The Proposed Road Development will have little effect on the existing landscape through this section, crossing mostly fenced field boundaries, however the route is within close proximity to a residential property off the L6159 and will

Environmental Aspect	EIAR Reference (Chapter/Section)	Phase	Mitigation and Monitoring Measure
			result in a significant visual effect. Proposed mitigation along this route will introduce a higher proportion of tree clusters to the proposed roadside boundary hedges. This treatment is considered appropriate to the landscape setting of the tree lined riverbanks to the south of the route.
Landscape and Visual	Chapter 13 Section 13.7.5	Operation	**Ch. 0+2500 to 3100** As the Proposed Road Development merges with the existing N63, the resultant road widening will cause the loss of the northern roadside hedge. The proposed mitigation will be to replace like with like for the duration of approximately 600 m. As the existing hedge has trees up to 6.0 m height, planting of mixed species hedgerows should include frequent occurrences of heavy standard trees in small clusters. Consideration of denser planting will be given at the junction of the Proposed Road Development with the existing N63, to reduce cumulative effect from both roads running adjacent to one another.
Major Accidents and Disasters (MADs)	Chapter 15, Section 15.8	Operation	• The design of the Proposed Road Development includes inherent features to improve safety and reduce risks such as the incorporation of surface water attenuation to collect spills and surface water runoff. The Proposed Road Development will comply with all applicable legislation and best practices. • These measures have demonstrated that the Proposed Road Development would not be particularly vulnerable to MADs or have a particular capacity to exacerbate potential MAD risks. The identified risks will therefore be reduced to a level ALARP. Therefore, no secondary mitigation or specific monitoring measures would be required.
Material Assets (Agriculture)	Chapter 17 Section 17.7.2	Operation	• The loss of agricultural land due to the construction of the Proposed Road Development will be a permanent loss which cannot be mitigated except through compensation • The separated land parcel will be accessible either via the local road network or via accommodation access roads. Where existing access gates are removed, these will be replaced. Access will be maintained to lands on other side of N63 • Where existing water and electricity supplies to fields or farm yards are severed, the supply would be reinstated by provision of ducting where possible. Alternatively, where ducting is not feasible a permanent alternative water source or electricity supply will be made available. Compensation payments will enable farmers to replace power and water supplies • Water from the Proposed Road Development will be diverted to attenuation ponds before discharging to watercourses or to ground. The drainage design of the Proposed Road Development will intersect existing field drains and carry the drainage water to suitable outfalls • The loss of shelter will be addressed by the proposed landscaping plan see Chapter 13 Landscape and Visual of the EIAR for further information • The Proposed Road Development boundary will prevent trespass of livestock onto the adjoining road development • Landscaping along the Proposed Road Development will minimise the visual impact on farms along the route of the Proposed Road Development.