Local Distributor Road 4 Abbeyland Navan

Environmental Impact Assessment Report
Volume 2: Main Text

Meath County Council

Project number: 60546769 / TRA 04 008
Reference: LDR4-REP-20-0000-EN-0001

June 2020

comhairle chontae na mí
meath county council

List of Volumes comprising this Environmental Impact Assessment Report

Environmental Impact Assessment Report

Volume 2: Main Text

Table of Contents

Figures

Tables

List of Acronyms

Acronym	Description
AA	Appropriate Assessment
AADT	Annual Average Daily Traffic
AAMP	Ambient Air Quality Monitoring Programme
ABP	An Board Pleanála
ACA	Architectural Conservation Area
ADM	Arterial Drainage Maintenance
ADS	Advanced Direction Signs
AEP	Annual Exceedance Probability
ALV	Alluvium
AP	Aerial Photography
ASI	Archaeological Survey of Ireland
ATC	Automatic Traffic Counts
AWS	Automatic Weather Station
BAP	Biodiversity Action Plan
BCI	Bat Conservation Ireland
BCT	Bat Conservation Trust
Bgl	Below ground level
BMI	Body Mass Index
BTO	British Trust of Ornithology
CAFE	Clean Air for Europe
C&D	Construction and Demolition
CEMP	Construction Environmental Management Plan
CESCP	Construction Erosion Sediment Control Plan
CFRAM	Catchment Flood Risk Assessment and Management
Ch.	Chainages
CH_4	Methane
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CLP	Classification, Labelling and Packaging
CMU	Catchment Management Unit
CO_2	Carbon Dioxide
COMAH	Control of Major Accident Hazards involving Dangerous Substances
CPO	Compulsory Purchase Order
CRTN	Calculation of Road Traffic Noise
CCR	Climate Change Resilience
CSO	Central Statistics Office
Db	Decibel
DCP	Dynamic Cone Penetrometers
DECLG	Department of Environment, Community and Local Government
Defra	Department for Environment, Food and Rural Affairs
DoCHG	Department of Cultural Heritage and the Gaeltacht
DoHGLP	Department of Health Good Laboratory Practice

Acronym	Description
DMRB	Design Manual for Roads and Bridges
DMURS	Design Manual for Urban Roads and Streets
DoS	Degree of Saturation
DTTAS	Department for Transport, Tourism and Sport
EEC	European Economic Community
EC	European Commission
EcMS	Ecological Monitoring Strategy
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EIS	Environmental Impact Statement
EMR	Eastern Midlands Region
EMRA	Eastern and Midland Regional Assembly
EMRWMP	Eastern-Midlands Regional Waste Management Plan
EPO	Environmental Operating Plan
EPA	Environmental Protection Agency
EPRC	Emerging Preferred Route Corridor
ER	Employer's Representative
EREP	Environmental River Enhancement Programme
ESB	Electricity Supply Board
ESR	Employer's Site Representative
ETS	Emission Trading Scheme
EU	European Union
EV	Electric Vehicle
FRA	Flood Risk Assessment
FRMP	Flood Risk Management Plan
GAA	Gaelic Athletic Association
GDA	Greater Dublin Area
GF & GC	Glacial Till
GGBS	Ground Granulated Blast Furnace Slag
GHG	Greenhouse Gas
GI	Ground Investigation
GLVIA	Guidelines for Landscape and Visual Impact Assessment
GNI	Gas Networks Ireland
GAI	Geological Survey Ireland
ha	hectare
HA	Highways Agency
HDV	Heavy Duty Vehicles
HFCs	Hydrofluorocarbons
HGV	Heavy Goods Vehicle
HIA	Health Impact Assessment
HSA	Health and Safety Authority
HSE	Health Services Executive

Acronym	Description
HV	High Voltage
IAI	Institute of Archaeologists Ireland
IAQM	Institute of Air Quality Management
ICCI	In-combination climate change impact assessment
ICE	Inventory of Carbon and Energy
IE	Industrial Emissions
IEL	Industrial Emission Licence
IEMA	Institute of Environmental Management and Assessment
IFI	Inland Fisheries Ireland
IGI	Institute of Geologists of Ireland
IHT	Institution of Highways and Transportation
ILP	Institute of Lighting Professionals
IPC	Integrated Pollution Control
IRP	Incident Response Plan
ISMP	Invasive Species Management Plan
ITM	Irish Traverse Mercator
IW	Irish Water
JTC	Journey Turning Counts
JTS	Journey Time Surveys
Kt	Kilotonne
LAM	Local Area Model
LCA	Landscape Character Assessment
L_{den}	Day Evening Night Sound Level
LDR	Local Distributor Road
LDV	Light Duty Vehicles
LED	Light-Emitting Diode
LGV	Light Goods Vehicle
LNRS	Low Noise Road Surface
LTP	Local Transport Plan
LVIA	Landscape and Visual Impact Assessment
MAD	Major Accident and Disaster
MCA	Multi Criteria Analysis
MCC	Meath County Council
MCDP	Meath County Development Plan
MG	Made Ground
µm	Microns
msa	Million Standard Axles
MV	Medium Voltage
N	Nitrogen
NBDC	National Biodiversity Data Centre
NDP	Navan Development Plan
NEC	National Emissions Ceiling

Acronym	Description
NH3	Amonia
NHA	Natural Heritage Area
NIAH	National Inventory of Architectural Heritage
NIS	Natura Impact Statement
NLS	National Landscape Strategy
NMI	National Museum of Ireland
NMS	National Monuments Service
NMU	Non-Motorised Users
NMVOC	Non-Methane Volatile Organic Compounds
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
NPF	National Planning Framework
NPWS	National Parks and Wildlife Services
NRA	National Roads Authority
NTA	National Transport Authority
NLTP	Navan Local Transport Plan
NTS	Non-Technical Summary
NWCPO	National Waste Collection Permit Office
OD	Ordnance Datum
O-D	Origin-Destination
OGV	Other Goods Vehicle
OPW	Office of Public Works
OS	Ordnance Survey
OSI	Ordnance Survey Ireland
PAG	Project Appraisal Guidelines
PAH	Polycyclic Aromatic Hydrocarbons
PC	Public Consultation
PCU	Passenger Car Unit
PFA	Pulverised Fly Ash
PFCs	Perfluorocarbons
Ph	Power of Hydrogen
PIA	Personal Injury Accidents
pNHA	proposed Natural Heritage Area
$PM_{2.5}$	Particulate Matter 2.5
PM_{10}	Particulate Matter 10
PMG	Project Management Guidelines
POWSCAR	Place of School or college census of anonymised records
PPV	Peak Particle Velocity
PRF	Potential Roosting Features
QI	Qualifying Interest
QL	Queue Length
RBMP	River Basin Management Plan

Acronym	Description
RMP	Record of Monument and Places
RoI	Republic of Ireland
RPG	Regional Planning Guidelines
RPS	Record of Protected Structures
RSA	Road Safety Authority
RSES	Regional Spatial & Economic Strategy
SAC	Special Area of Conservation
SCI	Special Conservation Interests
SDZ	Strategic Development Zone
SEAI	Sustainable Energy Authority of Ireland
SF_6	Sulphur Hexafluoride
SFRA	Strategic Flood Risk Assessment
SI	Statutory Instrument
SIFP	Strategic Integrated Framework Plan
SNWS	Semi Natural Woodland Survey
SO_2	Sulphur Dioxide
SPA	Special Protection Area
SPT	Standard Penetration Test
SSE	South-southeast
SSW	South south-west
THC	Total Hydro Carbons
TII	Transport Infrastructure Ireland
TMP	Traffic Management Plan
TMU	Traffic Monitoring Units
TTA	Traffic and Transport Assessment
TII	Transport Infrastructure Ireland
TS	Topsoil
U1	Unacceptable Material
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VEM	Visual Envelope Map
VOC	Volatile Organic Compounds
WAM	With Additional Measures
WM	With Measures
WERLA	Waste Enforcement Regional Lead Authority
WFD	Water Framework Directive
WHO	World Health Organisation
WMP	Waste Management Plan
WQMP	Water Quality Monitoring Program
WSSP	Water Services Strategy Plan
ZoI	Zone of Influence
ZTV	Zone of Theoretical Visibility

Chapter 01: Introduction

01

1. Introduction

1.1 General

This Environmental Impact Assessment Report (EIAR) for the proposed Local Distributor Road 4 (LDR4) (hereafter referred to as the 'Proposed Road Development') is "*A statement of the effects, if any, which proposed development, if carried out, would have on the environment*" (EPA, 2017) and has been prepared in respect of the construction and operation of the Proposed Road Development. The EIAR, as presented, has been prepared by AECOM with the assistance of Meath County Council (MCC) (hereafter referred to as the 'Applicant').

The EIAR is presented in four volumes as outlined below.

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

This EIAR should be read in conjunction with all the particulars of the planning application, which will be submitted by MCC to An Bord Pleanála (ABP).

A separate Natura Impact Statement (NIS) which complements the EIAR and vice versa has also been prepared.

1.2 Overview

The Applicant is proposing to develop a c. 1.15 km local distributor road, referenced in the Navan Development Plan (NDP) 2009-2015 and in Appendix IV of the Navan Local Transport Plan (NLTP) as Local Distributor Road 4 (LDR4). The Proposed Road Development will connect the N51/R147 Kells Road to the L3409 Ratholdron Road through Abbeyland, and will include junctions, footpaths, cycle paths, public lighting, and attenuation pond/tanks. The Proposed Road Development is located on a predominantly greenfield site located in the townlands of Abbeyland, Abbeyland South, Moathill, Townparks, Windtown in Navan, Co. Meath (herein referred to as the Proposed Road Development site) (Figure 1-1). The Proposed Road Development site is c. 8.63 Ha.

A new bridge crossing over the River Blackwater in the south is also proposed, which will improve access to lands to the north of the town between the L3409 Ratholdron Road and the R162 Proudstown Road, and also the Clonmagaddan Strategic Development Zone (SDZ).

The Proposed Road Development runs in a north-south direction across the River Blackwater between L3409 Ratholdron Road and N51/R147 Kells Road. The location is characterized by presence of open greenfield area with some wooded areas in the section north of the River Blackwater, which runs to the west of the recently developed Blackwater Park. The southern section of Proposed Road Development site contains the River Blackwater, where a new river bridge crossing is also proposed, and continuing to the south the scheme meets the N51/R147 Kells Road, which is lined by both residential and commercial properties. The River Blackwater is in a Special Area of Conservation (SAC) and Special Protection Area (SPA).

The Proposed Road Development site is on land which is zoned as A2 (New Residential), F1 (Open Space), H1 (High Amenity) and R1 (Rail Corridor), within the NDP 2009-2015 (Incorporating Variation 1, Variation 2 and Variation 3) (MCC, 2009). The land use zoning objectives in the area are described as follows:

- A2 New Residential: To provide for new residential communities with ancillary community facilities, neighbourhood facilities and employment uses as considered appropriate for the status of Navan as a Large Growth Town;
- F1 Open Space: To provide for and improve open spaces for active and passive recreational amenities;
- H1 High Amenity: To protect and improve areas of high amenity; and
- R1 Rail Corridor: To provide for a strategic rail corridor and associated physical infrastructure.

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 environmental impacts of the Proposed Road Development have been assessed, where appropriate.

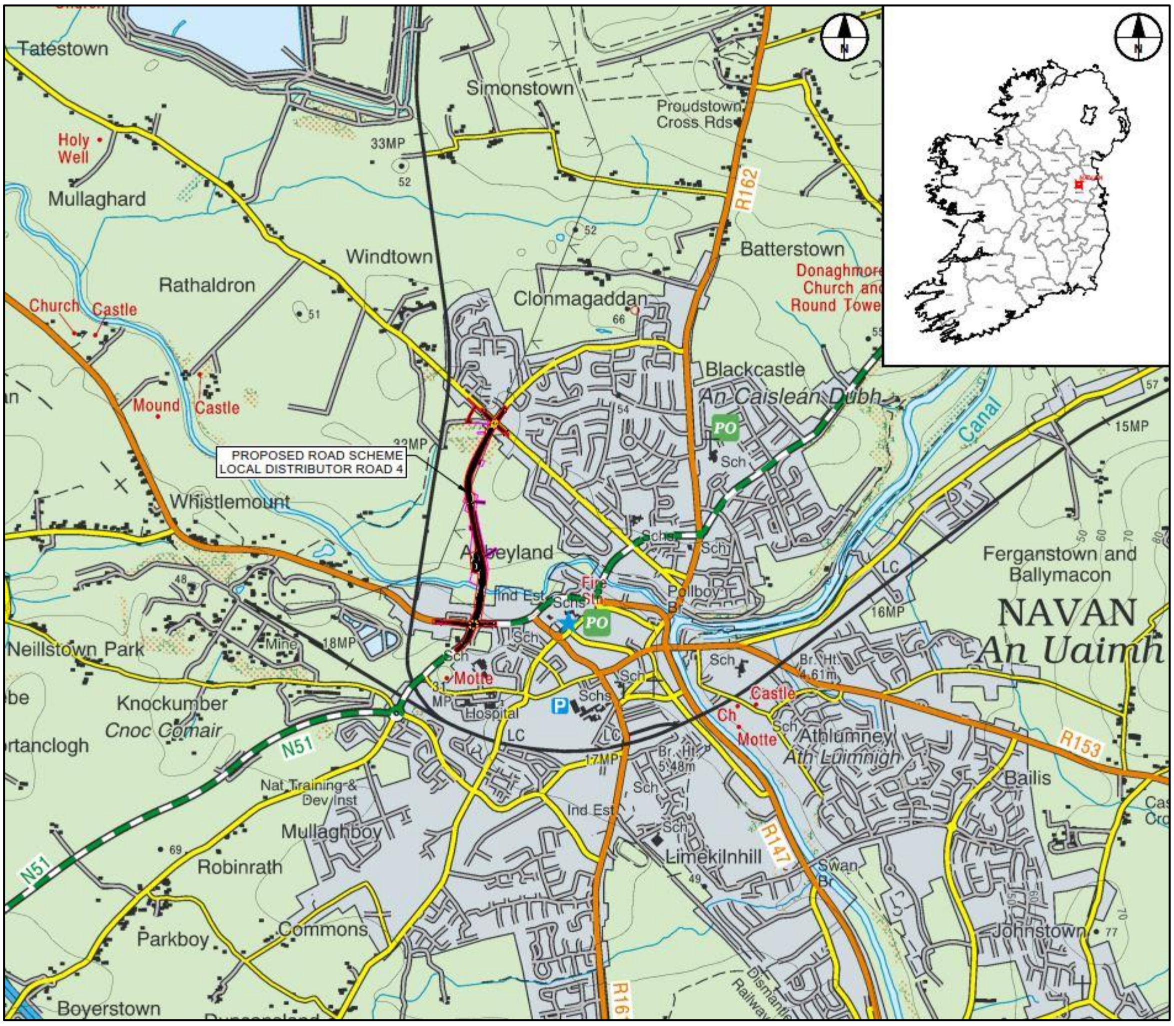


Figure 1-1 Location Plan

The Proposed Road Development comprises a local distributor road, incorporating footway and cycleway provision of approximately 1.15 km in length.

The proposed alignment commences with a proposed signalled junction at the N51/R147 on the north eastern side of Navan town centre in the townland of Abbeyland. The route runs in a north easterly direction across the River Blackwater SAC, where a new bridge crossing is proposed.

The route continues in a north westerly direction from here crossing through the south west corner of Blackwater Park and a number of open greenfields. The route then crosses in a north easterly direction through a small section of woodland/shrubland before joining Ratholdron Rd in the north.

The Proposed Road Development comprises the following major elements:

- Approximately 1.15 km of new urban Arterial Street (Design Manual for Urban Roads and Streets (DMURS) - 3.25 m lanes - single carriageway), incorporating pedestrian and cycle facilities (2.0 m wide raised one-way cycle track on both sides, 2.5 m wide footpaths on both side, 1.0 m road verges);
- Two new signalised junctions at the scheme termination points, L3409 Ratholdron Road and R147 / N51 Kells Road, both incorporating right turn lane and pedestrian/cycle crossings;
- One new single span river bridge over the River Blackwater (overall length 45 m);
- One new piped culvert over an existing field ditch;
- New pedestrian and cycle facilities, including 2 accesses to the Blackwater Park;

- Associated earthworks including excavation of unacceptable material, excavation and processing of rock and other material, provision of material deposition areas and deposition and recovery of unacceptable material for reuse in the works;
- Accommodation Works, including the provision of access roads and accesses;
- Drainage works, including the construction of an attenuation pond and storage tanks;
- Demolition of an existing commercial building in the southern section of the Proposed Road Development;
- Landscaping works, including the construction of earth bunds between the proposed scheme and the Town Park;
- Utilities and services diversion works, including the diversion of a high voltage electricity line crossing the Proposed Road Development mainline, including the provision of associated support poles;
- Safety Barrier, Public Lighting, Fencing; and
- Environmental measures and other ancillary works, including but not limited to the provision of 1 mammal underpass and mammal fencing.

The project location and extent of the Proposed Road Development is shown in Figure 1.1 of Volume 3 of this EIAR.

1.3 EIA Process

Environmental Impact Assessment (EIA) is the process for anticipating the effects (both beneficial and adverse) from a project on the environment. EIA requirements derive from Council Directive 85/337/EEC (as amended by Directives 97/11/EC, 2003/35/EC and 2009/31/EC) and as codified and replaced by 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. Amending EIA Directive 2014/52/EU, constitutes an update of the preceding Directive 2011/1192/EU and has been considered in the assessments completed herein.

Directive 2014/52/EU was transposed into Irish law on September 1st, 2018 in the form of the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018.

The EIA process itself includes a screening and scoping phase (Figure 1-2) The screening phase identifies whether EIA is required or not. If an EIA is required, as determined and agreed at screening stage, the scope and proposed methodology of the EIAR is determined and agreed with the statutory bodies at the scoping phase.

Projects listed in Annex I of the EIA Directive have mandatory EIA requirements. Each Member State decides on a case-by-case basis whether Annex II projects require an EIA. Thresholds have been set for Annex II projects in Irish legislation. But even projects which do not meet the threshold may require an EIA if the project is likely to have significant effects on the environment.

The Annex I and Annex II projects have been transposed into Section 5 (Parts 1 and 2) of the Planning and Development Regulations 2001, as amended.

An EIA is required for certain classes of project defined in the Planning and Development Regulations 2001 (as amended). Where a project falls into one of these classes and exceeds a related size threshold (also defined in the legislation) an EIA is required. Where the proposed development does not meet, or exceed, the applicable threshold, the likelihood of the proposed development having significant effects on the environment needs to be considered. The discretionary (or sub-threshold) requirements are based on an assessment of the likely significant environmental effects of the proposed development.

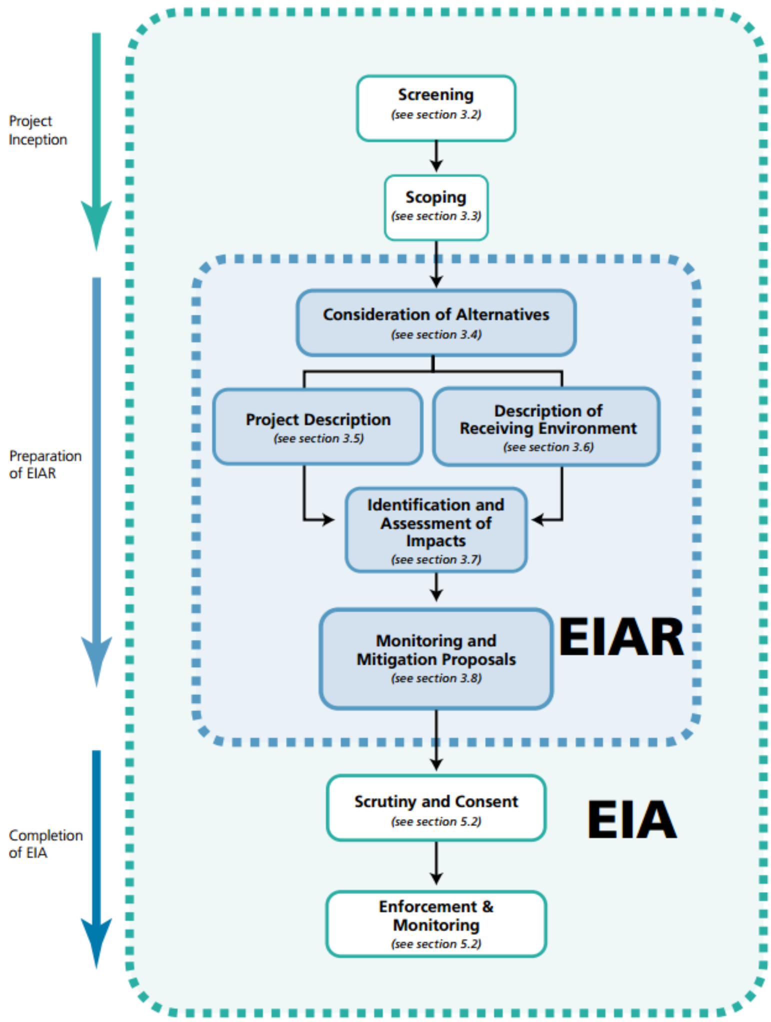


Figure 1-2 EIA Process (EPA, 2017)

1.3.1 Need for an EIA

The Proposed Road Development falls under the criteria outlined in S. 50(1)(b) of the Roads Act, 1993-2007 (as amended):

> *"Where An Bord Pleanála (ABP) considers that a proposed road development would be likely to have significant effects on the environment it shall direct the road authority to prepare an EIS".*

The Applicant received direction from ABP (Reference Number PL32.HD0020) to prepare an EIAR for the Proposed Road Development for a number of reasons and considerations including:

- *The nature of the proposed development;*
- *The environmental sensitivity of the proposed route, which traverses a candidate Special Area of Conservation, that is the River Blackwater, whose banks are governed by the H1 zoning objective in the Navan Town Development Plan 'to protect the setting, character and environmental quality of areas of high natural beauty; and*
- *the guidance set out in the "Environmental Impact Assessment (EIA) Guidance for Consent Authorities regarding Sub-Threshold Development" published by the Department of the Environment, Heritage and Local Government in August 2003.*

1.3.2 EIAR Methodology and Relevant Guidelines

1.3.2.1 EIAR Preparation

An EIAR is defined by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018) as:

"…*a report of the effects, if any, which proposed development, if carried out, would have on the environment and shall include the information specified in Annex IV of the Environmental Impact Assessment Directive*".

The primary objective of the EIAR is to identify baseline environmental and socio-economic conditions in the proposed development area, identify significant environmental effects, predict potential beneficial and/or significant adverse effects of the proposed development and propose appropriate mitigating measures where necessary.

This EIAR assesses, as required, the direct effects and any indirect, secondary, cumulative, transboundary, short term, medium term and long term permanent and temporary, positive and negative effects of the Proposed Road Development.

The following EIA regulations and Environmental Protection Agency (EPA) guidelines were considered in preparing this EIAR:

- The requirements of EC Directives and Irish Regulations regarding EIA such as European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. No. 296 of 2018); the Planning and Development Act (2000-2019), and the EIA Directive 2014/52/EU.
- European Commissions (EC's) 2017: *Environmental Impact Assessment of Projects – Guidance on Scoping (Directive 2011/92/EU as amended by 2014/52/EU*).
- EC's 2017: '*Environmental Impact Assessment of Projects, Guidance on the preparation of Environmental Impact Assessment Reports'*.
- EC's 2015: '*Interpretation of definitions of project categories of annex I and II of the EIA Directive'*.
- EC's 2013: '*Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment'.*
- EPA's 2017 Draft: '*Guidelines on the information to be contained in Environmental Impact Assessment Reports*'.

The following TII/NRA Environmental and Construction Guidelines were also considered by AECOM:

- NRA 2008: '*Environmental Impact Assessment of National Road Schemes - A Practical Guide*, Revision 1.
- NRA 2006: '*A Guide to Landscape Treatments for National Road Schemes in Ireland'*.
- NRA 2006*: 'Guidelines for Protection and Preservation of Trees, Hedgerows and Scrub Prior to, during and Post Construction of National Road Schemes'*.
- NRA 2013: '*Design Manual for Roads and Bridge's*.
- TII 2019: '*Landscape Character Assessment (LCA) and landscape and visual impact assessment (LVIA) of proposed national roads: Standards Document, PE-ENV-01105',* January 2019, Draft for Consultation.
- NRA 2009: '*Guidelines for Assessment of Ecological Impacts of National Roads Schemes'.*
- NRA 2006 '*Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes*'.
- NRA 2008: '*Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'*.
- NRA 2005: '*Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes'.*
- NRA 2008: '*Guidelines of Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes'*

Information on the Proposed Road Development and the receiving environment was obtained through a number of means including:

- Aerial Photographs;
- Site visits and field surveys;

- Site investigations (geotechnical, environmental and archaeological (geophysical and intrusive investigation);
- Meetings with MCC;
- Review of existing data for the general area of the Proposed Road Development site;
- Review of previous studies carried out at the Proposed Road Development site and locality; and
- Consultation with interested parties, listed in Section 1.3.2.3 below

1.3.2.2 Scoping of the EIAR

Scoping is an essential element of the EIA process and is carried out in order to identify and confirm the likely significant environmental effects of the Proposed Road Development that should be addressed in the EIAR. It is defined as: "*determining the content and extent of the matters which should be covered in the environmental information to be submitted in the EIAR" (*EC, 2017*).*

An extensive programme of consultation was undertaken throughout the development of the Proposed Road Development, in addition to the preparation of the EIAR. A key objective of the consultations was to identify any particular areas of environmental concern in relation to the Proposed Road Development as they pertain to individuals, groups or bodies who hold an interest in the project. At the outset of the project, meetings with MCC were held and the scoping of the contents and the format of the EIAR were discussed and agreed.

Section 1.3.2.3 below outlines the MCC departments and third parties that were consulted during the EIA scoping process.

1.3.2.3 Consultation

The following bodies were consulted throughout the development of the Proposed Road Development, in addition to the preparation of the EIAR:

MCC:

- Planning Department.
- Community and Enterprise Department.
- Heritage Officer.
- Archaeologist;
- Transportation Department.

In alphabetical order:

- An Comhairle Ealaíon - The Arts Council of Ireland;
- An Taisce;
- ABP;
- Badger Watch Ireland;i
- Bat Conservation Ireland (BCI);
- Birdwatch Ireland;
- Bord Gáis Energy;
- BT Ireland;
- County Meath Chamber;
- Department of Agriculture, Food and the Marine
- Department of Housing, Planning and Local Government (DHPLG);
- Department of Transport, Tourism and Sport (DTTAS);
- Development Advice Unit, Department of Culture, Heritage and the Gaeltacht;
- Fáilte Ireland - The National Tourism Development Authority;
- eNet;
- EirGrid Plc;

- Electricity Supply Board (ESB);
- EPA;
- Gas Networks Ireland (GNI);
- The Heritage Council;
- The Office of Public Works (OPW);
- Iarnród Éireann – Irish Rail;
- Irish Water (IW);
- Inland Fisheries Ireland (IFI);
- National Parks and Wildlife Service (NPWS);
- National Transport Authority (NTA);
- Transport Infrastructure Ireland (TII);
- Viatel; and
- Virgin Media.

Two public consultation events were held during the route selection process. The first Public Consultation (PC1) was held on the 11th January 2018, with Public Consultation (PC2) taking place on 1st May 2018. Both events took place between 2.30pm and 8.30pm at Ardboyne Hotel in Navan.

A summary of the feedback and further information on the public consultation events can be found in Chapter 3 (Examination of Alternatives).

Following PC2, a number of community groups have been consulted including:

- Communities:
  - Silverlawns Residents Association
  - Blackwater Park Residents Association
  - Navan Coarse Angling Club
  - Navan Anglers Association
- Park Users Groups:
  - Navan Road Club
  - Navan AC
  - Springboard Navan
  - Torro United AFC
  - Navan ParkRun
  - Navan Tidy Towns Committee
  - Meath Bulldogs American Football

1.3.2.4 Format of the EIAR

This EIAR has been prepared according to the 'Grouped Format Structure' as outlined in the EPA's '*Guidelines on the information to be contained in Environmental Impact Statements'* (EPA, 2002), and as evolved in '*Guidelines on the information to be contained in Environmental Impact Assessment* Reports' (EPA, 2017). The title of each of these subsections has evolved between the issue of the 2017 guidance documents.

The EIAR is divided into 18 chapters as follows including 5 chapters with background information and general descriptions of the Proposed Road Development:

- Chapter 1: Introduction;
- Chapter 2: Need for the Proposed Road Development and Planning Policy;
- Chapter 3: Examination of Alternatives;

- Chapter 4: Description of the Proposed Road Development; and
- Chapter 5: Traffic Analysis.

Chapters 6 to 18 deal with the remaining sections, which outline the likely significant environmental effects of the Proposed Road Development as follows:

- Chapter 6: Population and Human health;
- Chapter 7: Biodiversity;
- Chapter 8: Land & Soils (incorporating Soils, Geology and Hydrogeology);
- Chapter 9: Water (incorporating Water Quality and Hydrology);
- Chapter 10: Air Quality and Climate;
- Chapter 11: Noise and Vibration;
- Chapter 12: Landscape and Visual;
- Chapter 13: Cultural Heritage;
- Chapter 14: Material Assets;
- Chapter 15: Major Accidents and Disasters;
- Chapter 16: Climate;
- Chapter 17: Interactions of the foregoing; and
- Chapter 18: Mitigation and Mitigation Measures

1.3.3 Expertise of the EIA team

Table 1-1 below provides the name of the main contributor to each of the EIAR chapters, along with their relevant qualifications.

Table 1-1 Expertise of EIA team

	EIAR Chapters/Role	Consultant	Qualification
	Project/EIAR Manager	Eoin Greene	Technical Director, BA, BAI, MIEI, CEng
	EIAR co-ordinator	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MIEnvSc
1	Introduction	Noelle O'Leary	Environmental Consultant BSc (Hons), MSc, AMIEnvSc
2	Need of the Proposed Road Development	Eoin Greene	Technical Director, BA, BAI, MIEI, CEng
		Luca Bellini **/** Dean Atwell	Consultant Engineer, BEng, MEng, MIEI **/** Senior Planning Consultant, MRTPI
3	Examination of Alternatives	Eoin Greene	Technical Director, BA, BAI, MIEI, CEng
		Luca Bellini	Consultant Engineer, BEng, MEng, MIEI
4	Description of the Proposed Road Development	Eoin Greene	Technical Director, BA, BAI, MIEI, CEng
		Luca Bellini	

	EIAR Chapters/Role	Consultant	Qualification
			Consultant Engineer, BEng, MEng, MIEI
5	Traffic Analysis	Philip Shiels	Associate Director BEng (Hons) CEng MIEI
		Neil Caughey	Principal Consultant BEng (Hons) CEng MEng
6	Population and Human Health	Dave Widger	Regional Director, BSc (Hons), MSc (Econ)
		Elaine Keenan	Environmental Consultant BSc (Hons), MSc, PhD
7	Land & Soils	Janette Simpson	Senior Environmental Scientist, BSc, MSc
8	Water	Janette Simpson	Senior Environmental Scientist. BSc, MSc
9	Biodiversity	Dr. Eleanor Ballard	Regional Director BSc DPhil CEnv MCIEEM
10	Air Quality and Climate	Glenn McKay	Principal Environmental Consultant, BSc, MSc, MCIWEM, C.WEM, CEnv, CSci
11	Noise and Vibration	Pamela Lowery	Principal Acoustics Consultant, MEng, MSc, MIOA, PIEMA
12	Landscape and Visual	Joerg Schulze	Principal Landscape Architect, Dipl.-Ing. (FH), LA, MILI.
13	Cultural Heritage	David Kilner	Archaeological Consultant BA (Hons), PG Dip, MSc, MIAI.
14	Materials Assets	Eoin Greene	Technical Director, BA, BAI, MIEI, CEng
		Noelle O'Leary	Environmental Consultant BSc (Hons), MSc, AMIEnvSc
15	Major Accidents and Disasters	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MIEnvSc
16	Climate	Ian Davies	Associate Director, BA (Hons)
17	Interactions of the Foregoing	Niamh O'Connell	Principal Environmental Consultant, BA (Mod) Eng, H dip Env Eng, MSc, PM, MIEnvSc

Niamh O'Connell is a Principal Environmental Scientist in the AECOM Environment and Planning Team and has more than 15 years' post-graduate experience. 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 the planning process. Niamh has worked on a large number of major highway schemes in Ireland including the M3 Clonee to Kells, the N9N10 Knocktopher to Powerstown, the N8

Cashel to Mitchelstown, the N7 Castletown to Nenagh and the N25 Waterford Bypass. Niamh is currently closing out the LDR4 Abbeyland EIAR for the Applicant.

Eoin Greene is an experienced PM, and Employers Representatives with significant experience of delivering the construction phases of urban road schemes under the Public Works Contract, and NEC3. Eoin is adept at dealing contract issues such as RFI's, claims, and application of delay under the public works contact, and dealing with and resolving disputes. Since gaining chartered status he has been responsible for the day to day co-ordination of a number of schemes including the detailed design and contract documents for road improvement and urban schemes. He has been PM for the design of various infrastructure projects, and management of the tender stage design for a number of D&B tenders on behalf of various major Irish and international contractors.

As PM on infrastructure projects Eoin has led the broader AECOM team to deliver project from inception, through EIA, ABP & Part 8 planning, public consultation, to detailed design and construction. As part of his role on road schemes Eoin has been a senior member of the design team and provides project management and client facing support to the wider transport team to ensure the projects are delivered successfully.

Luca Bellini is an Engineering Consultant within the Roads team in the AECOM Dublin office. Luca has a bachelor's degree (B.Eng.) in Civil Engineering from the University of Trento (Italy) and a master's degree (M.Eng.) in Civil Engineering from the Politecnico di Torino (Italy). Luca is also a member of the Institute of Engineers Ireland (IEI) and has successfully completed the qualifying examination for Chartered Civil Engineer in Italy. Luca has worked as a road engineers in Ireland for over 3 years and has been involved as designer in several urban and rural road schemes across the country, both at preliminary and detail design stage. Luca has gained valuable experience in managing roads projects and coordinating multi-disciplinary input during the design process. Additional experiences include short working periods with a public transport operator and a civil and structural engineering firm in Italy.

Philip Shiels is Chartered Engineer and Transportation Planner with 14 years' experience in the modelling, appraisal, planning and design of a wide range of transport project, studies and strategies. Philip holds a BEng (Hons) degree in Civil and Transportation Engineering from Edinburgh Napier University. He has significant experience in the modelling and appraisal of roads projects and has developed and maintained on behalf of TII their National Transport Model and Project Appraisal Guidelines since their inception in 2008.

Neil Caughey is Chartered Engineer and Transportation Planner with 12 years' experience in the fields of road safety, modelling, appraisal and business case preparation. Neil holds a Master's degree in Engineering from Warwick University and has worked on projects throughout Ireland and UK, in addition to transport appraisals undertaken in New Zealand, Australia, Singapore and Brazil. Neil has supported such organisations as Transport Infrastructure Ireland, local authorities, Department for Infrastructure (Northern Ireland), Transport for London, New Zealand Transport Agency, Roads and Maritime Services (Australia) and Olympic Delivery Authority.

Dave Widger has over 18 years' experience, he is currently the Regional Director within the Economic Development & Regeneration Team at AECOM. Dave has a significant level of experience in economic development and regeneration with particular expertise in community, socio-economic and health impact assessment. He has worked on various large-scale projects namely; Technical Lead responsible for producing robust community and health impact assessments as part of the Environmental Impact Assessment Reports (EIAR) for the proposed route from Birmingham to Leeds.

Dave has recently carried out the population and human health section of the environmental risk package for CIP 2020 to 2025 where he analysed the potential risks to population and human health for all the feasibility studies. Following this role, he completed the scoping report for the "South Apron" infrastructure works and is leading on the preparation of the EIAR scoping report chapter on Population and Health for the capacity increase to 40mppa at Dublin Airport.

Elaine Keenan is an Environmental Consultant and a full member of The Institute of Environmental Sciences, who provides technical support to the environment and planning team across a range of multidisciplinary projects. Elaine has produced documents such as EIA Screening Reports and has inputted into chapters for both EIA Scoping Reports and EIAR. Elaine also co-ordinates aspects of EIA as part of EIAR deliverables and carries out environmental site inspections.

Janette Simpson is a Senior Environmental Scientist within the Environmental Liability Solutions team in the AECOM Dublin Office. Janette obtained a 1st Class Honours degree in Environmental Geoscience from the University of Birmingham (2011) and was awarded a Distinction in a Masters of Science degree in Environmental Engineering at Queens University, Belfast (2013). Janette has 7 years' experience in environmental consultancy, with a particular focus on contaminated land. She has carried out environmental impact assessments for land, soils, geology, hydrogeology and hydrology on a variety of proposed development types

Dr Eleanor Ballard is a Chartered Environmentalist and a full member of CIEEM. She has over 20 years' postgraduate experience in the environmental field and is currently a Technical Director with AECOM overseeing the AECOM Ecology Teams in Scotland, the Republic of Ireland and Northern Ireland. Dr Ballard has a first-class honours degree in Environmental Science and Doctorate in Plant Ecology, both from Ulster University. Her doctoral thesis was in the management of Irish Annex 1 habitat – Sand Dune Machair. More recently, Dr Ballard has read for a postgraduate diploma in Geographical Information Systems.

In early 2017, Dr Ballard worked with the AECOM Ecology team in Dublin to scope the initial ecology survey required for the Opera Site development, in light of the original brief and comments from the Heritage Officer in Limerick City and County Council. Dr Ballard reviewed, commented upon and verified the Biodiversity Chapter and Natura Impact Statement prepared by AECOM as part of the planning application for the Opera Site development in Limerick.

Glenn McKay is a Principal Environmental Consultant, primarily responsible for undertaking Environmental Impact Assessments (EIA) and Environmental Appraisals of major infrastructure projects. He has been with AECOM since 2004, affording him the opportunity to work on major projects from inception through to construction. Glenn holds a Bachelor of Science (Honours) degree in Geography and a Master of Science in Environmental Engineering. He is a Chartered Environmentalist (CEnv) with the Society of the Environment (SocEnv), a Chartered Scientist (CSci) with the Science Council, a Chartered Water and Environment Manager (C.WEM) with the Chartered Institution of Water and Environmental Management (CIWEM) and a full Member of the Chartered Institution of Water and Environmental Management (MCIWEM).

He has over fifteen years' experience of carrying out EIA for major infrastructure projects and development proposals, and in particular a range of major road projects throughout Ireland. The assessments have included the preparation of both Scoping Reports and Environmental Impact Assessment Reports.

He has fulfilled the role of air quality expert on nine major road infrastructure projects to date, ranging from high standard dual carriageways to local relief roads. Most recently he was the lead author of Chapter 13 (Air Quality and Climate) as included within Volume 2B of the Environmental Impact Statement for the Athy Distributor Road, a 3.4km semi-urban distributor road designed to alleviate significant congestion in the historic core of Athy in Co. Kildare. Glenn provided expert witness testimony in support of the proposed development at an oral hearing in July 2017. ABP granted planning consent and Compulsory Purchase Order (CPO) approval for the scheme in October 2017, without the imposition of any additional conditions.

Glenn also has experience of on-site monitoring/inspection and resolution of construction-related environmental issues, in line with Contractual requirements. In particular, this has included preparation of Air Quality Management Plans and identifying on-site construction related air quality issues, such as dust emissions and identifying appropriate mitigation measures.

Pamela Lowery was the technical lead for the noise and vibration assessment within this document. She has 18 years of experience in acoustics, gained through roles in both the public sector and consultancy. She has extensive experience in environmental acoustics, particularly in relation to the assessment and management of road traffic and construction noise sources. She has been responsible for providing technical support on the assessment of road and construction noise, leading the development of noise assessment and procedures for road schemes included within the Design Manual for Roads and Bridges (DMRB), and implementing these procedures in the assessment of noise and vibration impacts for a number of highway schemes. She is a Member of the Institute of Acoustics (MIOA) and a Practitioner Member of the Institute of Environmental Management and Assessment (PIEMA).

Joerg Schulze is a Principal Landscape Architect with over 16 years' professional experience. He has a comprehensive track record in developing and managing landscape and visual impact assessments of large linear infrastructural, commercial, residential, renewable energy and civic developments throughout the island of Ireland. 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 process, Joerg is also an expert in developing constraints studies, site suitability assessments, feasibility studies and associated mapping. He also supervises the production of photomontages and landscape mitigation proposals. Joerg is a regular expert witness at Oral Hearings/Public Inquiries.

David Kilner is an Archaeological Consultant in the Heritage Team at AECOM since 2017. He is a full member of the Institute of Archaeologists of Ireland with over 18 years' professional experience in producing desk-based assessments and managing excavations on a wide range of projects. David previously worked in the Irish commercial archaeology sector as a Site Director managing excavations and testing for archaeological remains on development sites and was Senior Researcher within an archaeological consultancy producing desk-based assessments and contributing to Environmental Statements on a wide range of projects ranging from single dwellings to large infrastructure projects.

Prior to this, David project managed the cataloguing of the Dr W.A. McCutcheon Industrial Heritage Archive on behalf of the, then, EHS: Built Heritage. During this period, he also completed a part time MSc in Maritime Archaeology from the University of Ulster. As such, in addition to archaeological research and excavation, he is experienced in Industrial Heritage, Building Survey and Intertidal Survey.

Noelle O Leary Noelle is an Environmental Consultant within the Environment and Planning Group in the AECOM Cork office. Noelle has a Bachelor of Science (B.Sc.) in International Field Geosciences, a joint degree awarded from the University College Cork, Ireland and the University of Montana, USA; and a Master of Science (M.Sc.) in Ecosystem Services from the University of Edinburgh, Scotland. Noelle is an Associate Member of the Institute of Environmental Sciences (IES).

Noelle has worked as a Junior Geologist in Perth, Western Australia for 2.5 years; gaining valuable experience in managing a range of field projects and supervising on site activities. Additional experience includes conservation management, community engagement and ecosystem services assessments; gained from volunteering abroad and conducting short contracts for a number of environmental groups in Scotland. Noelle is responsible for co-ordinating aspects of EIA as part of EIAR deliverables and carries out environmental site inspections.

Ian Davies, the AECOM Climate Change Technical Lead, is an Associate within the Climate Change and Sustainability Services team based in the Basingstoke office. Ian has over 15 years' experience specialising in the management and delivery of energy efficiency, carbon management, and climate change assessment. Ian's relevant project experience includes development of EIA chapters, including provision of a greenhouse gas impact assessment and climate change resilience review for a range of road, urban regeneration and nationally significant infrastructure projects within the UK, Europe and further afield.

1.4 Difficulties Encountered

There were no particular difficulties encountered in the preparation of the EIAR.

1.5 What happens next?

The planning application will be placed on display for public inspection for a statutory period of at least six weeks from the date of lodgement of the application.

A copy of the consent application and each document accompanying the application (including this EIAR) may be inspected, free of charge, during normal office or opening hours at the following location:

- Meath County Council, Buvinda House, Dublin Road, Navan, Co. Meath, C15 Y291; and
- An Bord Pleanála, 64 Marlborough Street, Rotunda, Dublin 1, D01 V902.

All planning documents will also be available for download from the MCC website.

The EIAR is also available for inspection at the EIAR Portal. This is a central point for notification to the public on all applications for development consent that are subject to an EIA, including development, works or activities, made across the country and under the various legislative codes. The EIA Portal also provides access to these applications and provides a link to the relevant information and documents associated with the application held by the relevant authorities responsible for approving such applications.

Submissions or observations on the application may be made only to ABP and must be accompanied by the appropriate fee of €50 (except for certain prescribed bodies).

1.6 References

- EC. (2017). *Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report, European Commission*
- EPA. (2017). *EPA Guidelines on the information to be contained in Environmental Assessment Reports*, Draft, August 2017, Environmental Protection Agency, Co. Wexford, Ireland.
- EU. (2018). Impact European Union (Planning and Development) (Environmental Assessment) Regulations 2018 (S.I. No. 296 of 2018), European Union.
- Government of Ireland. (1993). The Roads Act 1993-2007, as amended.
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, County Meath.

Chapter 02: Need for the Proposed Road Development

02

2. Need for the Proposed Road Development and Planning Policy Context

2.1 Introduction

This section outlines the need for the Proposed Road Development based on the planning policy, the deficiencies in the existing road network and identified future needs of Navan town.

This introductory section provides an overview of the key issues, which are then set out in detail in the following sections. Objectives are then set out for the project and the anticipated outcomes for the Proposed Road Development are considered against these objectives.

A Constraints Study and the Route Selection process were carried out to assess a number of potential sites for this development. During this process, which cumulated in a publication of a Route Selection Report, three route options, a Do-Nothing and a Do-Minimum were considered as part of the Stage 1 Assessment. The route selection process was undertaken in line with the NRA National Roads Project Management Guidelines (PMG) 2010 and TII National Roads PMG 2019 under the following criteria: Economy; Safety, Environment; Accessibility & Social Inclusion; and Integration (NRA, 2010). The examination of the above concluded that the development of Route Option B1 will have least adverse impact whilst maintaining an optimal standard of geometric design.

Further information can be found in the Route Selection Report in Appendix A2-1 in Volume 4.

2.2 Policy Background

2.2.1 General

The need for the Proposed Road Development has been identified in and is consistent with the following national, regional and local planning policy documents:

National Policy Context:

- Project Ireland 2040: National Planning Framework (NPF); and,
- National Development Plan 2018-2027.

Regional Policy Context:

- Regional Spatial and Economic Strategy for the Eastern and Midland Region (RSES) 2019-2031; and,
- Greater Dublin Area Transport Strategy 2016-2035.

Local Policy Context:

- Draft Meath County Development Plan 2020-2026;
- Meath County Development Plan 2013-2019; and,
- Navan Development Plan 2009-2015.

2.2.2 National Policy Context

2.2.2.1 Project Ireland 2040: National Planning Framework

The NPF is the Government's high-level strategic plan for shaping the future growth and development of Ireland to the year 2040, released in tandem with the National Development Plan which sets out the budget for national infrastructure investment for the next 10 years. The NPF emphasizes shared goals for the country, including:

- Compact Growth
- Enhanced Regional Stability
- Strengthened Rural and Economic Communities
- High-Quality International Connectivity

- Sustainable Mobility
- Strong Economy, supported by Enterprise, Innovation and Skills
- Enhanced Amenities and Heritage
- Transition to a Low Carbon and Climate Resilient Society
- Sustainable Management of Water, Waste and other Environmental Resources
- Access to Quality Childcare, Education and Health Services

County Meath falls within the Mid-East portion of the Eastern and Midland Region identified in the National Planning Framework, where:

> *"The strategic location of counties Kildare, Meath and Wicklow, proximate to the Capital, has in part, resulted in significant development in a region characterised by the dominance of Dublin. The Mid-East has experienced high levels of population growth in recent decades, at more than twice the national growth rate.*
>
> *Managing the challenges of future growth is critical to this regional area. <u>A more balanced and sustainable pattern of development, with a greater focus on addressing employment creation, local infrastructure needs and addressing the legacy of rapid growth, must be prioritised</u>. This means that housing development should be primarily based on employment growth, accessibility by sustainable transport modes and quality of life, rather than unsustainable commuting patterns."* (Pg..33, NPF)

The Proposed Road Development supports the shared aims of the NPF by contributing to the stability of the Eastern and Midland Region and development of the local Mid-East economy through infrastructure enhancements.

2.2.2.2 National Development Plan 2018-2027

The National Development Plan 2018-2027, which underpins the National Planning Framework, has, among its priorities, investment in regional growth potential. The Plan discusses their goals of increasing investment in national, regional and local road programmes throughout the country. Regional and local roads will benefit from an estimated €4.5 billion investment under the National Development Plan (NDP, 2018).

In relation to National Strategic Outcome 2; *Enhanced Regional Accessibility*, it states, investment in regional access will be complemented by investment in, and maintenance of, local and regional routes throughout the country, that will allow local communities to gain access to local, national and international markets and services. This is further detailed under National Strategic Outcome 3: *Empowered Rural Economies and Communities*. That will necessitate sustainable growth in all regions to secure balanced regional development.

2.2.3 Regional Context

2.2.3.1 Regional Spatial and Economic Strategy for the Eastern and Midland Region 2019-2031

The Eastern and Midland Regional Assembly (EMRA) was established in 2015. This assembly covers nine counties containing twelve local authorities located within the Midland, Eastern and Dublin Regions. The EMRA RSES was published in 2019 and directly supports Project Ireland 2040's NPF.

The growth strategy for this Region is underpinned by a settlement strategy and an integrated land use and transportation strategy which seeks to protect and enhance global connectivity and regional accessibility. The Core Region includes metropolitan hinterlands in the commuter catchment around Dublin, which covers the Mid-East counties.

The RSES identifies Navan, Co. Meath as a Key Town, that offers; *Large economically active service and/or county towns that provide employment for their surrounding areas and with high-quality transport links and the capacity to act as growth drivers to complement the Regional Growth Centres.* (Pg.44, RSES)

Regional Policy Objective 4.42: *Support the delivery of road infrastructure to release strategic residential and employment lands for sustainable development and to improve connectivity and the efficient movement of people and services in the town.* (Pg.79, RSES)

Regional Policy Objective 4.46: *Key Towns shall act as economic drivers and provide for strategic employment locations to improve their economic base by increasing the ratio of jobs to workers.* (Pg.79, RSES)

Furthermore, the RSES states that efforts to energise the catchments of strong towns and to improve cohesion with neighbouring regions. These towns have capacity for continued commensurate growth to become more self-sustaining and to attract high quality knowledge-based employment at strategic accessible locations. Some areas in the Core Region have emerged mainly as commuting towns, experiencing high rates of population growth but provide low levels of services and functions for their resident populations. Such towns require investment in local employment and services in order to achieve this proposed self-sustainability. With respect to these policies, the Proposed Road Development satisfies the objectives of the RSES.

2.2.3.2 Transport Strategy for the Greater Dublin Area 2016 – 2035

In April 2016 the NTA announced that its work in preparing the Transport Strategy for the Greater Dublin Area (GDA) 2016 to 2035 had concluded (NTA, 2016). The Strategy outlines a suite of public transport and highway proposals to be implemented through the GDA over the period 2016 to 2035. The Strategy is intended to guide decisions on transport throughout the GDA and will '*contribute to the economic, social and cultural progress of the GDA by providing for the efficient, effective and sustainable movement of people and goods*' (NTA, 2016).

The NTA Transport Strategy comprises a longer-term analysis of the needs of the transport network within the GDA (including the Navan Area). The Strategy builds upon the previous 2011 Draft Transport Strategy which recognised the need to reduce car commuting mode share and aimed to reduce car commuting mode share to 45% by 2030. The Strategy therefore recognises the need to invest in public transport solutions for the long-term sustainable development of the GDA.

With specific reference to the regional and local roads network, the Strategy states (Section 5.8.2):

Regional and local roads make up the vast majority of the road network in the Greater Dublin Area. In relation to this network it is intended to:

- *Develop orbital roads around town centres accompanied by and facilitating enhanced public transport, cycling and pedestrian facilities in the relevant centre;*
- *Develop appropriate road links to service development areas;*
- *Implement necessary upgrades to the regional and local road network in line with the "Principles of Road Development" set out in Section 5.8.3;*
- *Enhance pedestrian and cycle safety through the provision of safer road junctions, improved pedestrian crossing facilities and the incorporation of appropriate cycle measures including signalised crossings where necessary;*
- *Address localised traffic delay locations, including on radial routes inside the M50 C-Ring, in cases where the primary reason for intervention is to address safety or public transport issues at such locations; and*
- *Implement various junction improvements and local reconfigurations on the regional and local road network.*

With specific reference to principles of road development, the Strategy states (Section 5.8.3):

Given that national transport policy seeks a reduction in the growth in car travel and an increase in the use of public transport, cycling and walking, it is important that certain principles are reflected in the development of individual road projects within the Greater Dublin Area. Accordingly, it is intended that road development in the Greater Dublin Area will be undertaken in accordance with the following principles:

- *That each proposed road scheme is consistent with this Strategy and with Government policies related to transport;*
- *That the travel demand or the development needs giving rise to the road proposal are in accordance with regional and national policies related to land use and development planning;*
- *That the development of the road scheme does not diminish in any significant way the expected beneficial outcomes of the Strategy;*
- *That the road scheme, other than a motorway or an express road proposal, will be designed to provide safe and appropriate arrangements to facilitate walking, cycling and public transport provision; and*

– *That alternative solutions, such as public transport provision, traffic management or demand management measures, cannot effectively and satisfactorily address the particular circumstances prompting the road proposal or are not applicable or appropriate.*

2.2.4 Local Policy Context

2.2.4.1 Draft Meath County Development Plan 2020-2026

At the time of writing this report, a Section 251A(4) of the Planning and Development Act 2000 (as amended) has been lifted and the timeline with respect to the Draft Meath County Development Plan (Draft MCDP) has recommenced. It is anticipated that the Chief Executive Report on the submissions received will be issued for consideration approximately around the end of July to the beginning of August 2020. It should be noted the Draft MCDP 2020-2026 has been considered in conjunction with the consolidated 2013-2019 Development Plan.

It states the Key Policy for Navan within the Draft MCDP 2020, will be;

> *To consolidate and strengthen Navan's position a Key Town and the principle economic and service centre in Meath by continuing to support economic and population growth based on the principles of a sustainable community and a high quality and attractive urban environment.* (Pg.281, draft MCDP)

Furthermore, the Draft MCDP 2020 recognises the importance of supporting the delivery of key road projects, namely;

- i) Distributor Road LDR1a) Trim Road to Dublin Road
- ii) Distributor Road LDR 1b) Kilcarn Link Road
- iii) Distributor Road LDR 2a) Commons Road to Trim Road
- iv) Distributor Road LDR 2b) Commons Road and Athboy Road
- v) Distributor Road LDR 4 Ratholdron Road to Kells Road
- vi) Distributor Road LDR 6 Kentstown Road to Boyne Road

The Proposed Road Development is compliant with the proposed policies that have been set out within the Draft MCDP2020.

2.2.4.2 Meath County Development Plan 2013-2019

The consolidated Meath County Development Plan 2013-2019 (MCDP) sets out the overall strategy for the proper planning and sustainable development of County Meath for the 6-year plan period and beyond. The MCDP 2013 provides for the physical, economic and social development of the County and aligns with the national and regional development objectives set out by the above regional level policies, as far as is practicable. The MCDP 2013 has been prepared in accordance with the Planning and Development Act 2000 (as amended) and relates the whole functional area of Co. Meath. The life of the MCDP 2013 – 2019 has been extended as per Section 11c of the Planning and Development Act 2000, as amended.

The core strategy identifies Navan as a 'Large Growth Town I' in the settlement hierarchy, it is the only Large Growth Town I located within the whole of Co. Meath. The core strategy recognises the importance of attaining critical mass for the growth of Navan. Therefore, within the context of the previous point, Navan has been identified as the primary growth centre in Co. Meath. The Draft MCDP 2020 has highlighted that the population of Navan is targeted to increase from 30,173 persons in 2016 to 35,273 persons in 2026.

The MCDP 2013 has issued Strategic Transport policies, namely;

- TRAN SP 14 - To ensure the protection of the existing roads infrastructure while improving the capacity and safety of the road network to meet future demands.
- TRAN SP 15 - To protect investment in the capacity, efficiency and safety of national roads by applying the guidance contained in the 'Spatial Planning and National Roads - Guidelines for Planning Authorities' and collaboration with the NTA and the NRA. (Pg.109. CDP 2013)

2.2.4.3 Navan Development Plan 2009-2015

It should be noted, that an extension to the Navan Development Plan 2009–2015 as per section 11C of the Planning and Development Act 2000 (as amended) has been implemented, which refers to;

11C - Where after the passing of the Electoral, Local Government and Planning and Development Act 2013 provision is made by law for the dissolution of town councils (being town councils within the meaning of section 11A(1) then, irrespective of whether or not any relevant decision was made pursuant to section 11A(2)—

(a) the development plan for the administrative area of such a town council (in this section referred to as the 'dissolved administrative area') shall continue to have effect to the extent provided for by that plan and be read together with the development plan for the administrative area within which the dissolved administrative area is situated.

Furthermore, it has been stated in the Draft Meath Development Plan 2020 that a detailed Local Area Plan for Navan will be prepared during the lifetime for the Meath Development Plan 2020-2026.

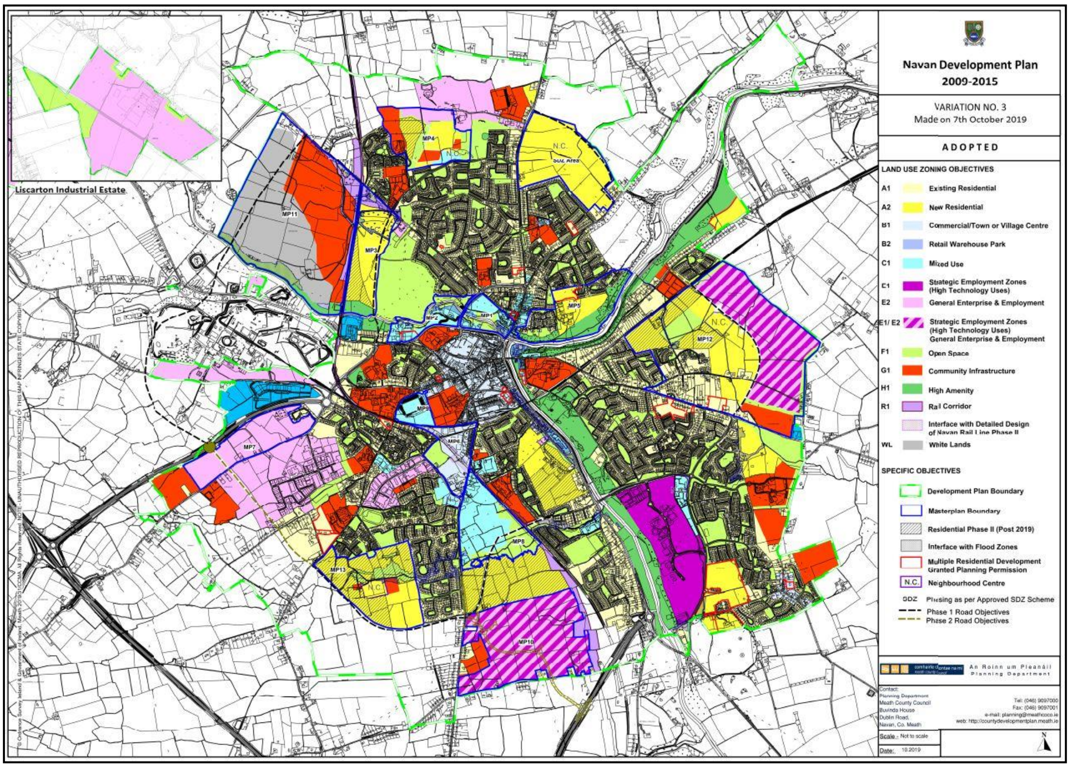


Figure 2-1 Navan Development Plan 2009-2015 incorporating Variation No. 3 (Land Use Zoning Objectives)

The primary land use zoning surrounding the Proposed Road Development, is zoned 'A2– New Residential', and the zoning objective for A2 zoned lands is;

"To provide for new residential communities with ancillary community facilities, neighbourhood facilities and employment uses as considered appropriate for the status of Navan as a Large Growth Town I." (Pg.57, NDP 2009)

Land uses that would typically be acceptable for A2 zoned lands include:

Permitted Uses

B & B / Guest House, Bring Banks, Community Facility / Centre, Childcare Facility, Convenience Outlet, Childcare Facility, Children Play / Adventure Centre, Education (Primary or Second Level), Halting Site / Group Housing, Home Based Economic Activities, Leisure /Recreation / Sports Facilities, Residential / Sheltered Housing, Retirement Home / Residential Institution / Retirement Village, Water Services / Public Services.

Open for Consideration Uses

Allotments, Bank / Financial Institution, Betting Office, Caravan Park, Cultural Facility, education (Third Level), Enterprise Centre, Health Centre, Healthcare Practitioner, Hotel / Motel / Hostel, Offices <100sq.

m., Offices 100 to 1000 sq. m. , Petrol Station, Place of Public Worship, Public House, Restaurant / Café, Supermarket, Shop, Take-Away / Fast Food Outlet, Veterinary Surgery.

The Proposed Road Development will bypass through other lands zoned as;

Existing Residential (A1) – *"To protect and enhance the amenity of developed residential communities."*

High Amenity (H1) – "*To protect and improve areas of high amenity"*

It should be noted that the LDR4 proposed alignment has been proposed within the Navan Development Plan since 2009, it has been considered by Meath County Council and their landscape architectural team when reviewing the future planning of the town park. The section of the LDR4 proposed alignment that runs through the high amenity zoning, is a designated urban park. It is proposed that the LDR4 alignment will use a small corner of the park that has not been designated for any specific use within the park , the implementation of the Proposed Road Development will allow for pedestrian access thereby increasing the utilisation of the park by providing increased linkage to the town.

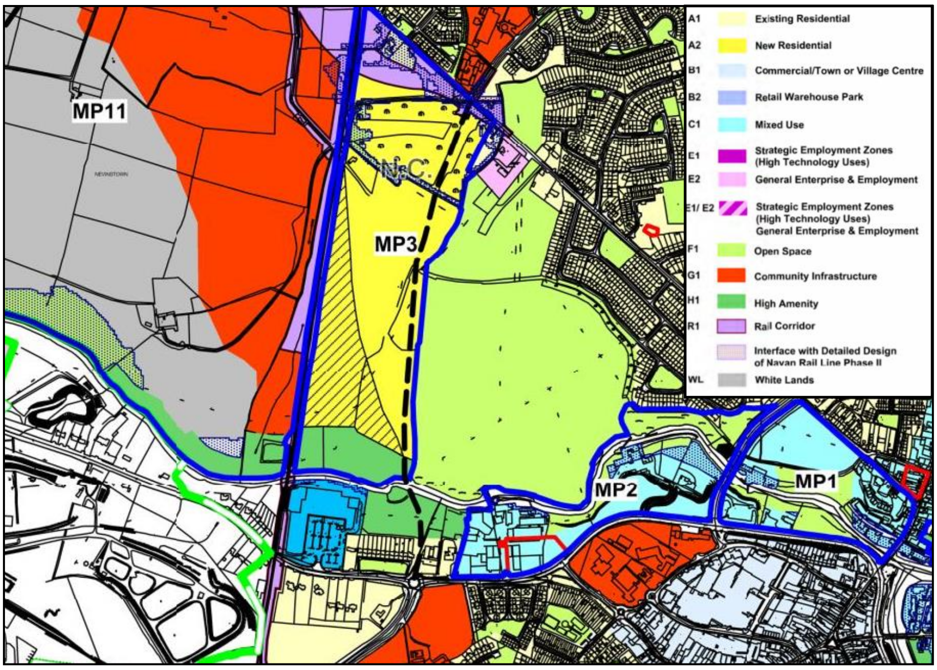


Figure 2-2 Land Use Zoning Objectives - Detail of the Scheme Location

The NDP 2009-2015 (MCC, 2009) has outlined a series of proposed new road schemes planned to support the sustainable development of the town. The LDR4 is identified as one of these road schemes, this road development is recommended as part of Infrastructure Objective 2 (b);

LDR 4: Construction of Distributor Road between Ratholdron Rd and the Kells Road (former N3). This road will improve access to lands in the north of the town between the Ratholdron Road and the Kells Road including Clonmagaddan SDZ. It will also reduce traffic congestion at the Round'O junction and in the Town Centre.

The NDP (MCC, 2009) contains a number of other LDRs and associated objectives; for example, LDR3, which is located approximately 1 km to the west of the LDR4 Scheme location. LDR3 is associated with the Navan Railway Line reopening, a potential regional hospital, and development of a wider orbital route and as such does not satisfy the objectives of the LDR4 scheme. Therefore, it has not been considered as part of the Route Selection process.

The NDP 2009-2015 also identifies the need for additional bridging points for pedestrian and cyclists over the River Blackwater as part of Infrastructure Objective 14;

"To prepare an integrated pedestrian and cycle path network for Navan as provided for in the Local Transport Plan, inclusive of additional bridging points over the Boyne & Blackwater Rivers, and to implement the emerging network, subject to the availability of finances, resources and physical constraints."

It also identifies the need for integrated green links between the town centre and the Blackwater Park as part of Public Open Spaces Policy 23:

> *"To develop an integrated green structure for the town, linking open spaces along the riverbanks of the Boyne & Blackwater with the town centre and its environs and historical features, in such a manner so as not to significantly negatively impact on the SAC or SPA either alone or in combination with other objectives in this or other plans."*

A Strategic Flood Risk Assessment Report was conducted in March 2017, it states in Infrastructure Objective 54;

> *"In determining the detailed design and final alignment of the Local Distributor Roads (LDR 3 and 4 refer), a Justification Test shall be applied if alignments being assessed interact with Flood Zone A and / or B. A detailed Flood Risk Assessment will be required to manage the risk and to demonstrate there will be no impact on adjacent lands. The detailed design of this route shall also be subject to as Appropriate Assessment pursuant to the Habitats Directive."*

The Flood Risk Assessment and Management Plan, states;

> *"The proposed road objective alignments LDR 3 & 4 are not yet confirmed although the latter has undergone a Constraints, Route Selection and Preliminary Design Report. During the environmental assessment stage for the road schemes, the Justification Test will need to be applied if alignments intersect with Flood Zone A/B, INF OBJ 54 refers. An FRA will be required to manage the risk and to demonstrate there will be no impact on adjacent lands."*

The implementation of the Proposed Road Development will improve access to lands in the north of the town between the Ratholdron Road and the Kells Road including Clonmagadden SDZ. It will also reduce traffic congestion at the Round'O junction and in the Town Centre. In consideration to the status of Navan identified as a Large Growth Town I, the upgrades to this type of infrastructure proposed by MCC are an essential objective that will assist the current and future plans for Navan and its surrounding areas.

2.2.4.4 Navan Local Transport Plan 2014-2019

The NLTP sets out the transport strategy for Navan to cover the period 2014 to 2019 (Appendix 4; NDP 2009-2015 (MCC, 2009)). The vision of the LTP for transport in the future is:

> "***Providing a safe and sustainable transport network within Navan Town & Environs**, where **safe** means a transport network people feel safe and secure using and **sustainable** means a transport network that is both environmentally and financially sustainable."*

The list of recommendations for infrastructural improvements contains the following points:

> ***LTP Action 8**: The capacity of the N51 between the Ratholdron Road and the R147 (Kells Road) is identified as a key constraint to allowing development of north Navan to proceed. The delivery of LDR 4 would alleviate this constraint and is necessary to facilitate the planned growth of north Navan.*

The above-mentioned action highlights the need for the future provision of the Proposed Road Development.

2.3 Existing Traffic Issues

The heaviest traffic flows around Navan are evident on the N51, R147, and R161 surrounding the town centre. Traffic flows on other links are relatively light. Some of the busiest points on the network are around the bridges crossing the River Boyne and River Blackwater. There are three crossings of the River Boyne – via the R153, Bóthar Sion, or R147 – and two crossings of the River Blackwater – via the N51 or Flowerhill. As Flowerhill is a one-way street, the N51 provides the only southbound crossing of the River Blackwater at Navan.

The main junctions showing delay are in the vicinity of these bridges and the town centre; for example, the N51 Bóthar Beaufort / R147 Kells Road / Abbey Road / N51 Kells Road (AM & PM peaks). Further information on existing traffic conditions can be found in the Route Selection Report.

Due to the town layout and geographical constraints of the rivers, there are very few cross-town routes beyond the main N51, R147, and R161. Any additional growth in traffic would significantly impact these routes and increase delays already experienced at the junctions in the area.

2.4 Existing Road Safety Issues

2.4.1 Collision Statistics

The Road Safety Authority (RSA) maintains a database of Personal Injury Accidents (PIA) collisions statistics. The database currently covers the 12-year period between 2005 and 2016 included. Collisions in this database are classified into 3 groups based on the severity (fatal, serious and minor).

Table 2-1 summarises the PIA data based on severity over the 12 years period up to and including 2016 (most recent available records). The records identify that a total of 24 collisions occurred in the immediate surrounding of the Proposed Road Development site in this time period, resulting in 27 casualties, two of which are serious or fatal (both at N51/R147 signalised junction).

It is important to note that the statistic reported before only refers to the most direct alternative route to the Proposed Road Development which includes N51 between the N51/R147 roundabout and the signalised junction with Ratholdron Road and then Ratholdron Road up to the T-junction with Clonmagadden Road.

Table 2-1 RSA Navan PIA Data (2005-2016)

Collision Severity	Total Number of Collisions	Total Number of Reported Casualties
Fatal	1	1
Serious	1	1
Minor	22	25
Total	**24**	**27**

Considering a more extended area (to include Round'O Roundabout, R162 Kingscourt Road and Clonmagadden Road), the total number of collisions over the same time period increases to 36, with 45 resulting casualties, two of which are serious (the most serious being located along the R162).

Figure 2-3 illustrates the location and severity of collisions in the north-west area of Navan between 2005 and 2016.

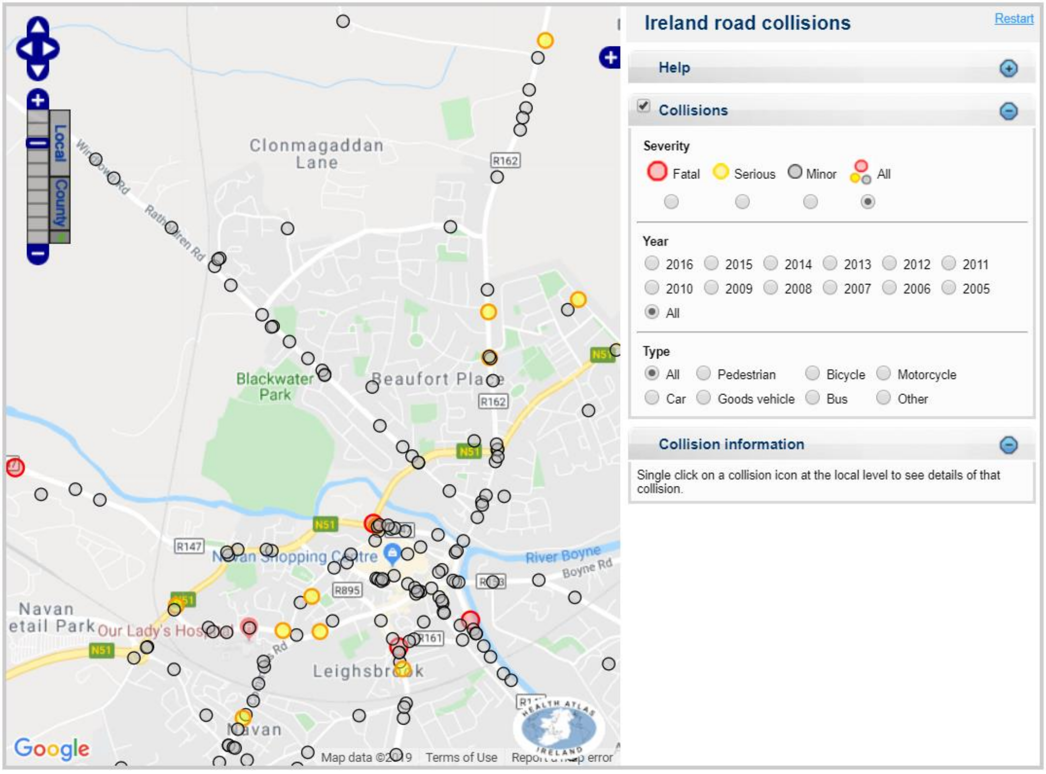


Figure 2-3 RSA Navan PIA Data (2005 – 2016)

2.4.2 Assessment of the Road Safety Impact

As part of the Route Selection process, AECOM undertook an initial assessment of the road safety impact of the existing infrastructure in Navan and its environs, in order to determine the impact, the Proposed Road Development within Navan would have on road safety, as shown in Chapter 5 (Traffic Analysis).

This initial assessment identified that numerous minor severity collisions have taken place on the roads surrounding the study area, with some limited clustering within the network, namely the junctions of Ratholdron Road / Clonmagadden Road and N51 / Kells Road, and roundabout of N51 / R147.

The assessment has indicated that the Proposed Road Development will improve safety as the provision of an alternative and safer (designed in compliance with current design standards) route for some traffic currently using the N51 and R162 will would be expected to reduce overall traffic volumes on the N51 through Navan town centre, with potential for reduction in the number of collisions along the existing corridor.

2.5 Project Objectives

The following are the key objectives of the Proposed Road Development:

- To provide a multimodal transport link for pedestrian, cyclist, and traffic, travelling from Clonmagadden Link Road and Ratholdron Road on the North side and N51/R147 Kells Road on the south side.
- To provide access to lands in the north of Navan town, in particular, improve access to lands located between the Ratholdron Road and the Kells Road, and in addition to lands located to the north within the Clonmagadden Strategic Development Zone.
- Provide a high-quality corridor between the north of Navan and the M3 Motorway, reducing traffic congestion at the Round'O junction and in the Town centre by improving the segregation of regional through-traffic and locally generated trips from across Navan town.

2.6 Summary

The Proposed Road Development is in line with national, regional and local policy guidelines. In addition to this, it is outlined as a specific objective within the current NDP (2009-2015) and NLTP (2014-2019).

As the Proposed Road Development is a multi-modal transport scheme, it will provide both cycling and walking connections.

The Proposed Road Development also forms a key north / south transport link across the River Blackwater, thus, providing a link to the national road network and to Navan town centre via the N51. This link provides the transport connections required for the development of zoned residential lands within the development plan, particularly to the north west of Navan town, allowing for the continued development of Navan town in the long term.

In addition, Navan town currently experiences significant traffic congestion issued on a number of junctions within the town centre, and the associated river crossing points. 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 (NMUs).

2.7 References

- AECOM. (2018). *Local Distributor Road 4 Abbeyland Navan, Route Selection Report*, Doc. Ref. 60546769-REP-20-0000-CH-0002 050974
- NDP. (2018) *National Development Plan 2018-2027* [online] Available at: https://assets.gov.ie/19240/62af938dce404ed68380e268d7e9a5bb.pdf
- NPF. (2018) Project Ireland 2040;: National Planning Framework [online] Available at: http://npf.ie/wp-content/uploads/Project-Ireland-2040-NPF.pdf
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, County Meath.
- MCC. (2013). Meath County Development Plan 2013-2019 Consolidated version [online] Available at:

- https://meathcountydevelopmentplan.files.wordpress.com/2011/01/meath-county-development-plan-2013-2019-consolidated-version-written-statement-december-2016.pdf
- NTA. (2016). *Transport Strategy for the Greater Dublin Area 2016 – 2035*, National Transport Authority, Dublin, Ireland.
- TII. (2019). Project Management Guidelines, Transport Infrastructure Ireland, Dublin, Ireland.
- RSA. (2019) [online] Available at: https://www.rsa.ie/RSA/Road-Safety/RSA-Statistics/Collision-Statistics/Ireland-Road-Collisions/
- RSES(2018) Eastern & Midland Regional Assembly Regional Spatial & Economic Strategy 2019-2031 [online] Available at: https://emra.ie/dubh/wp-content/uploads/2020/05/EMRA_RSES_1.4.5web.pdf

Chapter 03: Examination of Alternatives

03

3. Examination of Alternatives

3.1 Introduction

A requirement of the EIAR 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 the EIA Directive 2014/52/EU requires an 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)(d) of the Roads Act 1993 (as amended) the EIAR (or EIS as referred to under the Roads Act) is to contain "*an outline of the main alternatives studied by the road authority concerned and an indication of the main reasons for its choice, taking into account the environmental effects*".

In summary alternatives are considered under the following headings:

- Do-Nothing Alternative;
- Do-Minimum Alternative;
- Strategic Alternatives –Route Alignment options; and
- Design Development Alternatives.

3.2 'Do-Nothing' Alternative

The 'Do-Nothing' alternative is defined as (NRA, 2010):

> *The 'Do-Nothing' alternative shall comprise an investigation of the existing road infrastructure and its ability to meet future demands for traffic and safety without any upgrade works, other than routine maintenance. Investigation of the 'Do-Nothing' alternative should include an examination of existing policy on improvements to certain National Routes, safety and levels of service.*

The 'Do-Nothing' alternative investigated the existing road infrastructure and its ability to meet future demands for traffic and safety without upgrade works on the roads (other than routine maintenance). The 'Do-Nothing' alternative of the Proposed Road Development does not provide improvement to the existing road network, and therefore no crossing of the River Blackwater is proposed.

As a result, all local or regional traffic would be restricted to using the existing N51 bridge in the southbound direction or the existing N51 and Flower Hill bridges in the northbound direction.

Results from the 'Do-Nothing' investigation identified the following:

- The lack of additional crossings over the River Blackwater to reduce traffic congestion in Navan town centre;
- The narrow cross section of the carriageway and footpath along certain sections of the R162;
- Saturated traffic capacity; and
- Safety issues of the existing junctions along the N51.

3.3 'Do-Minimum' Alternative

The 'Do-Minimum' alternative is defined as (NRA, 2010):

> *The 'Do-Minimum' alternative will generally comprise an investigation of the feasibility of an 'on-line' upgrade of the existing route which would be capable of delivering the required levels of service and safety in accordance with the applicable design standards. This investigation should also examine the feasibility of a partial 'on-line' upgrade, where certain sections of the existing*

> *national route may be suitable for upgrade, particularly where the road has been subject to a previous improvement scheme and where additional landtake may not be required or will only be required at a minimum level.*

The ‘Do-Minimum’ alternative investigated the potential to upgrade rather than replace the existing infrastructure to meet the predicted demands for the next 30 years.

The ‘Do-Minimum’ alternative of the Proposed Road Development investigated the potential to undertake minor improvement works to provide relief from traffic congestion in the Navan town centre. This option would also provide safer alternatives for NMUs and would meet future traffic demands.

Minor improvements works include improvement to junctions along the R147/N51 and the R162. Due to the limited width of the two existing bridges over the River Blackwater, and the constrained urban environment, improvement options to the area surrounding the Round’O roundabout are limited.

Improvements to the NMU facilities, particularly cycling facilities, along certain key link road, including the N51 Inner Relief Road and the L3409 Ratholdron Road were also considered (Figure 3-1).

.

Figure 3-1 'Do-Minimum'- Proposed alternative road network improvement

Despite the potential reduced congestion in Navan town, the ‘Do-Minimum’ alternative failed to address the two main issues causing current traffic and safety issues in the town:

1. Traffic crossing the River Blackwater at the two existing bridges; and
2. Limited improvement to both the capacity and road safety at a number of junctions across the existing road network.

Overall, the ‘Do-Minimum’ alternative would not alleviate long-term pressures of increased traffic volumes in Navan town centre; therefore, this alternative was not considered further as part of the route selection process.

3.4 Strategic Alternatives - Route Corridor Options

3.4.1 Constraints Study

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

- Natural Constraints:
  - Designated Sites and Protected Areas
  - Nature Reserves and National Parks
  - Topography and Landscape
  - Water Quality and Fisheries
  - Geology and Hydrogeology
  - Ecology
- Artificial constraints
  - Existing Road Network
  - Pedestrians and Cyclists
  - Public Transport
  - Land Use
  - Archaeology and Cultural Heritage
  - Utilities
  - Local Amenities, Community Activities and Facilities
  - Noise and Vibration
  - Air Quality
  - Population, Economy, Business and Tourism

The full constraints study can be found in Chapter 4 of the Route Selection Report (Appendix A2-1 in Volume 4).

The Route Selection Report identified three primary route options (A1, B1, and C1) to satisfy the scheme objectives as outlined in Chapter 2; for example, to provide a multimodal transport link for pedestrian, cyclist, and traffic, travelling from Clonmagadden Link Road and Ratholdron Road on the North side and N51/R147 Kells Road on the south side.

These routes 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 route selection assessment process is summarised in the following sections. Further information can be found in the Route Selection Report developed for the scheme (Appendix A2-1 in Volume 4).

3.4.2 Stage 1 – Preliminary Options Assessment

As part of the Stage 1 Route Selection Assessment process three route corridor 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 south end of the scheme.

Each option was developed to a sufficient level of detail; this is to ensure that all options were potential feasible routes in both the horizontal and vertical profile of the road.

All three options commence in the north with a signalised junction on the L3409 Ratholdron Road in the vicinity of the existing T-junction with L34094-1 Clonmagadden Road and run south across a small area of woodland and agricultural land. Here the routes diverge in different directions crossing over the River Blackwater (Figure 3-2). The length for each option is as follows:

- Option A1 - 1.13 km;
- Option B1 - 1.15 km; and,
- Option C1 - 1.25 km.

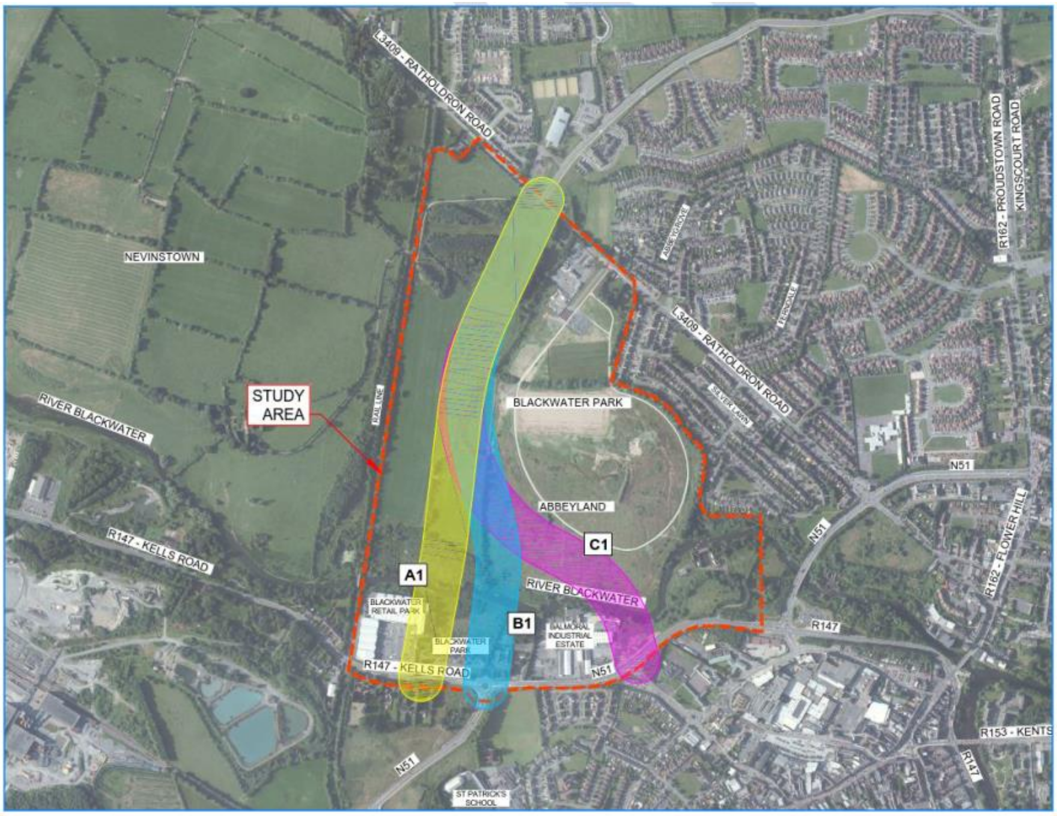


Figure 3-2 Stage 1 Route Options

A Stage 1 Preliminary Options Assessment was undertaken in accordance with the NRA/TII 2010 Project Management Guidelines (herein referred to as Stage 1). The route options, in addition to the Do-Nothing and Do-Minimum options, were assessed in terms of 'High', 'Medium' and 'Low' preference under the headings: Engineering, Environment and Economy.

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 Preliminary Options Assessment process. Table 3-1 below summarises the findings from the Stage 1 assessment.

Table 3-1 Stage 1 - Corridor Options Assessment

Overall	Engineering	Environmental	Economy	Progress to next stage?
Do-Nothing Option	Medium Preference	High Preference	Medium Preference	**Yes**
Do-Minimum Option	Medium Preference	Medium Preference	Medium Preference	**Yes**
Corridor Option A1	Low Preference	Low Preference	Low Preference	**Yes**
Corridor Option B1	High Preference	Medium Preference	High Preference	**Yes**
Corridor Option C1	Medium Preference	Low Preference	Medium Preference	**Yes**

Despite the 'Low Preference' for some of the route options, it was concluded that all options should be taken to the more detailed Stage 2 assessment, given the reduced number of options that were developed for the Stage 1 assessment.

3.4.3 Public Consultation 1 (PC1) – Route Options

Following the consideration of the Stage 1 assessment and prior to commencing the Stage 2 assessment, a Public Consultation (PC1) was held on the 11th January 2018 between 2:30pm and 8:30pm at the Ardboyne Hotel in

Navan. The purpose of the consultation was to present the study area and the three route corridors that arose from the Stage 1 Assessment to the public.

The objective of the public consultation was to:

- Introduce the scheme 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 corridor 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 the Applicant. A total of 20 submissions were received from the public.

A number of the PC1 submissions received indicated a Corridor Option preference. 6 ranked Option A1 as a first or second preference, 12 ranked Option B1 as a first or second preference and 1 ranked Option C1 as a first or second preference.

3.4.3.1 Public Feedback Conclusion

A general preference for Corridor Option B1 was indicated during the consultation and in the subsequent submissions. There were 3 submissions that indicated a negative preference to B1.

During the consultation queries were raised about options located to the west of the rail line (Figure 3-3). However, due to a number of constraints and high-level issues, including additional land take, limited connections points and high costs, associated with these route options outside of the study area, they were not progressed further to route selection stage.

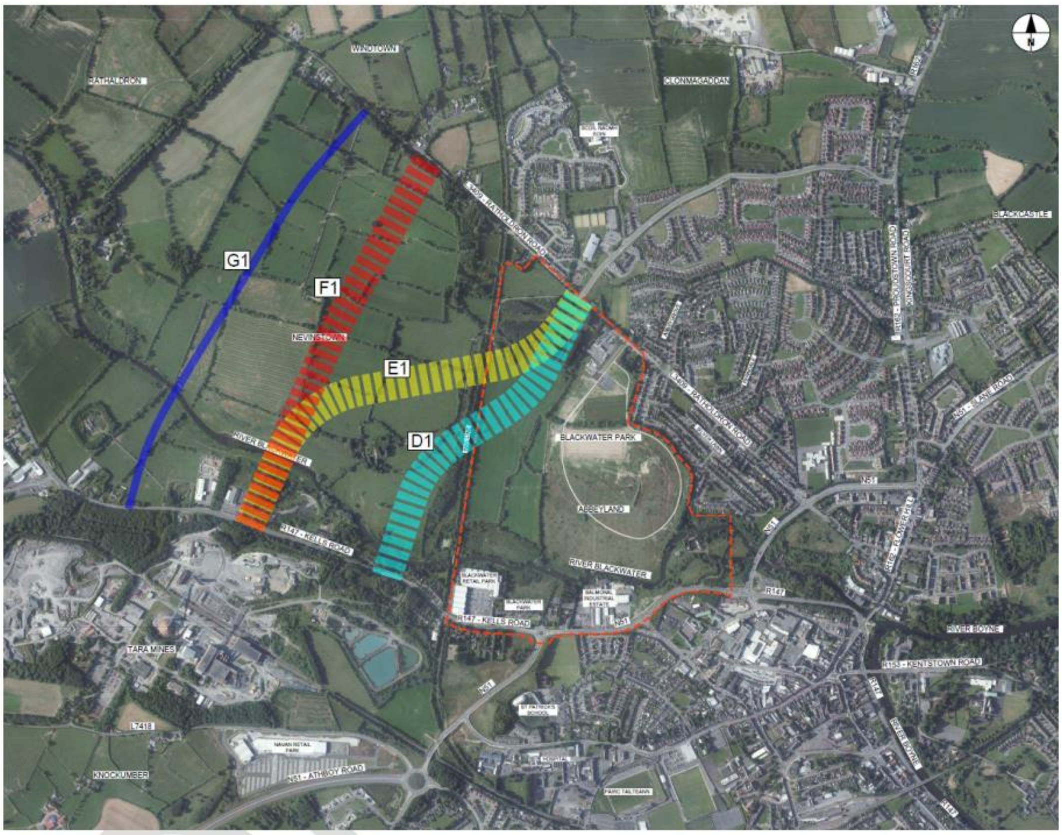


Figure 3-3 Possible alternative Route Corridor options to the west of the study area

3.4.4 Stage 2 – Project Appraisal of Route Options

The Stage 2 Project Appraisal of Route Options (herein referred to as Stage 2) was based on three Route Options which progressed from the Stage 1 assessment and 'Do-Minimum' and 'Do-Nothing' options. As outlined in Section

3.4.2, given the reduced number of options that were developed for the Stage 1 assessment, all three Route Corridor options progressed to the Stage 2 assessment.

From the Stage 2 assessment, it was recommended that Route Corridor Option B1 be taken forward as the Emerging Preferred Route Corridor (EPRC) for the Proposed Road Development (See Table 3-2 below).

Table 3-2 Project Appraisal Matrix Summary

	Do-Nothing Option	Do-Minimum Option	Route Corridor A1	Route Corridor B1	Route Corridor C1
Economy	Intermediate	Intermediate	Least Preferred	Preferred	Intermediate
Safety	Least Preferred	Intermediate	Intermediate	Preferred	Preferred
Environment	Preferred	Intermediate	Least Preferred	Intermediate	Least Preferred
Integration	Least Preferred	Intermediate	Intermediate	Preferred	Preferred
Accessibility & Social Inclusion	Least Preferred	Intermediate	Intermediate	Preferred	Preferred
Physical Activity	Least Preferred	Intermediate	Preferred	Preferred	Preferred
Overall	**Least Preferred**	**Intermediate**	**Least Preferred**	**Preferred**	**Intermediate**

3.4.5 Public Consultation 2 (PC2) – Emerging Preferred Route

Public Consultation 2 (PC2) took place on Tuesday 1st May 2018 between 2.30 pm and 8.30 pm in Ardboyne Hotel, Navan. The objectives of this consultation were:

1. To show the EPRC to the public;
2. To update the public on what stage the project was at;
3. To acquire any local information that was still unknown; and
4. To be available to answer any questions from members of the public.

Large scale maps and a brochure of the EPRC were presented to the public, as shows in Figure 3-4 below.

Figure 3-4 Emerging Preferred Route Corridor

MCC received four submissions after PC2, all of which were in favour of the scheme.

An analysis of the submissions highlighted the following comments:

- Implementing traffic control at the junction between Clonmagadden Road and the R162 Kingscourt Road to facilitate the free flow of traffic emerging from this new scheme.
- Consideration should be given to the extension of this road through Clonmagadden, through Blackcastle Demesne, Boyne Road etc.
- Accommodating access for anglers in the design of the bridge.

In overview, while various comments were received, a recurring message from both the first public consultation in January 2018 and the second public consultation in May 2018 was the urgent need to progress the distributor road scheme. The majority of people who the design team spoke with were in favour of the scheme and agreed with the EPRC.

3.4.6 Conclusions

The route selection process concluded that that the preferred route corridor was Route Corridor Option B1. It was recommended that this option be adopted as the preferred route corridor and was therefore taken forward to the design stage.

3.5 Design Development and Alternatives

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

3.5.1 Northern Section

The following items outline some of the main elements considered during the development of the northern section (Ch 0+000 to Ch. 0+400) of the proposed road alignment and further refinement of the design:

- The northern tie-in point was clearly defined by the location of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. The proposed road alignment has been designed to achieve an almost perpendicular arm for the proposed signalised junction.
- The horizontal alignment continues to run with a straight section in the SSW direction in order to avoid impact to the existing HV overhead lines, which will run almost parallel to the proposed alignment.
- The vertical alignment was dictated by the requirement of tie-in with the existing junction level to the north and the provision of adequate vertical clearance for a culvert structure at the crossing of the existing ditch at approx. Ch 0+225. A minimum vertical gradient has been provided in order to ensure adequate drainage capacity.
- The minimum vertical gradient continues to approximately Ch. 0+350 where a crest curve has been designed. This location has been optimised to coincide with the horizontal curve of the alignment and achieve an effective coordination of horizontal and vertical alignment.

3.5.2 Central Section

The following items outline some of the main elements considered during the development of the central section (Ch 0+400 to Ch. 0+800) of the proposed road alignment and further refinement of the design:

- The horizontal alignment turns to SSE direction and continues with a straight section on the eastern edge of the preferred route corridor. This alignment option was developed in order to minimise the impact on the existing hedgerow along the western boundary of the Town Park and make use of the existing gaps within the hedgerow.
- Following the crest curve in correspondence of the horizontal curve at Ch. 0+350, the proposed alignment reduces in level towards the river valley. During the development of the proposed design, the vertical alignment was lowered even further in the section running parallel to the western boundary of the Town Park, as shown in Figure 3-5 and Figure 3-6 below. This design solution, together with the introduction of an earth bund, allowed for a reduction in visual and noise impacts of the Proposed Road Development on park users (as discussed further in Chapter 11 (Noise and Vibration) and Chapter 12 (Landscape and Visual).
- The proposed design also includes two pedestrian accesses to the Town Park as the provision of one single access point to the park (from the proposed road development) was deemed not sufficient to ensure adequate connectivity. The locations of the two access to the Town Park has been separated as practically as possible in order to ensure a direct access for pedestrian users which will approach the Town Park from both the northern and southern junctions of the Proposed Road Development.

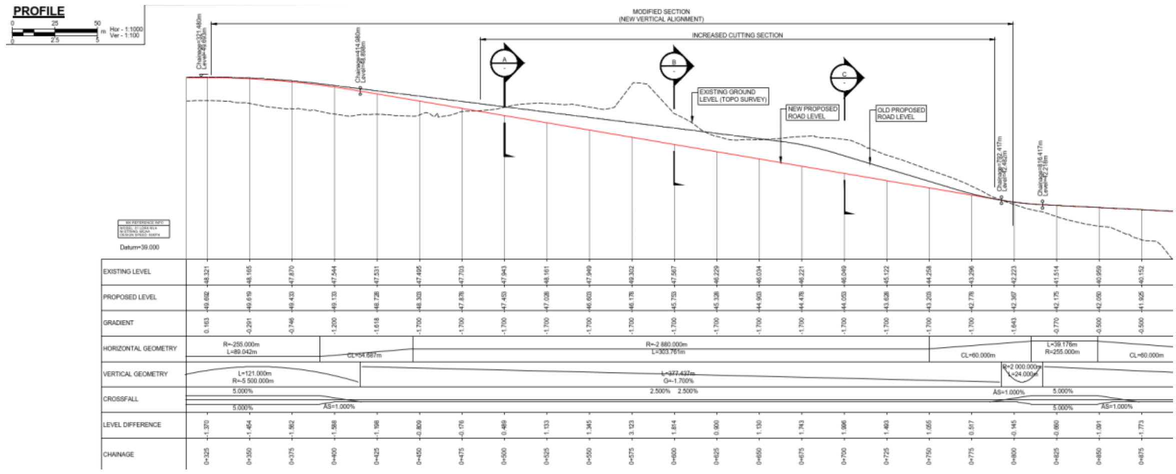


Figure 3-5 Road centreline profile showing the increased cutting section between Ch. 0+500 and Ch. 0+800

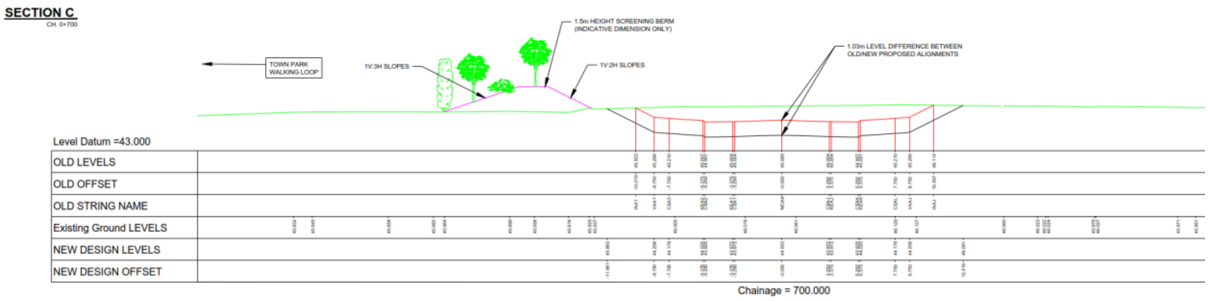


Figure 3-6 Cross-Section C (Ch. 0+700) showing the increased cutting and additional earth berm

3.5.3 Southern Section

3.5.3.1 Alignment Options

Following the identification of the preferred route corridor, a technical note was developed to assess the alignment options relative to the south section of the Proposed Road Development (between the crossing of River Blackwater and the junction located in place of the existing N51/R147 roundabout). Three centreline alignment options were considered for the last section (from Ch. 0+850 onwards), all lying within the boundary defined by the overall Preferred Route Corridor B1, as shown in Figure 3-7.

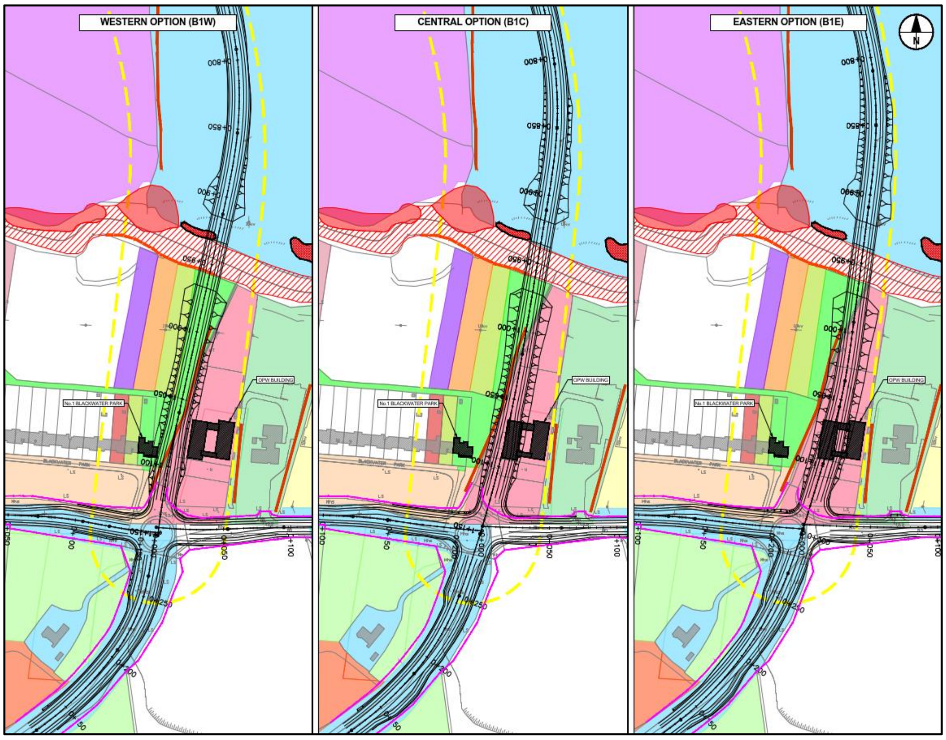


Figure 3-7 Centreline alignment options

The three alignment centreline options are described in the following sections:

- **Western Option (B1W):** Following a RHS R255m bend on the north side of River Blackwater, the Western Option alignment crosses the river almost perpendicularly in a SSW direction and continue southbound passing through the gap between the existing No.1 Blackwater Park residential building and OPW commercial building. The alignment ends in the centre of the existing N51/R147 roundabout. It is noted that the impact on the two buildings (No.1 Blackwater Park and OPW building) could be reduced by the provision of retaining wall structures on either side of the road, which reduce the footprint of the embankments. Considering the option with retaining wall structures, only the garage on the east side of No.1 Blackwater Park will require to be demolished. If no retaining structures will be considered, additional demolitions will be required (full demolition of No.1 Blackwater Park and demolition of at least the western block of the OPW building).
- **Central Option (B1C):** Following a RHS R255m bend on the north side of River Blackwater, the Central Option alignment crosses the river with a slightly skew angle in a south direction. The alignment continues southbound following the eastern boundary of the OPW land plot. The centreline alignment passes along the western façade of the OPW building and ends at the existing N51/R147 roundabout. It is noted that this option will require the full demolition of the commercial property and will partially impact on the garden of residential property (No.1 Blackwater Park).
- **Eastern Option (B1E):** Following a RHS R255m bend on the north side of River Blackwater, the Eastern Option alignment crosses the river with a slightly skew angle in a south direction. The alignment continues southbound along the existing western boundary of the OPW land plot. The centreline alignment passes entirely through the OPW building and ends on the east side of the existing N51/R147 roundabout. It is noted that this option will require the full demolition of the OPW building and will not impact on the residential property (No.1 Blackwater Park).

3.5.3.2 Alignment Options Assessment

An assessment matrix has been prepared under the following headings: Environment, Economy, Safety, Accessibility & Social Inclusion and Integration (as specified in the TII Project Appraisal Guidelines 2016). The assessment matrix assigned the following ratings depending on the severity of impact on the receiving environment:

- Preferred
- Intermediate
- Least Preferred

A summary of the key assessment rankings is provided in the summary Table 3-3 below.

Table 3-3 Alignment Option Assessment Matrix

	Western Option (B1W)	Central Option (B1C)	Eastern Option (B1E)
Environment	Least Preferred	Intermediate	Preferred
Economy	Preferred	Least Preferred	Intermediate
Safety	Intermediate	Intermediate	Intermediate
Accessibility & Social Inclusion	Intermediate	Intermediate	Intermediate
Integration	Intermediate	Intermediate	Intermediate
Overall Ranking	**2**	**3**	**1**

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

- Environment:
  - *Landscape and Visual*: Eastern Option (Preferred) will be located further away from the existing residential buildings of Blackwater Park compared to the other two options, reducing the visual impact and allowing for more space to eventually locate mitigation measures.
  - *Air Quality and Noise*: Eastern Option (Preferred) will be located further away from the existing residential buildings of Blackwater Park compared to the other two options, reducing the noise impact and allowing for more space to eventually locate mitigation measures.
  - *Agronomy and Land Use*:
    - Western Option (Least Preferred) directly impacts on residential properties with extensive landtake and partial/full demolition of one house.
    - Central Option (Intermediate) creates higher issue in term of land severance as it leaves a long and narrow strip of land to the east of the scheme with limited accessibility.
    - Eastern Option (Preferred) requires the acquisition of one plot of land (commercial property) and the demolition of the same commercial property (currently disused for the last 10 years), in addition to a small strip of common land to the north of No.1 Blackwater Park.
  - *Ecology*: It has been identified that none of the three options will impact on the wet willow alder-ash woodland (Annex 1 and SAC QI) located on the north bank of the River Blackwater. The indirect effects (through shading) on fragment *hydrophilous* tall habitat of County importance located on the north bank of the river Blackwater (not considered SAC QI Annex 1 habitat due to fragmentation) is greatest for option B1W and decreases for option B1C and B1E. A similar trend is expected for hedgerows located on the south side of the River Blackwater. The Eastern Option (B1E) has therefore been identified as the Preferred option.
  - *Soils & Geology, Hydrology, Hydrogeology and Archaeology & Cultural Heritage*: No differences have been observed under these headings; therefore, all options have been ranked as equally preferred (Intermediate):
- Economy:
  - *Benefit*: all options have been assessed to provide the same level of economic and traffic benefits.
  - *Costs*: a combination of construction costs, land costs and demolition costs resulted in the Western Options to be the Preferred options, followed by the Eastern Option (Intermediate) and Central Option (Least Preferred).
- Safety, Accessibility & Social, and Integration:
  - All the three options are considered equally preferred (Intermediate) with regard to Safety, Accessibility & Social, and Integration.

3.5.3.3 Conclusion

The assessment of the alignment option for the southern section under the headings of Environment, Economy, Safety, Accessibility & Social Inclusion and Integration (TII, 2016) concluded that Eastern Option (B1E) was the preferred alignment option.

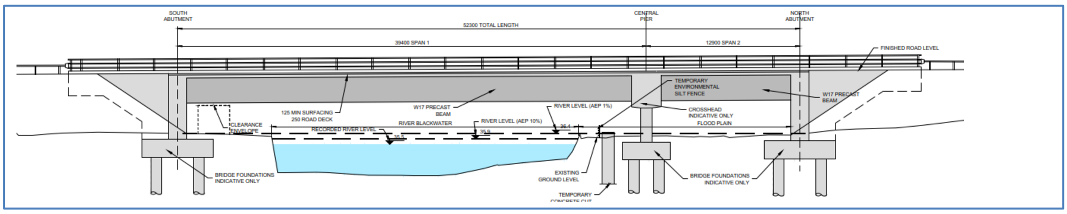
3.5.4 Bridge Design Alternatives

3.5.4.1 Bridge Options

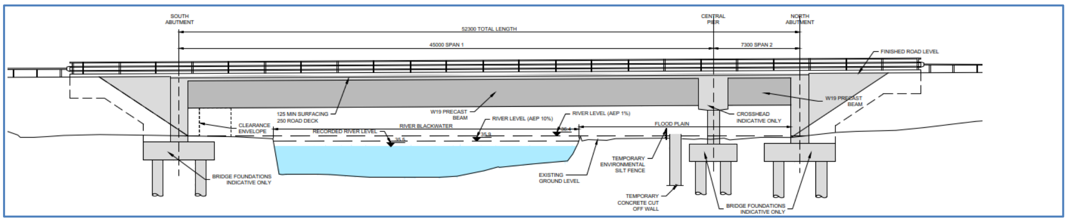
Following the identification of the preferred route corridor and the preferred alignment option at the river crossing point, a technical note was developed to investigate the various bridge options which may be considered and to establish the most appropriate river crossing option based on a Multi Criteria Analysis (MCA) for a number of key constraints.

Six options have been investigated as described below:

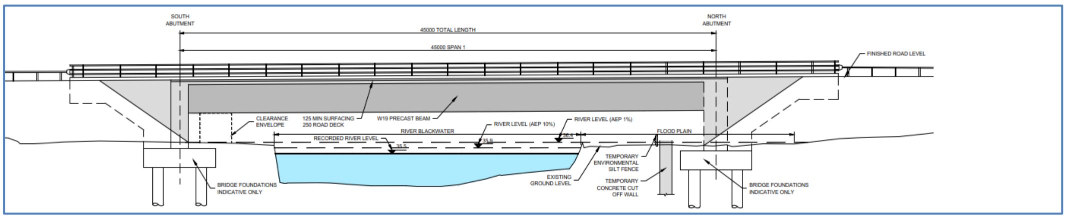
- Option 1 - Two Span Precast Concrete Bridge (Span 1 39.4 m and Span 2 12.9 m)
- Option 2A - Two Span Precast Concrete Bridge (Span 1 45.0 m and Span 2 7.3 m)
- Option 2B - Single Span Precast Concrete Bridge (Span 45.0 m)
- Option 2C - Single Span Precast Concrete Bridge (Span 45.0 m) with associated flood relief culvert
- Option 3 - Single Span Steel Structure (Span 52.3 m)
- Option 4 - Single Span Steel Bridge (Span 65.0 m)



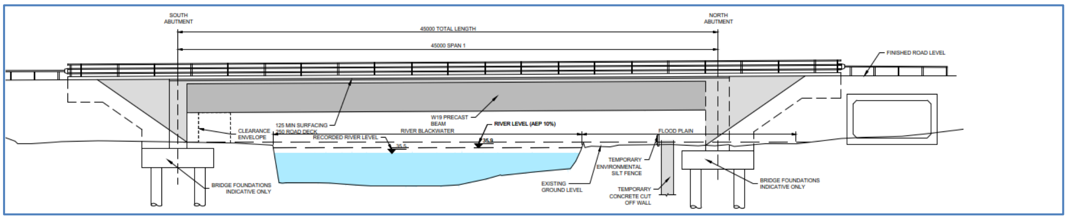
Option 1



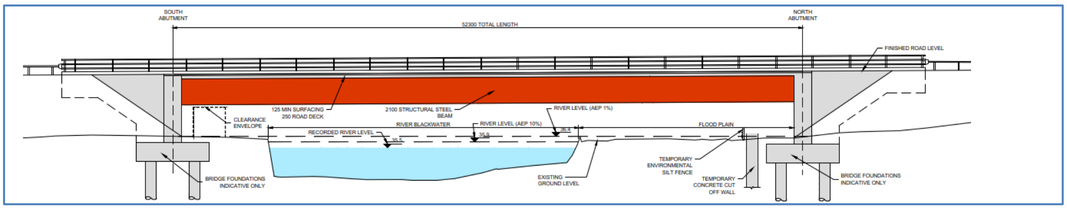
Option 2A



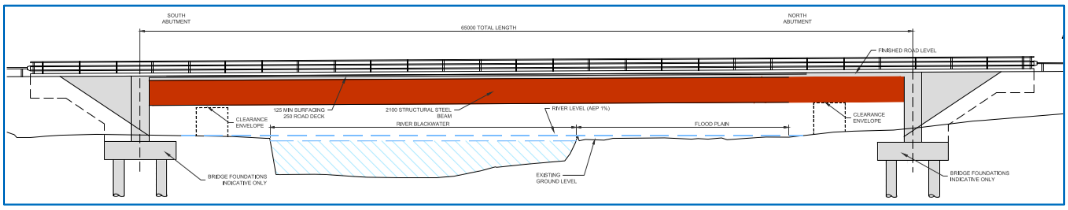
Option 2B



Option 2C



Option 3



Option 4

Figure 3-8 Bridge Options

3.5.4.2 Multi Criteria Analysis

The bridge options have been assessed under the headings of Environment, Engineering and Economy, as provided under the TII PMG Stage 1 Preliminary Options Assessment. The options have been compared based on a five-point scale, ranging from having significant advantages to having significant disadvantages over the other options.

For illustrative purposes, this five-point scale is colour coded as presented in the table below with advantageous options graded to 'dark green' and disadvantageous options graded to 'dark red'.

Colour	Description
	Significant advantages over the other options
	Some advantages over other options
	Neutral compared to other options
	Some disadvantages compared to other options
	Significant disadvantages compared to other options

A summary of the key assessment rankings is provided in the summary Table 3-4 below.

Table 3-4 Bridge Option Assessment Summary

Assessment Criteria	Option 1 Two Span Precast Concrete Bridge (Span 1 39.4m and Span 2 12.9m)	Option 2A Two Span Precast Concrete Bridge (Span 1 45m and Span 2 7.3m)	Option 2B Single Span Precast Concrete Bridge (Span 45m)	Option 2C Single Span Precast Concrete Bridge (Span 45m) with associated flood relief culvert	Option 3 Single Span Steel Structure (Span 52.3m)	Option 4 Single Span Steel Structure (Span 65m Draft for assessment)
Environment						
Biodiversity						
Aesthetics						
Engineering						
Constructability						
Operational Maintenance						
Economy						
Construction Cost						

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

- Biodiversity: the 'mitigated' Options 2A, 2B, 2C and 3 are considered similar as it is concluded that they will not adversely affect any European sites, following implementation of measures including seasonal works, and installation of a cut-off trench (and temporary flood defence wall to protect the working area).
- Aesthetics: single span in Options 2B, 2C, 3 and 4 will provide considerably improved bridge aesthetic with further improvements associated with steel structures (more slender structure).
- Constructability: difficulties associated with works within flood plain, proximity to the river bank edge and complexity of the lifting required are main driver to the constructability assessment.
- Operational Maintenance: all precast concrete options will provide significant advantages over steel structure due to the very limited maintenance required.
- Construction Cost: steel structures are substantially more expensive than the precast concrete equivalent.

Option 2B and 2C in particular, given the reduced overall span and the associated potential change to the hydraulic regime caused by reduction in conveyance capacity, have required further and more detailed hydraulic analysis. This analysis has demonstrated that there is limited potential to impact on the flood regime of the River Blackwater and has been considered as part of the biodiversity assessment of each option within this assessment.

3.5.4.3 Conclusion

The results of the MCA under the heading of Environment, Engineering, and Economy for the six bridge options selected showed that Option 2B was more favourable when compared to the alternative options.

In light of the options assessment undertaken, Option 2B was adopted as the preferred bridge option and therefore taken forward to the design stage.

3.6 References

- AECOM. (2018). *Local Distributor Road 4 Abbeyland Navan, Route Selection Report*, Doc. Ref. 60546769-REP-20-0000-CH-0002 050974
- EC. (2017). *Environmental Impact Assessment of Projects, Guidance on the preparation of the Environmental Impact Assessment Report, European Commission*
- 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.
- NRA. (2010). *Project Management Guidelines*, National Roads Authority, Dublin, Ireland.
- TII. (2016). *Project Appraisal Guidelines*, Transport Infrastructure Ireland, Dublin, Ireland.

Chapter 04: Description of the Proposed Road Development

04

4. Description of the Proposed Road Development

4.1 Introduction

This chapter provides a description of the Proposed Road Development, also referred as LDR4 scheme. It is based on the design and includes details of the engineering features, land requirements and construction and operation requirements.

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 south from the northern tie-in with the L3409 Ratholdron Road towards the southern tie-in at the existing roundabout between the N51 and the R147 Kells Road.

It should be noted that surveys, assessments and information that form the basis of this 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 EIA and indeed Appropriate Assessment (AA) to be carried out by the competent authority. While further detailing will be required to fully inform procurement and construction no design changes will be permitted that have the potential to undermine the basis of assessment of the environmental impacts undertaken in this EIA and the AA processes.

4.1.1 General Description

The Applicant is proposing to develop a c. 1.15 km local distributor road referenced in the NDP 2009-2015 and in Appendix IV of the NLTP on 8.63 ha of predominantly greenfield site in the north-west of Navan, Co. Meath. The Proposed Road Development comprises an urban Arterial Street, incorporating both pedestrian and cycle facilities provisions, connecting the N51/R147 Kells Road to the L3409 Ratholdron Road through Abbeyland. The scheme is located in the townlands of Abbeyland, Abbeyland South, Moathill, Townparks, Windtown in Navan, Co. Meath.

The Proposed Road Development runs in a north-south direction across the River Blackwater between the L3409 Ratholdron Road and the N51/R147 Kells Road. The location is characterized by presence of open greenfield area with some wooded areas in the section north of the River Blackwater, which runs to the west of the recently developed Blackwater Park. The southern section of the study area contains the River Blackwater and continuing to the south the scheme meets the N51/R147 Kells Road, which is lined by both residential and commercial properties. The River Blackwater is in a Special Area of Conservation (SAC) and Special Protection Area (SPA).

A new bridge crossing over the River Blackwater in the south is also proposed, which will improve access to lands to the north of the town between the L3409 Ratholdron Road and the R162 Proudstown Road, and also the Clonmagaddan SDZ.

The Proposed Road Development comprises the following major elements:

- Approximately 1.15 km of new urban Arterial Street (DMURS - 3.25 m lanes - single carriageway), incorporating pedestrian and cycle facilities (2.0 m wide raised one-way cycle track on both sides, 2.5 m wide footpaths on both side, 1.0 m road verges);
- Two new signalised junctions at the scheme termination points, L3409 Ratholdron Road and R147 / N51 Kells Road, both incorporating right turn lane and pedestrian/cycle crossings;
- One new single span river bridge over the River Blackwater (overall length 45.0 m);
- One new piped culvert over an existing field ditch;
- New pedestrian and cycle facilities, including 2 accesses to the Blackwater Park;
- Associated earthworks including excavation of unacceptable material, excavation and processing of rock and other material, provision of material deposition areas and deposition and recovery of unacceptable material for reuse in the works;
- Accommodation works, including the provision of access roads and accesses;
- Drainage works, including the construction of an attenuation pond and storage tanks;
- Demolition of an existing commercial building in the southern section of the Proposed Road Development;

- Landscaping works, including the construction of earth bunds between the Proposed Road Development and the Town Park;
- Utilities and services diversion works, including the diversion of a high voltage electricity line crossing the Proposed Road Development, including the provision of associated support poles;
- New safety barrier, public lighting, fencing; and
- Environmental measures and other ancillary works, including but not limited to the provision of 1 mammal underpass and mammal fencing.

The project location and extent of the Proposed Road Development is shown in Figure 4.1 to 4.4 contained in Volume 3 of this EIAR.

4.1.2 Key Provisions of the Proposed Road Development

The implementation of the Proposed Road Development will provide the following:

- Reduce the reliance of the road network on the existing crossings of the River Blackwater located near the Navan town centre (namely N51 and Flower Hill);
- Reduce the high traffic volumes and congestion experienced in Navan town centre;
- Provide a road that is fit for purpose and which is designed and constructed in accordance with current design standards;
- Provide a consistent cross-section which will allow for the efficient movement of persons and goods through Navan;
- Provide high quality pedestrian and cycle facilities by providing safe routes to and from Blackwater Park and the town centre for the surrounding communities;
- Provide safe crossing points throughout the road corridor for NMUs;
- Provide appropriate junctions and accesses in accordance with current design standards; and
- Provide road surface water runoff collection and treatment facilities to ensure that rainfall is effectively removed from the road surface and treated before discharge to the existing water environment. This includes the provision for cut-off and storage in the event of a road accident causing spillage of deleterious materials.

4.2 Geometric Design

4.2.1 Road and Junction Standards

The standards adopted in the design follow the requirements included in:

- TII Standard;
- DMURS prepared by DTTAS and DECLG; and
- National Cycle Manual prepared by the NTA.

4.2.2 Side Roads

All non-mainline roads affected by the Proposed Road Development are termed ‘Side Roads’. As the Proposed Road Development is largely at grade, only very local diversions of existing side roads are 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.

All side roads realignments are less than 180 m in length (e.g. short link roads, direct connections from proposed junctions) although it should be noted that some realignment will only involve the widening of existing link on one side, not affecting existing kerb line and cycle/pedestrian facilities on the other side.

Table 4-1 provides a schedule of the side roads affected by the proposed works as part of the Proposed Road Development detailing the existing and proposed cross section and the proposed length of road realignment. It is noted that all the side roads are forming part of the proposed junctions and for this reason they are described in detail within Section 4.2.5.

In all cases, the cross section on the immediate approach to the signalised junctions with the mainline has been widened to include two lanes approaches, central island (where required), cycle and pedestrian facilities.

4.2.3 Road Cross Section

The mainline single carriageway of the Proposed Road Development has been designed as an urban Arterial Street with 3.25 m wide lanes, in accordance to DMURS (DMURS Figure 4.55 – Carriageway Width: Standard carriageway widths for Arterial and Link streets. Range for low to moderate design speeds).

From Highways England TA79/99 design standard titled Traffic Capacity of Urban Roads, an Urban All-Purpose (UAP2) class road closely correlates to that of an urban Arterial Street (3.25 m wide lanes). This standard indicates that for a cross section of 6.1 m, it will have an hourly capacity of 1020 vehicles per direction. The traffic predictions (see Chapter 5 (Traffic Analysis) of this EIAR) indicate that a peak hour flow of 515 vehicles per direction will be observed in the 2037 design year, as such there will be considerable reserve capacity of the distributor road.

In general, the proposed widths of realigned roads intersected as part of the Proposed Road Development have been designed to closely follow that of the existing road. Considering that the realigned side roads are located within the existing speed restrictions for the urban setting of Navan, the DMURS design standard applied, although TII standard has been considered as a reference point for the definition of the horizontal and vertical alignment.

The cross-sections for the different road types utilised within the design are detailed in Table 4-1 and in Figure 4.8 contained in Volume 3 of this EIAR.

Table 4-1: Carriageway Cross Sections (Typical)

Road	Road Classification	Carriageway Width	Verge Width
LDR4	Local Road	2 x 3.25 m lanes	5.5 m incorporating 2.5 m footpath and 2.0 m one-way raised cycle track.
Junction 1A - Existing L3409 Ratholdron Road (North)	Local Road	6.0 m carriageway	Existing 1.8 m footpath widened to 4.0 m shared footpath in northern verge.
Junction 1B - Existing L34094-1 Clonmagadden Road	Local Road	7.3 m carriageway	1.0 m verge + 3.0 m shared footpath (west side), 2.0 m verge + 3.25 m shared footpath (east side)
Junction 1C - Existing L3409 Ratholdron Road (South)	Local Road	6.0 m carriageway	Existing 1.8 m footpath widened to 2.8 m shared footpath in northern verge.
Junction 2A - Existing N51 (East)	National Secondary Road	6.5 m carriageway	1.75 m cycle lane (1-way) + 2.0 m footpath (both sides)
Junction 2B - Existing N51 (South)	National Secondary Road	7.3 m to 7.6 m carriageway,	2.0 m raised cycle track (1-way) + 2.0 m footpath (both sides)
Junction 2C - Existing R147 Kells Road (West)	Regional Road	6.5 m carriageway	1.75 m cycle lane (1-way) + 2.0 m footpath (both sides)

It is also noted that all side roads form at-grade junctions with the mainline. All the proposed cross sections are relative to the tapering with the existing road cross section and all approaches to junction have been designed to include two lanes approach with 3.0 m wide lanes.

The design has been developed on the basis of providing a working space requirement between the earthworks and the boundary fence line of 5 m, however where space constraints or construction and maintenance methodology demand, the working space has been respectively reduced or increased locally.

4.2.4 Pedestrian and Cycle Provision

At the present there are limited dedicated cycle facilities within Navan, however the NTA have published proposals for a number of facilities covering the GDA which also covers Navan. This strategy includes the provision of Primary/Secondary facilities, Greenways (M5 Boyne Valley and M6 Navan to Kingscourt Railway line in particular) and urban feeder routes within Navan town.

During the design of the Proposed Road Development, cognisance was taken of the proposals from the NTA to ensure that the Proposed Road Development would complement these proposals and seek to implement those that were in close proximity to the scheme.

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 LDR4 mainline, a 2.0 m wide raised one-way cycle track and 2.5 m wide footpaths have been incorporated on both sides. Two new dedicated pedestrian links between the Proposed Road Development and the walking route within the Blackwater Park have also been incorporated into the design.

Where existing facilities are intersected by the Proposed Road Development (see junctions at the north and south end of the scheme, these have been connected to the proposed facilities, and pedestrian and cycle crossings have been incorporated into the design. Pedestrian and cycling facilities are presented in Figures 4.9 to 4.12 inclusive contained in Volume 3 of this EIAR.

4.2.5 Mainline Alignment

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 Local Distributor Road 4 scheme.

The alignment is composed of one single section (Chainage from 0+000 to 1+150), running north to south for a total length of 1.15 km, between the existing L3409 Ratholdron Road / L34094-1 Clonmagadden Road Junction (Junction 1) and the existing N51 / R147 Roundabout (Junction 2) and it is illustrated on Figures 4.5 to 4.7 and Figures 4.31 to 4.33 inclusive contained in Volume 3 of this EIAR.

The alignment was developed to achieve a design speed of 60 km/h, consistent with the posted speed limit of 50km/h for urban environment (TII DN-GEO-03031 Table 10.1).

The LDR4 mainline alignment commences to the north with a proposed 4-way signalised junction on the L3409 Ratholdron Road in place of the existing T-junction with L34094-1 Clonmagadden Road. The alignment then runs south across a small area of woodland and agricultural land. The alignment then turns south east with a left hand 255m radii curve and follows broadly the existing hedgerows that indicate the western boundary of Town Park.

The alignment starts with a short section at grade and then slowly moves to an embankment section with minimum longitudinal gradients (+0.5%) and one culvert located at Ch. 0+225. After a crest point located at Ch. 0+320 the vertical alignment starts to descend with a constant -1.7% gradient until Ch. 0+800.

The horizontal alignment then turns south with a right hand 255m radii curve and across the River Blackwater almost perpendicularly (Ch. 0+920 to Ch. 0+975). The vertical alignment presents a reduced gradient to -0.5% along the entire crossing of the river.

The alignment continues running southbound to the east of the existing residential properties at Blackwater Park, requiring the acquisition and demolition of an existing commercial building. The vertical alignment presents a low point at Ch. 1+035 and then rises in level with a +2.5% gradient. The alignment ties into the existing R147/N51 roundabout which will be upgraded to a 4-arm signalised junction.

4.2.6 Junctions

Two alterations of existing junctions have been incorporated into the design of the Proposed Road Development. Two four-arm signalised junctions are proposed in place of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road, and in place of the existing roundabout between N51 and R147 Kells Road.

For each of the proposed junctions, the traffic flows along the mainline and the intersecting road, along with the expected turning movements, have been obtained from the traffic modelling (as detailed in Chapter 5 (Traffic Analysis) of this EIAR) and analysed to determine the capacity of the proposed junction to ensure that traffic demand at the junction can be accommodated.

Signalised junctions are more appropriate in urbanised areas and assist in facilitating NMUs to a greater degree than other junction forms. As such, two signalised junctions have been incorporated into the design and have been designed in accordance with TII DN-GEO-03044. They also take cognisance of the DMURS for the appropriate treatment of NMUs.

The junctions proposed as part of the Proposed Road Development are described in further detail below and are shown in Figures 4.13 to 4.16 inclusive contained in Volume 3 of this EIAR.

4.2.6.1 Junction 1 (Ch. 0+000) – L3409 Ratholdron Road and L34094-1 Clonmagadden Road

A signalised cross-road junction has been selected as the preferred junction type at this location. A signalised junction will assist in the higher through flows envisaged from the traffic modelling at this location, and provide the safe operation of a cross-roads junction layout. All four arms of the junction have been widened on the approaches to the junction to provide right turn lane for waiting traffic at the junction.

The traffic modelling indicates a daily traffic flow (in the design year 2037) on the LDR4 south of the L3409 Rathodron Road of 8556 vehicles per day; this number decreases to 7426 vehicles per day north of the junction on L34094-1 Clonmagadden Road. The flows on L3409 Rathodron Road are approximately 4601 west of the junction and 7899 east of the junction.

LinSig modelling has been undertaken for the AM (8-9am) and PM (5-6pm) peak flows to assess the capacity of the junction. The analysis indicates that all arms of the junction operate well within capacity with a maximum Degree of Saturation (DoS) of 52.9% on the L3409 North arm (PM peak). This indicates that the proposed junction DoS is below the 85% value, currently considered to be optimum DoS for a traffic signal-controlled junction.

4.2.6.2 Junction 2 (Ch. 1+150) – N51/R147 Kells Road

A signalised cross-road junction has been selected as the preferred junction type at this location. A signalised junction will assist in the higher through flows envisaged from the traffic modelling at this location and provide the safe operation of a cross-road junction layout. All four arms have been widened on the approaches to the junction to provide right turn lane for waiting traffic at the junction.

The traffic modelling indicates a daily traffic flow (in the design year 2037) on the LDR4 north of the junction of 8556 vehicles per day; this number increases to 12545 vehicles per day south of the junction on N51 (South). The flows on the east arm of the junction (N51) are approximately 13241 vehicles per day and on the west arm of the junction (R147) are approximately 13022 vehicles per day.

4.3 Structures

The Proposed Road Development incorporates one main structure, as described in detail below:

4.3.1 River Blackwater Bridge

The River Blackwater bridge has a single span of 45.0 m, with the bridge abutments located outside the river channel to minimise instream works for the construction of the bridge over the River Blackwater SAC. This bridge will be 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 4.17 contained in Volume 3 of this EIAR.

The structure will be located west of Navan town at coordinates 686093.7, 768174.0 (ITM). The bridge will cross the River Blackwater and its flood plain in a north south direction. At the crossing point, the river bank topography shows relatively steep embankments of 6 m to 7 m in height.

The bridge will consist of a 45.0 m single span ensuring a clear span over the river channel. The proposed underbridge alignment will cross the River Blackwater at a skew of approximately 12° to the perpendicular. The structural depth of the underbridge will be 2.55 m with minimum vertical clearance of 2.4 m provided.

The construction methodology and the measures adopted to mitigate the impact on the River Blackwater SAC are described in Section 4.11.3.5 below.

4.4 Road Drainage

4.4.1 General

This section covers the drainage design of the Proposed Road Development. The proposed design incorporates:

- The collection and conveyance system proposed for the scheme; and

- Measures to treat and attenuate the surface water run-off from the new carriageway.

This report should be read in conjunction with the drainage design Figures 4.18 to 4.21 inclusive contained in Volume 3 of this EIAR.

4.4.2 Carriageway Drainage – General Principals

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);
- DN-DNG-03065 - Road Drainage and the Water Environment (including Amendment No. 1 dated June 2015);
- DN-DNG-03066 - Design of Earthworks Drainage, Network Drainage, Attenuation & Pollution Control.

4.4.2.1 Principles of Design

The main parameters used in the drainage design of the Proposed Road Development are as follows:

- Longitudinal sealed carrier drains designed to accommodate a one-year storm in-bore without surcharge and checked against a five-year storm intensity to ensure that surcharge levels do not exceed the levels of chamber covers.
- Minimum full-bore velocity 0.75 m/s to maintain self-cleansing;
- Maximum full-bore velocity at outfalls 2.5 m/s;
- Minimum pipe gradient 1 in 500;
- Pipe roughness, ks 0.6 mm;
- 1.2m minimum desirable cover to crown of pipe.

4.4.2.2 Cut-off Drains or Ditches

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

- top of cutting slopes where the adjoining land slopes towards the cutting;
- 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.

4.4.3 Proposed Road Drainage Networks

As the Proposed Road Development will cross the River Blackwater SAC and SPA, and due to the use of kerbs on the road section, it is proposed that 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 three separate networks, A, B and C respectively. The road drainage outfalls at three locations into the River Blackwater, via vegetated interceptor ditches at two locations and via an existing pipe system at a third location. 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 Figures 4.18 to 4.21 inclusive contained in Volume 3 of this EIAR.

4.4.3.1 Network A - Chainage 0+000 – 0+225 (Northern Tie-in Section)

Network A facilitates a total length of 225 m of mainline road drainage from Ch. 0+000 to Ch. 0+225. In addition to that, road drainage from the following areas also discharges into this drainage network:

- 150 m of the L3409 North
- 80 m of the L3409 South
- the proposed signalised junction.

This section proposes to connect into the existing Windtown Surface Water Outfall pipeline at Chamber S8, which in turn discharges downstream in to the River Blackwater. The outfall from the proposed road drainage discharges via a petrol interceptor to a storage tank on the western side of the mainline at approx. Ch.0+040 to provide attenuation, with a flow control device and shut off valve. The existing pipeline crosses the proposed LDR4 mainline at Ch.0+075. In accordance with the Windtown Surface Water Outfall planning drawings, the existing pipeline is 900 mm in diameter with an invert level sitting approximately 4 m under the existing ground surface. The contractor must verify this information on site prior to the commencement of the works. Replacement of existing drainage infrastructure and diversions of existing services may be necessary at tie in locations.

4.4.3.2 Network B - Chainage 0+225 – 0+900 (Greenfield Section)

Network B facilitates a total length of 675 m of mainline road drainage from Ch. 0+225 to Ch. 0+900.

This section discharges to the northern bank of the River Blackwater via a vegetated interceptor ditch. The road drainage runoff discharges via a petrol interceptor to an attenuation pond on the western side of the mainline at approx. Ch.0+800, with a flow control device and shut off valve. The attenuation pond will be designed to incorporate a permanent water zone in order to provide additional treatment to the runoff.

The headwall will be constructed using precast concrete or Stone Gabions to minimise the potential for pollution to enter the River Blackwater during construction. The vegetated interceptor ditch will be located downstream of the outlet of the attenuation tank and will also provide treatment to the runoff before discharging into the River Blackwater.

4.4.3.3 Network C - Chainage 0+900 – 1+150 (Southern Tie-in Section)

Network C facilitates a total length of 250m of mainline road drainage from Ch. 0+900 to Ch. 1+150. In addition to that, road drainage from the following areas also discharges into this drainage network:

- 440 m of the N51 South
- 180 m of the R147 West
- the proposed signalised junction
- the proposed bridge deck over the River Blackwater

This section discharges to the southern bank of the River Blackwater. The runoff from the proposed road drainage discharges via a petrol interceptor to an attenuation tank on the Eastern side of the mainline at approx. Ch.1+100, with a flow control device and shut off valve.

A vegetated interceptor ditch will be constructed at the tank outlet. This will be upstream of the River Blackwater (which is a SAC) and will provide additional treatment. The headwall will be constructed using precast concrete or Stone Gabions to minimise the potential for pollution to enter the River Blackwater during construction. Replacement of existing drainage infrastructure and diversions of existing services may be necessary at tie in locations.

4.4.4 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 is not greater than the original greenfield runoff rate. This will be achieved using pond and tank attenuation systems with a flow restricting device such as a vortex flow control device upstream of the outlet to a receiving waterbody.

The scheme proposes to use a pond upstream of the discharge point to the River Blackwater for the greenfield section of the scheme. The remaining sections at the northern and southern tie-in points will be attenuated using tank systems.

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. 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.

4.4.4.1 Flow Attenuation – Pond

The attenuation pond has 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 is via a permeable bund.

Due to the environmentally sensitive nature of the area and because the pond will be used for spillage containment, the pond will be lined. The pond shape and orientation consider the local topography and environment and is designed to appear natural and aesthetically unobtrusive (see Figure 4.3 contained in Volume 3 of this EIAR). The pond uses soft geometries with curved boundaries and undulating margins, rather than straight lines and hard edges. The pond will incorporate suitable planting mix to aid filtration and pollution control.

The attenuation pond will be located in land adjacent to the Proposed Road Development – see Figures 4.18 to 4.21 inclusive contained in Volume 3 of this EIAR for locations of attenuation systems. Access for future maintenance will be accommodated by provision of a gated access track running around the proposed attenuation pond and connected to the road mainline.

4.4.4.2 Flow Attenuation – Tank

The storage tanks proposed at two locations will be in the form of a high strength plastic modular system which will be provided upstream of the flow restriction. These high strength units typically provide a void ratio in excess of 94%. The tank system will be surrounded with an impermeable geomembrane to create a sealed unit. The outlet from this sealed "tank" is then controlled to facilitate a slow release of the stored water back into the receiving watercourse at the permitted runoff rate.

The tank systems will be located in land adjacent to the Proposed Road Development and will be landscaped after installation – see Figures 4.18 to 4.21 inclusive contained in Volume 3 of this EIAR for the locations of attenuation systems. Access for future maintenance will be accommodated by incorporating inspection crates within the system at appropriate intervals.

4.4.4.3 Flow Attenuation – Storage Volumes

The storage volumes required for the attenuation structures proposed for each drainage network are demonstrated in Table 4-2 below.

Table 4-2: Storage Volumes of Attenuation Structures

Drainage Network	Attenuation Structure	Storage Volume (m^3)	Maximum Permissible Discharge (l/s)
Network A	Tank	234	5
Network B	Pond	305	6.5
Network C	Tank	680	9.3

4.4.5 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.

When considering the risk of spillages from a road and potential pollution to the receiving environment, TII (NRA) DN-DNG-03065 recommends that the:

- the calculated spillage risk return period must not be greater than 1 in 100 years;
- the 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 spillage assessment carried out on the Proposed Road Development demonstrates a very low magnitude of risk for individual or grouped catchment outfalls and shows the overall spillage risk for the entire scheme to be 1 in 8128 years. Shut-down facilities at outfalls will be provided as a precautionary measure due to the presence of the SAC and SPA.

4.4.6 Culverts

Streams and interceptor ditches crossed by the scheme will be culverted. At chainage 0+225 the scheme crosses an existing waterbody. The existing waterbody has a very flat longitudinal gradient. It has been observed that during periods of dry weather that this waterbody does not have a flow. It is assumed that from the available information that this waterbody only collects local overland runoff during normal rainfall events.

OPW flood mapping does suggest, however, that the waterbody does accommodate flood waters which back up from the existing culvert under the railway which acts as a throttle. The mapping indicates flooding downstream of the proposed culvert at a level of 47.72mOD for a 1 in 100-year flow rate of 0.78 m^3/sec. The new culvert will be sized to accommodate this flow with 300mm additional freeboard clearance above the 100-year water level.

4.4.7 Flood Risk Assessment

A Flood Risks Assessment (FRA) been undertaken for the scheme (Appendix A8-2 in Volume 4). This review concluded that based on the available information, flooding of the site and surrounding area, and subsequent risk to receptors due to the Proposed Road Development, presents negligible flood risk.

4.5 Accommodation Works

Where identified as necessary, measures to facilitate landowners affected by the Proposed Road Development will be provided. These typically involve the properties adjacent to the Proposed Road Development who are impacted by either the mainline or the realignment of a side road.

In some cases, driveways will be required to be re-graded to suit altered levels of the existing road, or boundary walls/fencing will be set back and replaced where they are directly impacted by the Proposed Road Development.

House entrances will be constructed to replicate the existing access layout as far as is practicable, whilst ensuring that visibility is achieved from the revised access, the details of which will be agreed with the impacted land/property owner.

4.6 Earthworks and Pavement

4.6.1 Ground Investigations

A ground investigation (GI) for the Proposed Road Development site was scoped, specified and supervised by AECOM, and conducted by IGSL Ltd. (Appendix A8-1 in Volume 4). The Site Operations of the investigation were performed during the period 09 July to 30 July 2019.

The investigations were conducted in accordance with the Specification and related documents for GI in Ireland (Engineers Ireland, 2016). In addition, they complied with the requirements of Eurocode 7 (National Standards Authority of Ireland, 2005a, 2005b and 2007).

The exploratory holes of the investigations comprised:

5. Eight boreholes (BH01 to BH08) advanced, in 200 mm diameter, by Dando 2000 cable percussion boring rigs, to between 1.3 and 6.4 m below ground level. They terminated on encountering refusal to progress through very stiff/hard glacial clay, dense gravels or on an obstruction. Standard penetration tests (SPT) were carried out at 1 m intervals. Small and bulk disturbed samples were also taken within the soil strata.
6. Rotary drilled boreholes put down from ground level adjacent to three of the cable percussion boreholes. The rotary boreholes were numbered similarly to the cable percussion holes with prefix "RC". Drilling employed a Knebel truck-mounted rig using:
    a. Rotary coring of firm to very stiff clay, using a Geobor S geotechnical core barrel, producing nominal 102 mm diameter cores. It is considered a Category A sampling method, capable of producing Class 1 samples suitable for laboratory testing to determine compressibility and shear strength (National Standards Authority of Ireland, 2007).
    b. Rotary coring of very strong to strong Limestone to confirm bedrock and obtain samples for geotechnical testing

7. Ten trial pits (TP01 to TP10) excavated to between 1.6 and 4.5 m below ground level. Representative bulk disturbed samples were taken of the soil strata encountered. Where possible hand shear vanes were obtained within the trial pit walls. The trial pits were accompanied by Dynamic Cone Penetrometers (DCPs).

4.6.2 Earthworks Quantities

To achieve the required engineering design, the Proposed Road Development has a gross earthworks deficit with a total general fill requirement (excluding capping) of 35,000 m^3 consisting of an import volume of 30,800 m^3 required to be brought onto the site and a re-use volume of 4,200 m^3. The total fill requirement including capping material is approximately 34,300 m^3.

Excavation of soils (Alluvium) will be required as part of the bridge foundation construction for the river crossing. Additional excavation of soils (Made Ground) will be required in the areas surrounding the commercial building on the south side of the river. These excavations are likely to be limited in area and depth.

The distribution of the gross cut/fill volumes and balance of materials along the Proposed Road Development are outlined in Chapter 8 (Land and Soils).

4.6.3 Pavement Materials

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

The design traffic loadings have been calculated in accordance with TII standard PE-SMG-02002 Pavement Design and Maintenance Traffic Assessment. The future cumulative pavement traffic loading, in terms of million standard axles (msa) are as detailed in Table 4-3 below:

Table 4-3: Pavement Design Traffic

Section	Carriageway	AADT	Design Traffic (msa)
Mainline	LDR4	6000	6

It has been derived from the design traffic loadings provided in Table 4-3 that the pavement thickness will vary from between 260 mm to 230 mm depending on the stiffness of the binder content for the Proposed Road Development.

The sub-base layer, using granular material (crushed rock) is proposed to be 150 mm thick and is likely to be founded on a 250 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.

4.7 Boundary Treatments and Road Side Equipment

4.7.1 Boundary Treatment

The road boundary fencing will typically be timber post and tension mesh fencing where the development traverses' agricultural lands in accordance with TII CC/SCD/00320.

4.7.2 Safety Barrier

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

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.

4.7.3 Traffic Signs

Directional Signs and Regulatory Signs will be provided in accordance with the 'Traffic Sign Manual' as published by the DTTAS. The sign faces for the Local Distributor Road 4 will be designed for a design speed of 60 km/h and for an urban Arterial Street. The Proposed Road Development will be provided with Advanced Direction Signs (ADS) at the approaches to each junction in accordance with table 2.2.3 of the traffic signs manual. Text on signage will be in both Irish and English in accordance with the Traffic Signs Manual and destinations that can be reached either via the existing N51 through Navan town centre or via the LDR4 will be signed to direct traffic onto the LDR4 and away from Navan town centre.

Road Markings, Reflective Markings and Road Studs will be provided in accordance with the 'Traffic Signs Manual' and in accordance with TII Specification for Road Works - Series 1200 (CC-SPW-01200).

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).

White-on-brown tourist signage panels will be provided where appropriate. These will be of a standard form and with the name of the town or village and will contain a short descriptive phrase to highlight features likely to be of interest to tourists in accordance with the TII 'Policy on the Provision of Tourist and Leisure Signage on National Road' March 2010.

4.7.4 Public Lighting

The full extent of the Proposed Road Development and side roads will be illuminated, excluding the pedestrian links to the Blackwater Park (not currently lit). 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 and dimmable technologies.

Public lighting has been provided within the design in accordance with TII Standard DN-LHT-03038 - Design of Road Lighting for National Roads, BS5489-1:2013, and the Institution of Lighting Professionals (ILP) Professional Lighting Guide PLG02 – The Application of Conflict Areas on the Highway. The lighting design will comply with the requirements of MCC's Public Lighting Technical Specification & Requirements.

The extent of public lighting for the Proposed Road Development is shown in Figures 4.22 to 4.25 inclusive contained in Volume 3 of this EIAR. Four distinct lighting zones have been identified:

- Mainline Zone: This comprises of the mainline. It is proposed that the mainline zone will be lit to class ME4 or M4 in accordance with Table A.3 of BS5489-1. This is applicable for single carriageway traffic routes (v ≤ 40 mph ≈ 64.4 km/h) with low to moderate traffic flow.
- Conflict Zone: This comprises of the northern and southern signalised junctions, as well as the two pedestrian crossings along the mainline. These areas will be lit to a higher level of luminosity to provide increased visibility to reduce the risk of accidents. It is proposed that the conflict zones will be lit to class CE3 or C3 in accordance with Table A.4 of BS5489-1:2013. This is applicable at conflict areas of roads lit to class ME4 or M4.
- Pedestrian Zone: This comprises of the two pedestrian access tracks linking the mainline with the Blackwater Park recreational area. The pedestrian links incorporated as part of the works that are remote from an adjacent road shall be lit to class S5 or P5 in accordance with Table A.6 of BS5489-1. This is applicable for normal anticipated usage.
- Natural Zone: This comprises of the area around the bridge over the River Blackwater. The River Blackwater is a Special Protection Area (SPA) and the banks of the river are a Special Area of Conservation (SAC). The River Blackwater and its banks provide a habitat for a variety of wildlife, including animals sensitive to light such as bats. Light can increase luminance levels in natural areas which could affect ecological functions. Therefore, in this zone the light distribution should be controlled to minimize light spill onto adjoining areas by selection of an appropriate installed intensity class from BS EN 13201-2:2003.

In addition to the lighting class being provided, the lighting design shall include the following:

- Lighting columns shall be set-back a minimum of 1 m from the back of cycleways to provide clearance for handle bars to the column;

- 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 minimum colour temperature of 4000 Kelvin 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;
- All cabling associated with lighting will be located underground.

4.8 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 locations of significant existing utility services are shown in Figures 4.26 to 4.29 inclusive contained in Volume 3 of this EIAR. The utilities and services identified include:

- Electricity;
- Gas;
- Water services;
- Foul & storm water services; 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 14 (Material Assets).

4.9 Major Accidents and Disasters

The Proposed Road Development has been assessed to determine the risks to the Proposed Road Development from either a major accident or in the event of a natural disaster. Details on the assessment carried out can be found in Chapter 15 (Major Accidents and Disasters).

4.10 Land Acquisition

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

- Road construction;
- Pedestrian & cycle facilities;
- Construction of verges, embankments, cuttings and noise attenuation bunds;
- Construction of structures;
- Working space requirements;
- Drainage and associated outfall attenuation;
- Landscaping and boundary treatments;
- Accommodation Works;
- Acquisition of severed plots;

- Ground/Soil conditions, including borrow area and deposition area; 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 landtake including both permanent and temporary acquisition comprises approximately 8.63 ha of land.

The permanent acquisition for the scheme totalling 6.46 ha is categorised below (areas are approximate):

- 1.55 ha classified as Part of Public Road;
- 1.76 ha classified as Part of Recreational Land;
- 0.19 ha classified as Part of Amenity Land;
- 0.64 ha classified as Part of Commercial Property;
- 2.18 ha classified as Part of Agricultural Land;
- 0.02 ha classified as Part of Private Access; and
- 0.12 ha classified as Part of River.

In addition to the permanent acquisition, 2.17 ha of land is being temporarily acquired. Of this:

- 0.56 ha is being acquired for the duration of the works from lands adjacent to L3409 Ratholdron Road to facilitate the installation of the construction compound;
- 0.44 ha is being acquired for the duration of the works from lands adjacent to the River Blackwater to facilitate construction access to the proposed bridge;
- 0.75 ha is being acquired as a short duration acquisition to facilitate the construction of the earth bund and pedestrian connection between the proposed road and the existing park;
- 0.21 ha is being acquired as a short duration acquisition to facilitate the relocation of the existing high voltage mast and other utilities.
- 0.21 ha is being acquired as a short duration acquisition to facilitate the construction of access tracks and tie-in with existing private accesses.

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

4.11 Construction

4.11.1 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 clearly dependent on both planning and funding approvals, the following descriptions are prepared on the presumption that these approvals would be in place, in order to inform the EIA.

The River Blackwater bridge has a single span of 45.0m, with bridge abutments located outside the river channel to minimise instream works for the construction of the bridge over the River Blackwater SAC and will be 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.

Due to the semi-urban nature of the scheme, there are a number of services impacted by the scheme. Among these, the most relevant is one high voltage (110 kV) overhead power line, which will require diversion. These services will require particular attention with regard to implementation of the diversion measures prior to construction activities commencing at these locations and will be delivered either through advance works contract or as a priority in the construction programme for the Proposed Road Development.

It is also noted that a Construction Environmental Management Plan (CEMP) will be developed prior to any construction phase to ensure all the seasonal constraints and sensitive requirements are considered.

4.11.2 Duration of Works

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

4.11.3 Construction Works

4.11.3.1 Pre-Construction Works

Pre-construction works may include certain diversion works of services and utilities, particularly the high voltage electricity overhead cables crossing the mainline between Ch. 0+400 and 0+500, but may also include other electricity, gas mains, telecommunications, water mains and other sanitary services. 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, archaeological testing and resolution, GI and fencing contracts may be undertaken as these activities are dependent on the anticipated seasonal timing of the award of the main contract.

4.11.3.2 Preliminary Construction Works

The establishment of the construction compounds and connection of services for their operation will likely be undertaken at the start of the works. This will 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’s 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.

4.11.3.3 Main Construction Works

The main construction works consist predominantly of the construction of the River Blackwater bridge, in conjunction with earthworks and road pavement construction.

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. The construction of the structures will involve the delivery of beams, reinforcement, concrete and granular fill 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 construction of noise barriers, 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.

4.11.3.4 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 will be constructed in accordance with the IFI guidelines, Construction Erosion and Sediment Control Plan (CESCP) and to the EIAR requirements in relation to works on or near watercourses. Details of the proposed drainage identified outfalls and treatment is provided in Chapter 9 (Water) of this report.

4.11.3.5 River Blackwater Bridge

There is one river crossing proposed as part of this road development, involving a single span (45.0 m) crossing of the River Blackwater. The abutment will be located within the 1 in 100 years flood event extents. Detailed hydraulic modelling carried out as part of the preliminary design has demonstrated that abutment locations will not adversely impact the flood regime.

The proposed bridge would be founded on bored piles, with two insitu reinforced concrete abutment walls and cantilever wingwalls completing the substructure arrangement. The superstructure will be formed of large, 2.3 m deep, W19 precast beams spanning 45.0 m with a 250 mm thick reinforced insitu concrete deck. An insitu or precast parapet edge beam will also be provided.

In order to construct the bridge a temporary cut off wall coupled with dewatering measures will be required to create a safe and dry works area for the duration of construction. The proposed wall will be 5 m deep, 1 m wide and approximately 33 m long constructed of in situ concrete using an excavator, bog matts and a trench box. The cut off wall may also be constructed using precast concrete elements avoiding concrete works within the flood plain. Using precast would also provide an option to recover the cut off wall from the flood plain following construction.

The 45.0 m span beams are expected to weigh in the region of 140 tn and will be transported through Navan Town. A route analysis will be carried out to ensure the beam can be delivered to site without the need for advance works. It is noted that the beams will likely be delivered at night to minimise disruption to the road traffic as this may requires temporary road diversion and/or closures. It is also noted that the required permit for transport and delivery will be agreed in advance with MCC and any other relevant road authority. It is proposed that the beams will be installed using a 400 tn crawler crane with the lift occurring from the area to the north of the bridge. The crane will be supported on a temporary crane lifting platform, formed of compacted 6N/6P fill material. The thickness of the fill will be determined based on the ground conditions and allowable bearing pressures. Bog mats will be used to ensure equal distribution of crane loading to this fill material.

Control measures such as silt fencing will be utilised throughout the construction phase to reduce the risk to the River Blackwater and the SAC. Regular monitoring and recording of the effectiveness of the control measures will be utilised with additional control measures employed if and when required. The contract documents will include details on the proposed control measures and will require the contractor to submit detailed method statements to demonstrate how they will comply with the requirements contained in the CESCP, EIAR and NIS.

The assumed construction sequence for the bridge is as follows:

- Construct temporary cut off wall.
- Install piling platform and any required ground improvements within the footprint of the temporary cut off wall.
- Excavate bridge support zone to required formation level .
- Install piles to abutment foundations.
- Cast insitu abutment foundations, abutment wall and wingwalls.
- Construct approach embankments.
- Backfill to abutments (required for stability during installation of beams).
- Erect all precast beams.
- Cast deck slab.
- Cast abutment diaphragm beams.
- Cast insitu/erect precast parapet edge beam.
- Apply waterproofing to deck slab.
- Complete backfill to abutments.
- Construct verges with required service ducts and drainage.
- Erect parapet system.
- Road Surfacing.

4.11.3.6 Side Roads

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

4.11.3.7 Landscaping

Landscaping will include the construction of bunds, berms, noise barriers and the placing of topsoil and other materials to complete the landscape shaping of the site. Grassing and appropriate specified planting of side slopes and other specific landscaped areas will also be undertaken in accordance with landscape design strategy as detailed in Chapter 12 (Landscape and Visual) of this EIAR.

4.11.4 Construction Materials

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

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

4.11.4.1 Earthworks Materials

The details of the existing ground conditions and proposals for earthworks design based on data obtained from the preliminary site investigations are outlined in Chapter 8 (Land and Soils) of this report. The quantities are based on the site investigations and are indicative only, as actual conditions may differ. A summary of the earthwork's quantities is given in Table 8-4 in Chapter 8 (Land and Soils). 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 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.

4.11.4.2 Sourcing of Materials and Waste

From the earthwork's quantities given in Table 8-4 in Chapter 8 (Land and Soils), it is anticipated that a significant volume of acceptable material, sub-base material and structural backfill material (Class 6N, 6i & 6j) will be imported from local quarries to the site. Further information can be found in Chapter 8 (Land and Soils).

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.

Chapter 8 (Land and Soils) details the measures incorporated in the design to deal with the unsuitable material arising as part of the works. 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.

4.11.4.3 Pavement Material

It has been calculated that the volume of pavement materials, excluding capping material, to be hauled to the site will be approximately 4,000 m^3 of bituminous material and 2,000 m^3 of crushed rock sub-base material.

Quarries that could be considered as potential sources for the pavement materials, particularly for the bituminous materials, are detailed in Chapter 8 (Land and Soils).

4.11.4.4 Concrete Material

The Proposed Road Development includes the construction of one river bridge, a culvert and footpaths. These structures contain both pre-cast concrete units and in-situ concrete. Precast concrete elements will be sourced from specialist producers. Potential sources for In-situ concrete will be from producers identified in Chapter 8 (Land and Soils).

4.11.5 Temporary Traffic Management

In general, the 1.15km of the mainline traverses the greenfield site (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 side road realignments and the at-grade junctions.

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.

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 scheme (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).

The actual 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 be also responsible for acquiring the necessary licensing and permissions for the use of these roads with regard to temporary closures and traffic management.

4.11.6 Construction Traffic

4.11.6.1 Site Access Routes

The haulage of materials to and from the site could create nuisance to both road users and to residents living along haul roads. To minimise this it is important that only authorised site access points, as directed by the Local Authority, are used by construction vehicles. Site access points are presented in Figure 4.30 contained in Volume 3 of this EIAR.

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

- N51;
- R147 Kells Road;
- L34094-1 Clonmagadden Road; and
- L3409 Ratholdron Road;

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

4.11.6.2 Construction Traffic Routing

To construct the earthworks, materials will need to be hauled between different sections of the development as described in Chapter 8 (Land and Soils).

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 routes.

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 may be required for each of the national, regional and local roads crossed by the scheme. The crossings will require local traffic management, in accordance with the issued Traffic Management Plan (TMP), the Traffic Signs Manual and the Safety, Health & Welfare at Work (Construction) Regulations.

4.11.7 Construction Compound

A construction compound will be required along, or in the vicinity of the Proposed Road Development.

It was proposed that the primary construction compound would be located on the land located to the south-west of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. An alternative and secondary compound is proposed to the north of the existing N51/R147 roundabout on the land currently occupied by the commercial building to be demolished.

The potential main compound will be 4000 m^2 in size and will include stores, offices, material storage areas, plant storage and parking for site and staff vehicles. This site is proposed to remain in place for the duration of the contract, but may be scaled up or down during particular activities on site.

The layout of the construction compounds will however have to incorporate the protection and control measures outlined in the EIAR, and conform to the requirements outlined in the CESCP (see Section 4.11.8.3 below), NIS and planning conditions.

Following completion of construction these areas will 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.

4.11.8 Construction Environmental Management Plan

An Outline Construction Environmental Management Plan (CEMP) has been developed for the Proposed Road Development. The Outline CEMP (Appendix A4-1 in Volume 4 of this EIAR) sets out the procedures, standards, work practices and management responsibilities to address potential environmental effects that may arise from the construction of the Proposed Road Development.

Prior to any demolition, excavation or construction, this Outline CEMP will be further refined and expanded by the appointed Contractor into a full Contractor CEMP as more certainty and more information becomes available in terms of the proposed layout, construction methods, programme and potential environmental impacts to be mitigated against.

The CEMP details the contractor’s overall management and administration of the works and incorporates and further develops the CESCP, Construction and Demolition (C&D) WMP and the draft Incident Response Plan (IRP). The CEMP will also include any commitments included within the statutory approvals.

The CEMP, CESCP, WMP and IRP will be developed at detail design stage to a sufficient level of detail to ensure that the control measures contained within these plans will assist in avoiding the potential effects on the receiving environment during construction. These control measures will be incorporated into any future construction contract as the minimum standard required to be implemented by the contractor, thereby minimising the risk of potential pollution incidents impacting on surrounding sensitive habitats.

The contractor will be required to include details under the following headings:

- Details of working hours and days;
- Details of emergency plan - in the event of fire, chemical spillage, cement spillage, collapse of structures or failure of equipment or road traffic incident within an area of traffic management. The plan must include contact names and telephone numbers for: Local Authority (all sections/departments); Ambulance; Gardaí and Fire Services;
- Details of chemical/fuel storage areas (including location and bunding to contain runoff of spillages and leakages);
- Details of construction plant storage, temporary offices and on-site chemical toilet areas;
- TMP (to be developed in conjunction with the Local Authority Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; other traffic management requirements;
- Truck wheel wash details (including measures to reduce and treat runoff);
- Dust management to prevent nuisance (demolition & construction);
- Site run-off management;
- Noise and vibration management to prevent nuisance (demolition & construction);

- Landscape management;
- Management of demolition of all structures and assessment of risks for same;
- Lighting details (construction & operation);
- Signage;
- Stockpiles;
- Project procedures & method statements for:
  - Demolition & removal of buildings, services, pipelines (including risk assessment and disposal);
  - Diversion of services;
  - Construction of pipelines;
  - Temporary hoarding & lighting;
  - Borrow Pits;
  - Storage and Treatment soft soils;
  - Protection of watercourses from contamination and silting during construction;
- Construction Compounds.

The production of the CEMP will also detail areas of concern with regard to Health and Safety and any environmental issues that require attention during the construction phase. Adoption of good management practices on site during the construction and operation phases will also contribute to reducing environmental impacts.

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;
- 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 EIAR and the CEMP are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.

4.11.8.1 TII Environmental Construction Guidelines

The TII Environmental Construction Guidelines provide guidance with regard to environmental best practice methods to be employed in construction of road projects for the following:

- Guidelines for the Treatment of Badgers prior to the Construction of a National Road Schemes;
- Guidelines for the Treatment of Bats during the Construction of National Road Schemes;
- Guidelines for the Crossing of Watercourses during the Construction of National Road Schemes;
- Guidelines for the Testing and Mitigation of the Wetland Archaeological Heritage for National Road Schemes;
- Guidelines for the Protection and Preservation of Trees, Hedgerows and Scrub Prior to, During and Post-Construction of National Road Schemes;
- Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes;
- Guidelines on the Management of Noxious Weeds on National Roads;
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes;

- Guidelines for the Treatment of Otters Prior to the Construction of National Road Schemes;
- Guidelines for the Management of Waste from National Road Construction Projects;
- Guidelines for the Creation, Implementation and Maintenance of an Environmental Operating Plan.

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

4.11.8.2 Construction and Demolition Waste Management Plan

Included within the CEMP will be the 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 control 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.

4.11.8.3 Construction Erosion and Sediment Control Plan

An outline 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 effects on the receiving environment during the construction of the proposed road scheme. These control measure will be implemented in full and will ensure that sediment laden runoff from the construction site does not enter watercourses or water bodies.

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 ABP. 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 of the measures, mitigations, controls, requirements, procedures, etc. included in the plan.

4.12 References

- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, Meath, Ireland.
- DTTAS and DHPLG. (2019). *Design Manual for Urban Roads and Streets (DMURS)*, Department for Transport, Tourism and Sport and the Department of Housing, Planning and Local Government.
- NTA. (2011). *National Cycle Manual*, National Transport Authority, Dublin, Ireland.
- NTA. (2013). *Greater Dublin Area Cycle Network Plan (December 2013*). National Transport Authority. Available online at https://www.nationaltransport.ie/publications/transport-planning/gda-cycle-network-plan/ [Accessed August 2018].
- TII. *TII Publications*, Transport Infrastructure Ireland, Dublin, Ireland.

Chapter 05: Traffic Analysis

05

5. Traffic Analysis

5.1 Introduction

This chapter of the EIAR assesses the potential traffic impacts of the Proposed Road Development. It outlines the development of the traffic models used to analyse the LDR4 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. 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 4 (Description of the Proposed Road Development) and the assessments presented in Chapters 10 (Air Quality), Chapter 11 (Noise and Vibration) and Chapter 16 (Climate). An overall commentary on the predicted changes in traffic conditions is provided as a setting for all the other assessments undertaken in this EIAR.

5.2 Model Development Process

5.2.1 Modelling Tool

A Navan Traffic Model, also referred as Local Area Model (LAM), was developed using the transport modelling tool SATURN (11.4.06D) for the modelled study area illustrated in Figure 5-1. The modelled area encompasses the town of Navan, the main radial routes into/out of Navan, and a section of the M3 motorway between Junction 7 and Junction 9. This area, the modelled extents, also comprises the detailed model area, which consists entirely of simulation links (there is no ‘buffer’ network beyond the model’s Navan area). The network within Navan is highly detailed, with all major junctions and the majority of minor junctions included in the model.

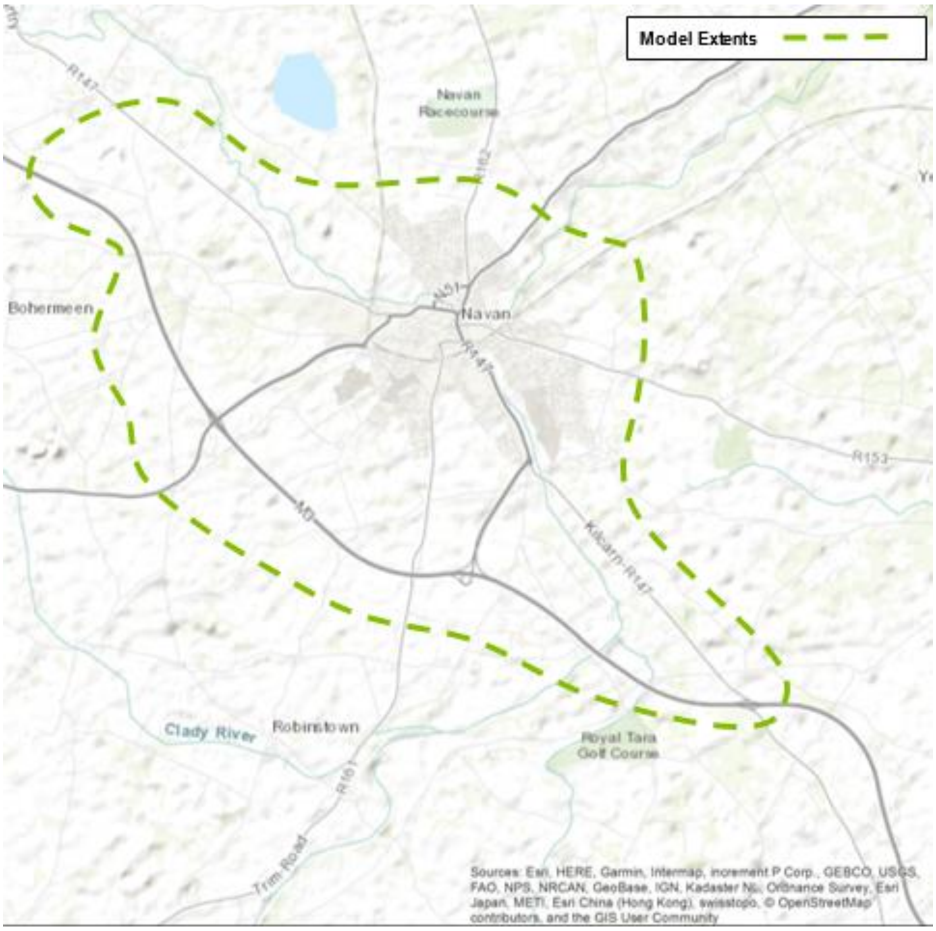


Figure 5-1 Modelled Area

A series of tests were initially undertaken using an existing Navan Traffic Model to assess and compare the performance of options for the Local Distributor Roads (LDRs) on the fringe of the town. The LDRs form part of the existing NDP and are intended to facilitate growth and achieve objectives of improving the town centre, as highlighted in the extract of the NDP reported below.

> *"[…] new road schemes will be required in order to support the sustainable development of the town. The construction of new and improved roads will also facilitate the reallocation of road space on the existing radial road network to pedestrians, cyclists and /or public transport users.*
>
> *[…]… The north Navan area which is presently served only by the N51 for southbound traffic requires additional capacity which is most likely to require a new bridge crossing of the River Blackwater to alleviate existing and projected development (LDR 4). The analysis also indicates that the extent of development earmarked for the eastern area of Navan will continue to exacerbate pressure on the junctions of the Kentstown Road with the R147, the Boyne Road and Convent Lane junctions with the Kentstown Road as well as on the Sion Road / R147 junction."*

Navan Development Plan 2009-2015 (Incorporating Variations No.1, No.2 and No. 3 – Page 180-181)

The outcomes of the option testing of LDR1, LDR2, and LDR4 highlighted the need for an updated Navan Traffic Model. To facilitate this update, new traffic data was collected in November 2017.

5.2.2 Traffic Data Collection

In order to develop the LAM, a significant volume of traffic data was collected, to ensure that the model could appropriately replicate existing traffic patterns and volumes of Navan. A series of detailed traffic surveys were therefore undertaken to inform the development of the Base Year (2017) LAM. The surveys undertaken included:

- Junction Turning Counts (JTC);
- Automatic Traffic Counts (ATC);
- Origin-Destination (O-D) Surveys;
- Queue Length (QL); and
- Journey Time Surveys (JTS).

As applicable in each of the surveys, a conversion exercise was undertaken on the survey data. This common modelling approach converts the vehicle data into a Passenger Car Unit (PCU) value, taking into account the differing road space requirements of each mode. The PCU value of each classification is shown in Table 5-1.

Table 5-1 Vehicle Classifications and PCU Values

Vehicle Classification	PCU Value
Car	1.0
Light Goods Vehicle (LGV)	1.0
Other Goods Vehicle – 2-axle or 3-axle rigid (OGV1)	2.0
Other Goods Vehicle – 3-axle articulated, 4-axle rigid, 4-axle articulated, 5-axle articulated or 6-axle articulated (OGV2)	2.3
Bus	2.0
Motorcycle	0.4
Pedal cycle	0.2

The following sections describe the collation of traffic data for the construction of the Base Year (2017) LAM.

5.2.2.1 Junction Turning Counts

Classified JTC give an indication of the turning movements observed at key junctions in the network. These were commissioned in the 12 locations shown in Figure 5-2, and recorded in 15-minute intervals between 07:00 and 19:00 on Wednesday 6th December 2017.

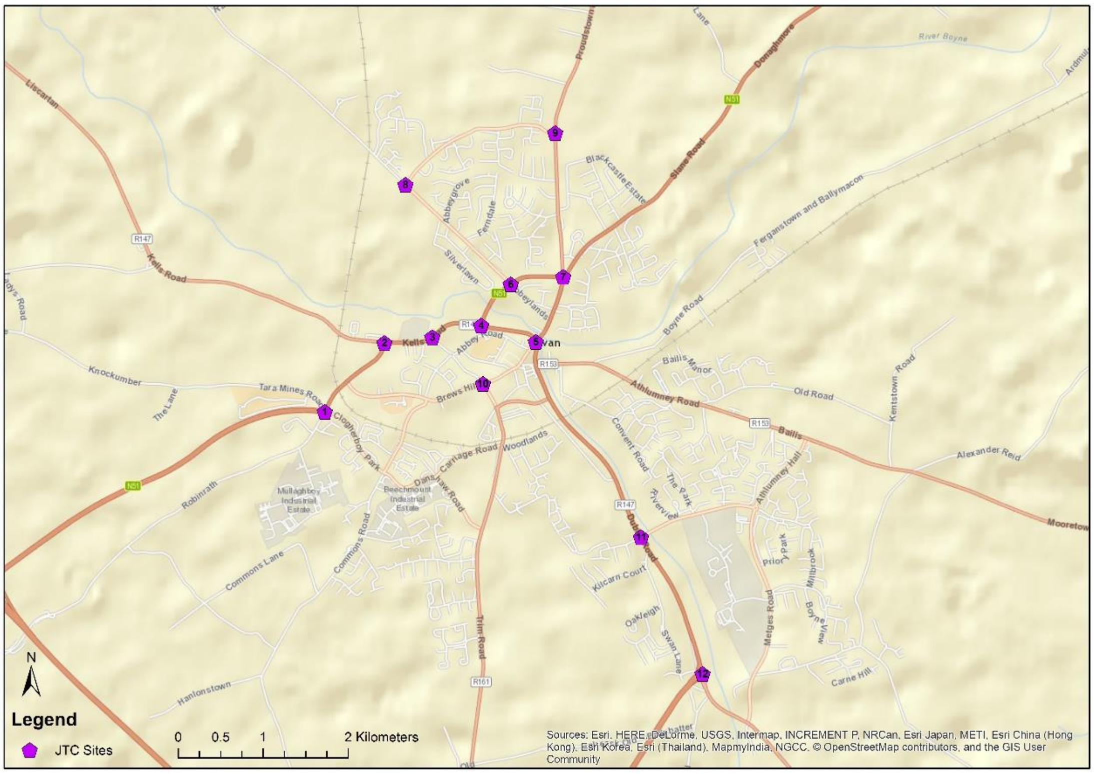


Figure 5-2 Junction Turning Count Location Map

5.2.2.2 Automatic Traffic Counts

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. ATC data was collected at the 21 sites shown in Figure 5-3. Each site was active for two weeks, with the majority of sites actively collecting data between Friday 24th November 2017 and Thursday 7th December 2017.

Three of the 21 sites experienced issues as follows:

- At Site 7, only a week's worth of data was collected between Monday 11th December 2017 and Tuesday 19th December 2017;
- At Site 14, only 9 days' worth of data was collected between Tuesday 5th December 2017 and Thursday 14th December 2017; and
- At Site 18, the northbound direction collected data between Friday 24th November 2017 and Thursday 7th December 2017, but the southbound direction only collected 9 days' worth of data was collected between Wednesday 29th November 2017 and Thursday 7th December 2017.

Despite some data loss at these sites (data collection shortened), the majority of ATC collection provides for a detailed representation of traffic movements across Navan.

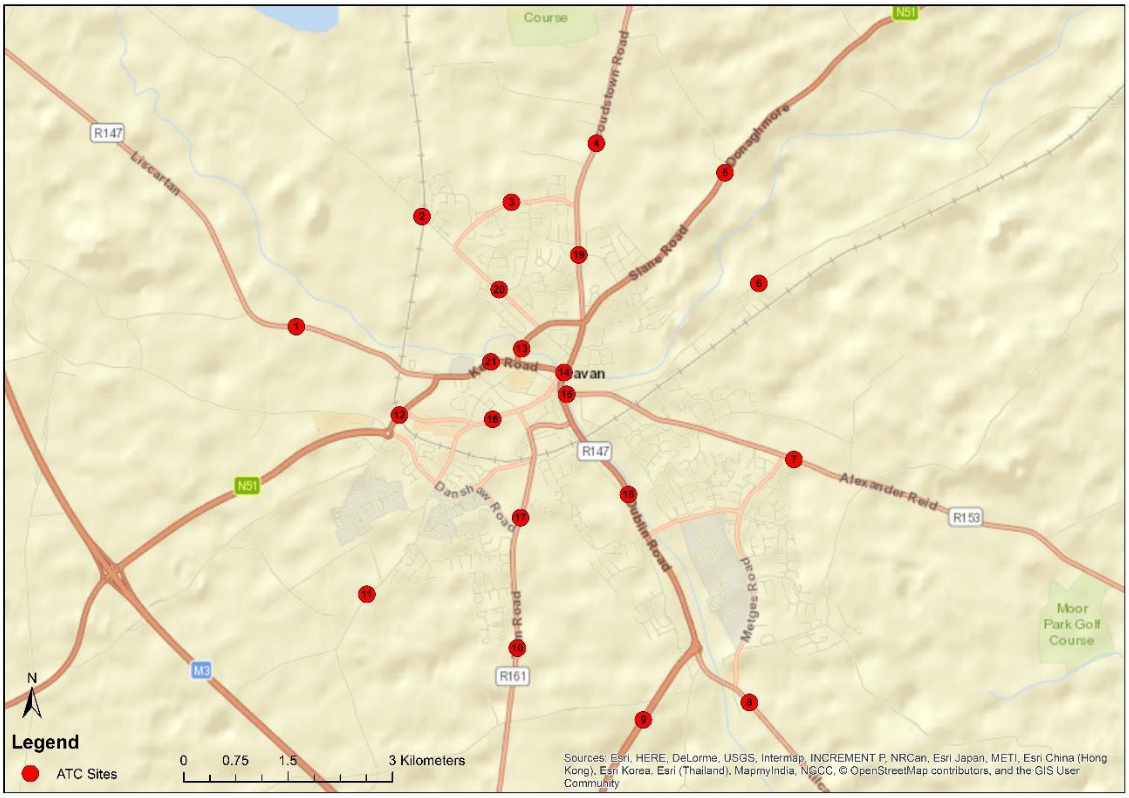


Figure 5-3 Automatic Traffic Counts Locations Map

The ATC survey data indicated a variation in the peak hour between the sites (with an early afternoon 'school home time' peak occurring at several locations). To determine the peak hours for Navan as a whole, it was necessary to combine all the data from ATC sites. The flow for each hour was averaged across all the sites and plotted on a graph, shown in Figure 5-4. This reveals that the peak hours are 08:00-09:00 and 17:00-18:00. Whilst the AM peak shows a distinct peak in traffic around 08:00-09:00, the PM peak shows a steady increase from 12:00. Between 15:00-16:00, traffic levels are of a similar level to the AM peak, and then show a particular peak between 16:00-18:00.

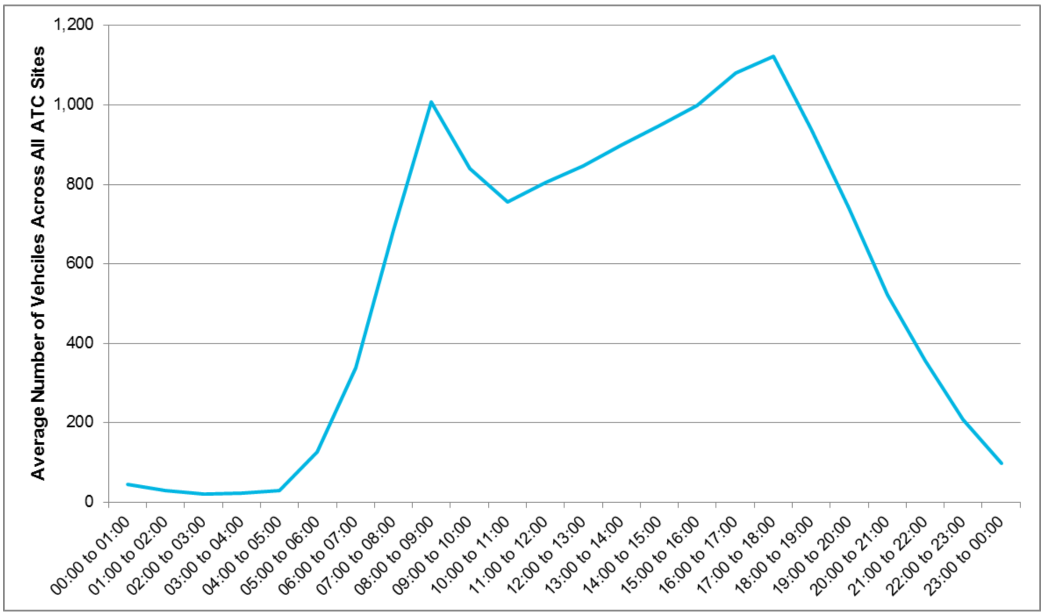


Figure 5-4 Average Weekday Traffic Flow from ATC Sites (Five-Day Average)

5.2.2.3 Origin – Destination (O-D) Surveys

Origin – Destination (O-D) surveys were undertaken at 15 sites using Automatic Number Plate Recognition (ANPR). The surveys were undertaken on Tuesday 5th December 2017 between 07:00 and 19:00. The 15 sites correspond to the locations of the first 15 ATC sites and are shown in Figure 5-5.

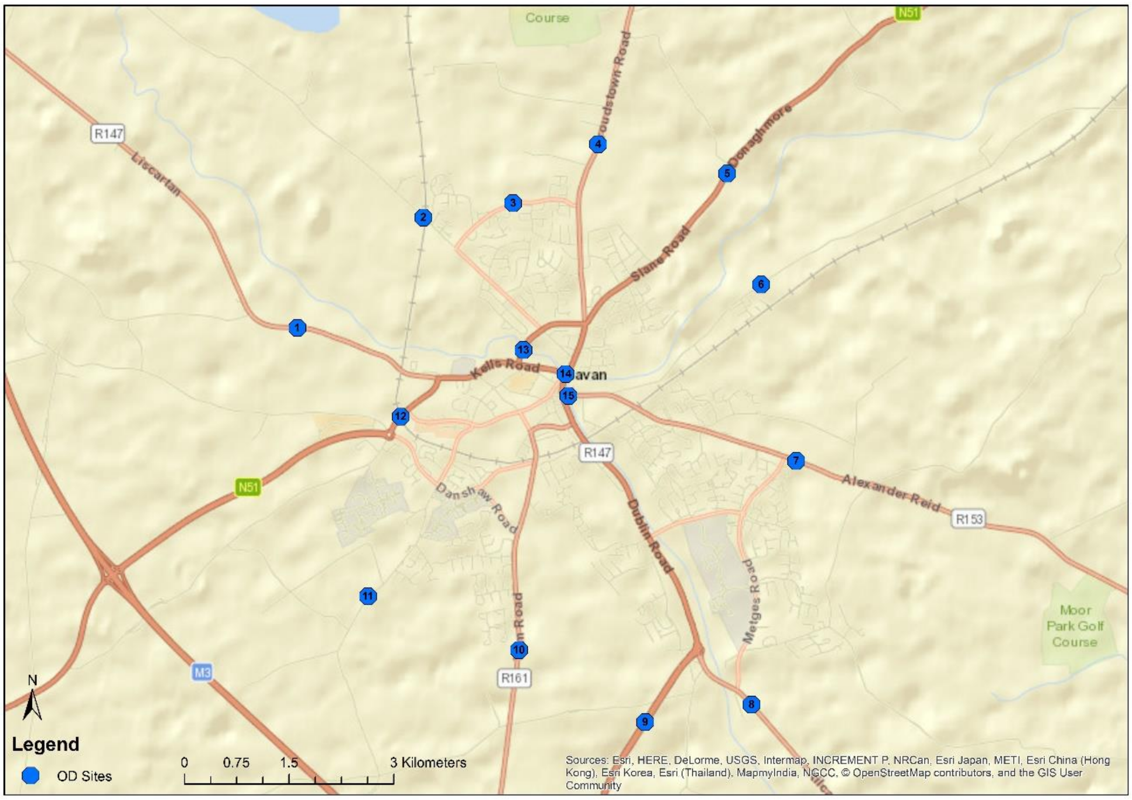


Figure 5-5 O-D Survey Sites Location Map

The survey only captures movements that have passed through the cordon, and does not include trips that have an origin or destination within the cordon unless they have crossed the river and were captured at Site 13, 14, or 15.

The major movement was between Site 1 and Site 12, which represents R147 Kells Road to N51. Other large movements included:

- Site 1 to Site 7 (R147 Kells Road to R153 Athlumney Road)
- Site 5 to Site 12 (N51 Slane Road to N51)
- Site 12 to Site 1 (N51 to R147 Kells Road).

In addition to these movements, there was a large movement with both an origin and designation at Site 12. This indicates that there were vehicles entering the cordon from the M3, stopping in Navan for a short time, then exiting again.

During the PM peak, the major movement was between Site 12 and Site 1, (N51 to R147 Kells Road) which represents the reverse to the AM peak. Other large movements included:

- Site 1 to Site 12 (R147 Kells Road to N51)
- Site 12 to Site 13 (N51 to N51 River Blackwater Bridge)
- Site 12 to Site 4 (N51 to R162 Proudstown Road)
- Site 5 to Site 12 (N51 Donaghmore Road to N51)
- Site 12 to Site 7 (N51 to R153 Athlumney Road).

This indicates some of the main movements were through trips from southwest to northwest and vice versa. A notable exception was the movement from Site 12 to Site 13, which indicates a movement from the south-west (the M3 motorway) to the residential area to the north of Navan.

5.2.2.4 Queue Length Surveys (QL)

In addition to classified counts, queue length surveys were undertaken at each of the 12 junctions. Queue counts were undertaken every 15 minutes during the survey period, as a way of gaining a complete understanding of

Navan traffic in 2017. These are not used at the strategic level (to update the LAM) but may be applied to later scheme investigations at a local link or junction level.

5.2.2.5 Journey Time Surveys

Journey time data was collected using anonymised phone location data on the following days:

- Wednesday 2nd May 2018 (PM);
- Thursday 3rd May 2018 (AM);
- Tuesday 15th May 2018 (PM);
- Wednesday 16th May 2018 (AM and PM); and
- Thursday 17th May 2018 (AM).

A total of six bi-directional routes were established as shown in Table 5-2 and Figure 5-6.

Table 5-2 Journey Time Routes

Route Colour	Journey Route	Length
	N51	6.7 km
	R147	10.7 km
	Navan South to R162	6.1 km northbound / 6.8 km southbound
	R161	5.5 km anti-clockwise / 6.3 km clockwise
	Commons Road	2.7 km
	M3 Junction 7 to Junction 9	10.0 km

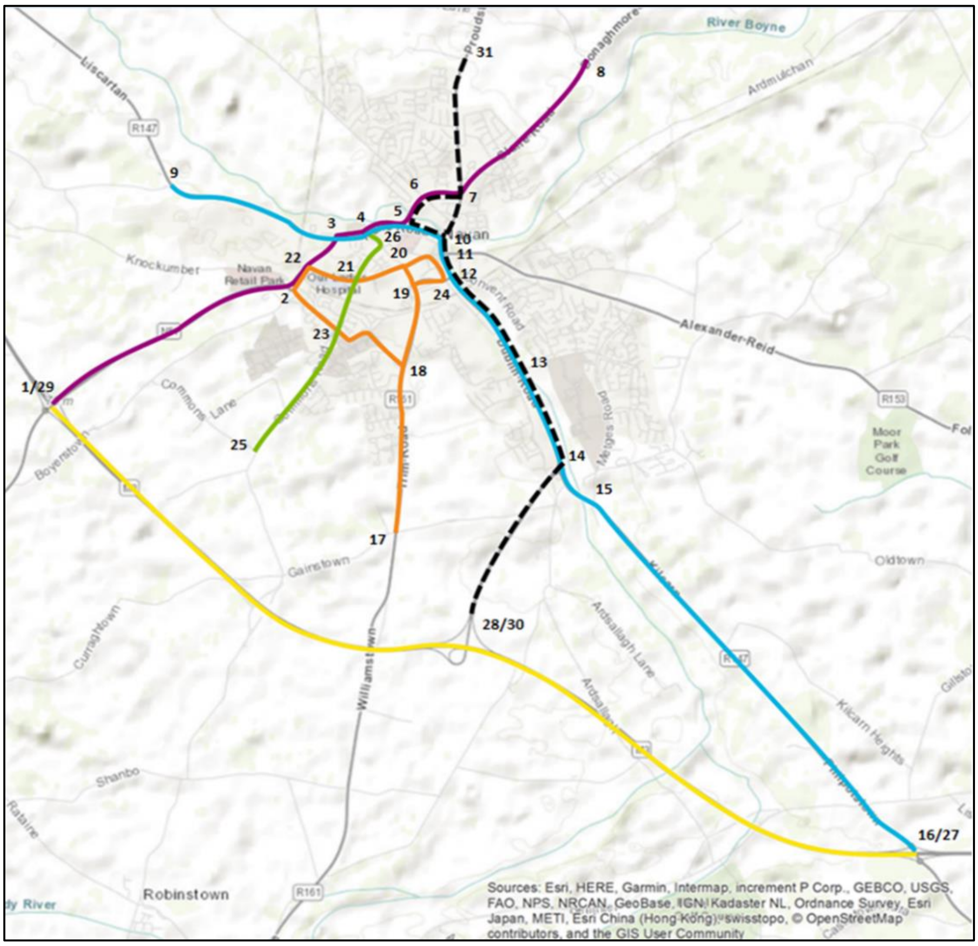


Figure 5-6 Navan Journey Time Routes

The journey times have been collected for the purpose of model validation and post-project assessment. Furthermore, collection of current journey times enables long-term changes to be monitored for the town.

5.2.3 Network Development

The model provides significant detail that each junction's performance can be assessed. The junction modelling includes priority ('give-way') T-junctions, crossroads, roundabouts and signalised junctions. In line with best practice, smaller roundabouts have been modelled as a single node, whereas larger roundabouts have been 'exploded', with each point of conflict modelled as a separate node.

Since the previous model was developed in 2012, a number of priority junctions have been upgraded to signalised. Figure 5-7 indicates the locations of all signalised junctions in Navan.

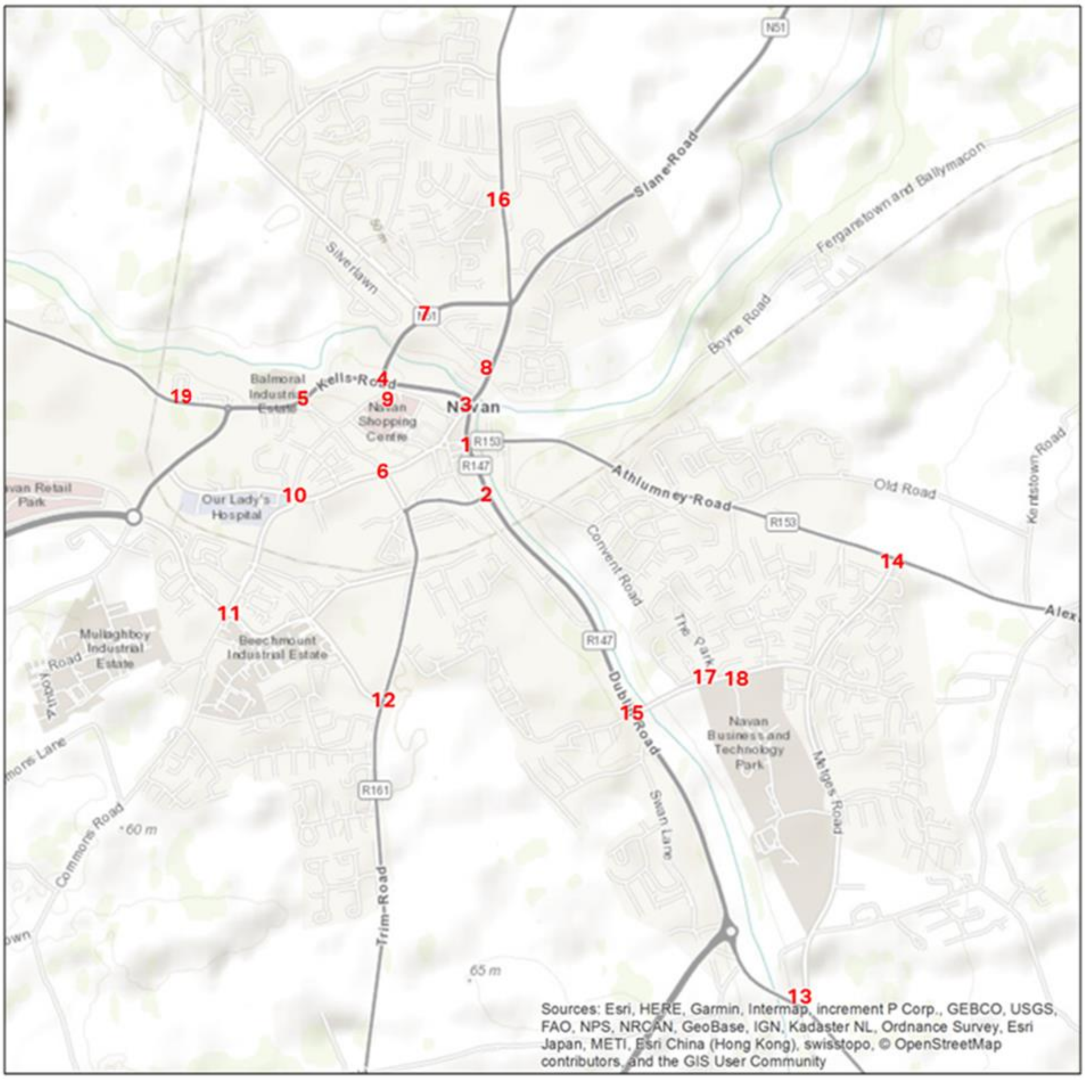


Figure 5-7 Signalised Junctions in Navan

5.2.4 Matrix Development

This section describes the development of the traffic matrices for the light and heavy vehicles user classes separately.

5.2.4.1 Establishing Screenlines and Sectors

From the data collection, a series of five cordons were formed within and around Navan – these cordons also correspond to the extents of the O-D survey. The five screenline cordons are set out in Table 5-3.

Table 5-3 Screenline Cordons

Cordon Name	ATC Sites Included
Northern External	2, 4, 5
Eastern External	6, 7
Southern External	8, 9, 10, 11
Western External	1, 12
Internal	13, 14

The screenline cordons have been developed to monitor and control the volume of traffic entering and leaving Navan in the traffic model, and to capture internal movements across the River Blackwater, which divides the northern and southern areas of Navan. Traffic movements between each of the areas were fully observed from the O-D survey undertaken as part of the data collection exercise. The screenlines cordons and sectors are shown diagrammatically in Figure 5-8.

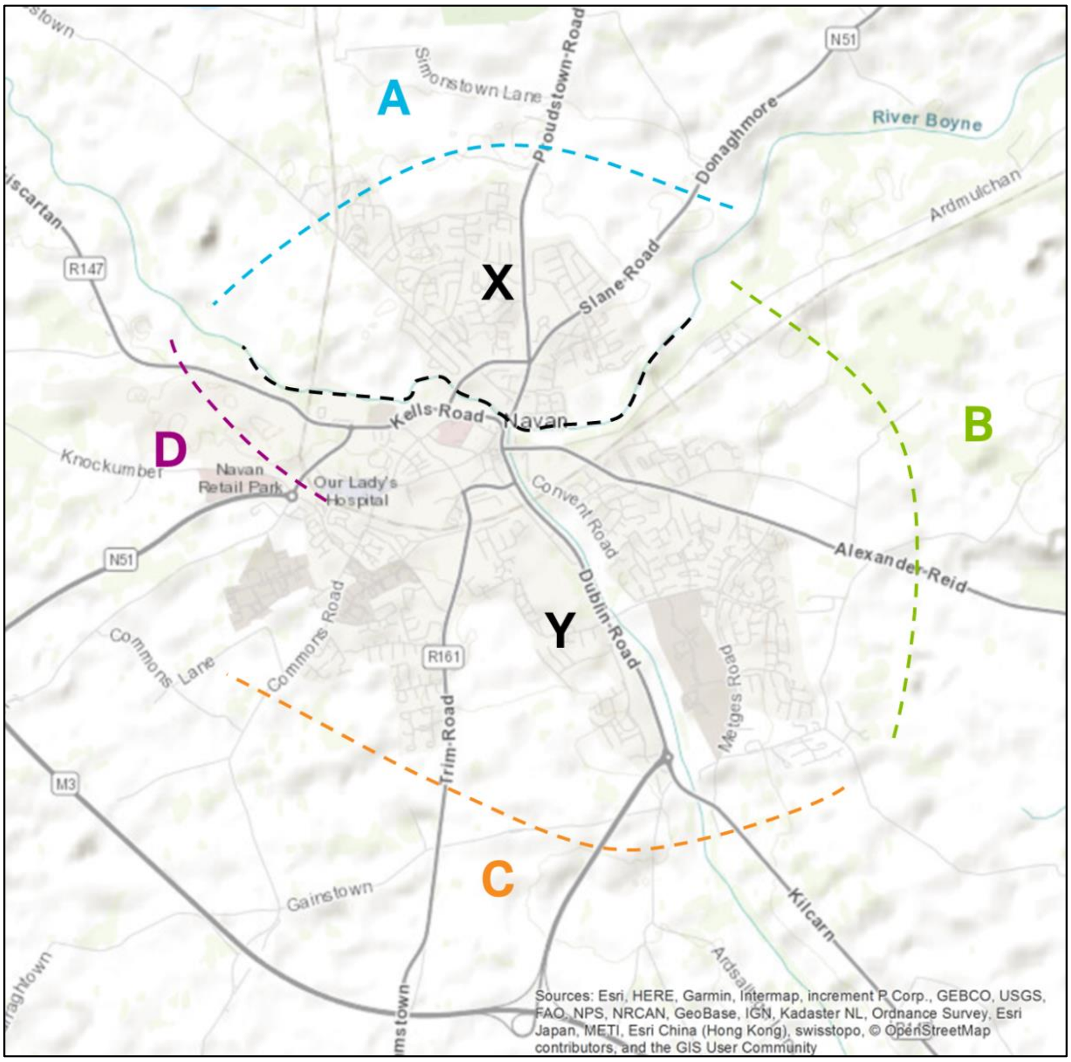


Figure 5-8 Screenline Cordons and Sectors

5.2.4.2 Observed Trip Matrices from Origin-Destination Data

The O-D survey resulted in a series of 15 by 15 trip matrices showing movements between each of the survey sites. The 15 by 15 trip matrices were then summed to represent sector-to-sector movements between each of the sectors shown in Figure 5-8.

A series of data-correcting exercises were undertaken for the O-D to prepare the routing information for the new LAM. Data correction is undertaken to ensure that trips entering and leaving particular sectors are accounted for, and that traffic in each sector is representative and comparable with all other sectors across Navan.

The observed O-D matrices do not include intra-sector trips, but these trips can be synthesised from Census data. The following section details the use of the census data.

5.2.4.3 Synthetic Matrices from Census Data

As part of the 2016 Irish census, the Central Statistics Office (CSO) produced the Place of Work, School or College Census of Anonymised Records (POWSCAR) database. The POWSCAR dataset provides detailed trip data on the journey to work and education at Small Area level, which corresponds to the model zone structure. This data includes:

- The origin (residence) and destination (place of work/education) of each individual trip;
- The time of departure; and
- The mode of travel.

The POWSCAR data was processed in a similar manner as undertaken for TII National Transport Model Update.

5.2.5 Final Synthetic Matrices

Following computation of 2016 census (POWSCAR) data, journey to work and education synthetic trip matrices were produced. The final totals are shown in Table 5-4.

Table 5-4 Synthetic Matrix Totals

Trip Purpose	AM Matrix Totals	PM Matrix Totals
Journey to Work	5,401	6,634
Education Driver	292	134
Education Passenger	1,610	708
Total	7,303	7,476

5.2.6 Model Calibration/Validation

A calibration and validation process have been developed as part of the model updating process. The level of calibration and validation which the model achieves, ultimately outlines how well the model represents traffic movements throughout Navan. Both these processes have been undertaken in line with TII's PAG Unit 5.2: Construction of Traffic Models.

The purpose of model calibration is to ensure that the model accurately reflect the existing traffic movements across Navan's town and environs. Calibration is an iterative process, whereby the model is continually revised to ensure that the most accurate replications of the base year conditions are represented. Validation uses a small proportion of data sites (not used in calibration), to verify the acceptability of the model.

5.2.6.1 Calibration and validation outcome

The results of the model calibration process show that the model is calibrated in line with the guidance set out in the TII Project Appraisal Guidelines (TII, 2016). The model is calibrated both in terms of screen lines and link flows, with observed traffic flows and traffic patterns (as determined by the traffic surveys) suitability reflected in the both the AM and PM peak hours base year model.

The model validation process shows that overall there is a good fit between observed and modelled data. The model is fully validated in terms of journey times.

In summary, the base year models are calibrated and validated to an acceptable level for the modelling of Navan's transport schemes, including LDR4.

5.2.7 Future Traffic Forecasts

The update of the Navan traffic model allows for the assessment of future road schemes and development proposals across the town. The local development plan provides locations and areas for future housing, commercial areas and community facilities (such as hospitals, schools or transport stops), therefore informing growth that should be applied to particular areas within the future year models.

Using the updated model and the development plan it is possible to forecast the expectant traffic movements of future years associated with the growth.

To assess the Proposed Road Development, future year models have been created for the Opening Year (2022), and a Design Year (2037, opening year +15 years) which accommodate the following:

- Applicable background traffic growth for the respective model years
- Traffic generated from new development areas which are proposed for completion by the respective model years.

By way of example, the 2022 model caters for traffic at an additional eight development zones. By 2037, 29 zones throughout Navan are expected to have been developed, many of which will contribute to increased traffic flows across the town.

In the next sections, the following years are represented:

- Base Year – 2017;
- Scheme Opening Year – 2022; and
- Scheme Design Year – 2037.

Future year models were developed for both a Do-Minimum scenario (no new road development) and a Do-Something scenario (with the Proposed Road Development in place), to report traffic flows along the Proposed Road Development and on all roads within the modelled network, the Navan Traffic Model assessed for the following periods:

- AM Peak Hour (08:00 – 09:00); and
- PM Peak Hour (17:00 – 18:00).

5.3 Base Year Traffic Models (2017)

Base year (2017) traffic models were developed to represent traffic flows and patterns during the AM peak hour and the average PM Peak hour. These models were developed, calibrated, and validated as per the TII PAG. Future year traffic growth for two forecast years (Opening/Design) was established based on the PAG guidance.

To estimate the modelled AADT, regression analysis was undertaken based on the traffic data collected from the eight TII Traffic Monitoring Unit (TMU) sites located within the study area, as illustrated in Figure 5-9. The regression was done between the peak hour traffic volume and estimated AADT observed from site for all the TMU sites combined. Thus, respective regression coefficients were obtained for AM and PM peaks. Modelled AADT can be obtained by substituting the corresponding values in the following formula:

$$Modelled\ AADT = (u * f_u) + (v * f_v)$$

Where,

u = *Regression coefficient for AM Peak*

v = *Regression coefficient for PM Peak*

f_u = *Modelled flows in AM*

f_v = *Modelled flows in PM*

Figure 5-9 TII Traffic Monitoring Unit sites

The regression is done for all the road categories combined together, as well as for National Roads and Motorways separately. The “u” and “v” values obtained as the result of regression is tabulated in Table 5-5.

Table 5-5 Regression Coefficients According to Road Classification

Classification of Road	u	v
All categories of Road	6.456	4.825

The modelled AADT is compared with the observed AADT for all the TMU sites located on different categories of road and same is presented in Table 5-6. The average percentage difference of -12% is observed between modelled and observed AADT.

Table 5-6 Accuracy of AM & PM Peak Hour Expansion Factors to AADT

ATC	ATC Location	AM	PM	Observed AADT	Modelled AADT	% difference
T20	R147	690	786	8175	8248	-1%
T21	M3 J6-7	1713	2019	21690	20799	4%
T30	M3 J7 Slips	240	341	2427	3194	-32%
T32	M3 J7-8	1662	2027	20920	20510	2%
T35	M3 J8 Slips	271	239	1785	2903	-63%
T37	M3 J8-9	1618	1943	18614	19819	-6%
T40	M3 J9 Slips	212	183	2150	2254	-5%
T41	M3 J9-10	1069	1230	13076	12841	2%

Modelled AADT flows for key sections of the network in the Base Year (2017) are presented in Table 5-7. For simplicity of use, the same AADT flows (rounded to the nearest 50) are illustrated graphically in Figure 5-10.

Table 5-7 2017 AADT (Modelled)

ID	Location	Base Year (2017) AADT
1	R147, West of R147/N51 Rbt	12479

2	N51, South of R147/N51 Rbt	9548
3	N51, East of R147/N51 Rbt	15869
4	N51, at River Blackwater crossing	18197
5	L7418 Tara Mines Road, around Navan Retail Park	3813
6	L3409 Ratholdron Road, North of L3409/N51 Jct	7418
7	L3409 Ratholdron / Windtown Road, North of L3409/L34094-1 Jct	2064
8	R162, North of Round'O Jct (R162/N51 Rbt)	10215
9	L34094-1 Clonamagadden Road	3084
10	R162, North of R162/L34094-1 Jct	5474
11	R162 / Flower Hill at River Blackwater crossing (South of Round'O Jct)	5893
12	N51 Athboy Road – M3 Link	11377
13	R147, East of R147/N51 Jct	10612
14	N51 Slane Road, East of Round'O Jct (R162/N51 Rbt)	8405
15	R153 Kentstown Road, East of River Boyne crossing	11149
16	R147, along River Boyne at rail overbridge	9725
17	R161 New Road / Trim Road, at rail level crossing	8681
18	Commons Road, at rail level crossing	3282
19	Boyne Road	1777
20	R153 Kentstown Road, East of R153 / Boyne Rd Jct	7886

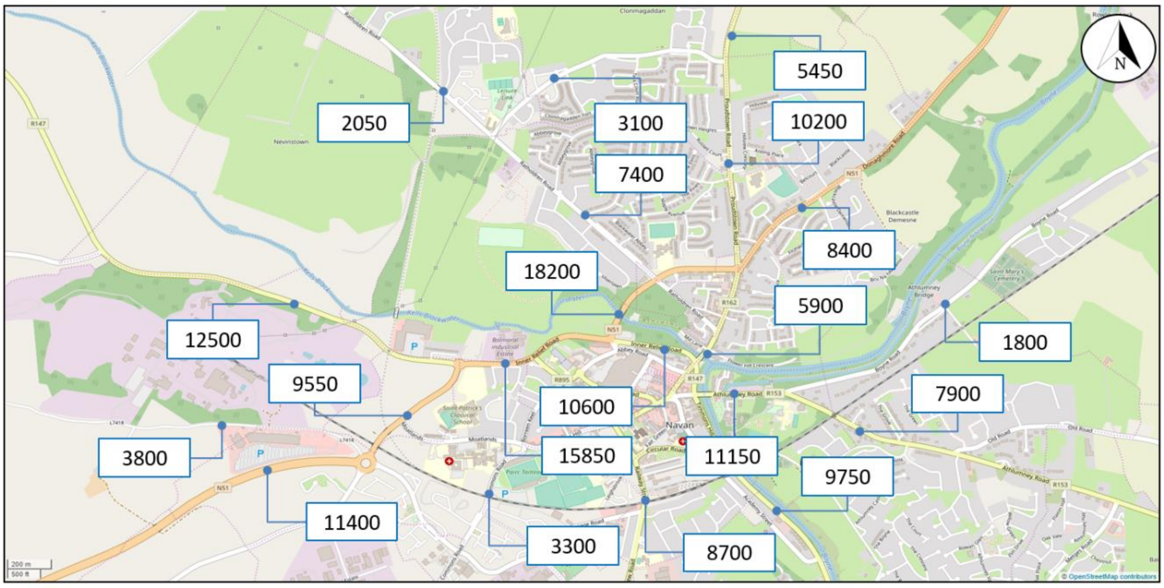


Figure 5-10 Base year AADT Map (2017)

5.4 Future Year Traffic Models (2022 and 2037)

5.4.1 Network Development

As there are no committed schemes in the study area, the future year 'Do-Minimum' network consists of the existing road network as illustrated in Figure 5-11.

The future year 'Do-Something' network includes all the assumptions of the Do-Minimum network plus the Local Distributor Road 4. The Do-Something network is shown in Figure 5-12.

Figure 5-11 Do-Minimum Road Network

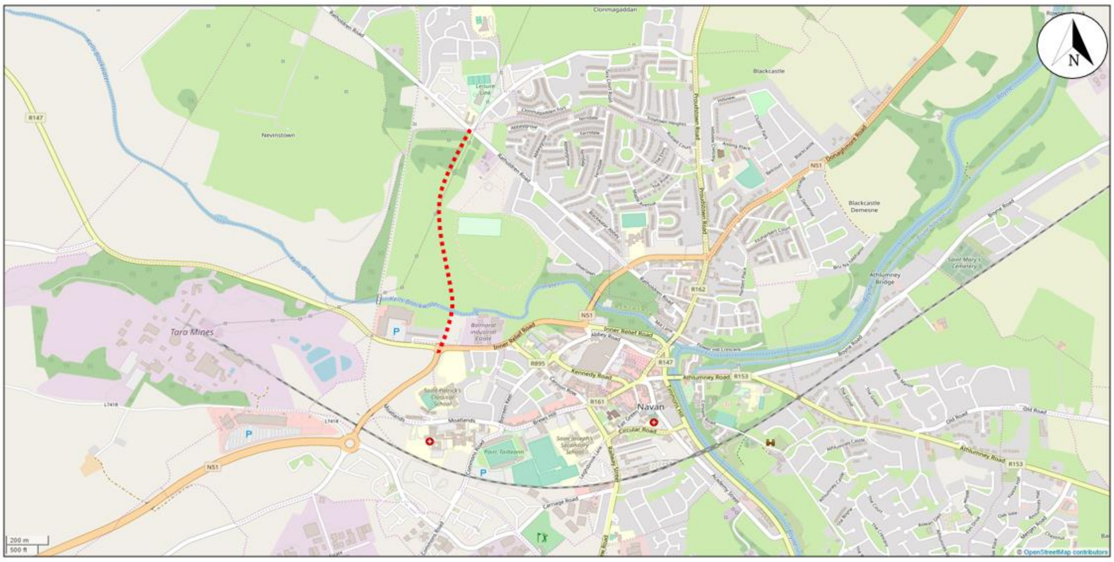


Figure 5-12 Do-Something Road Network

5.4.2 Traffic Growth

The development of traffic growth forecasts for the future year Navan Traffic Models have been based on the requirements set out in PAG Units 5.3: Travel Demand Projections. That guidance sets out separate methodologies for establishing trip end growth for internal and external zones within Navan. The potential yield land for Navan has been considered from the NDP. Figure 5-13 illustrates the NDP.

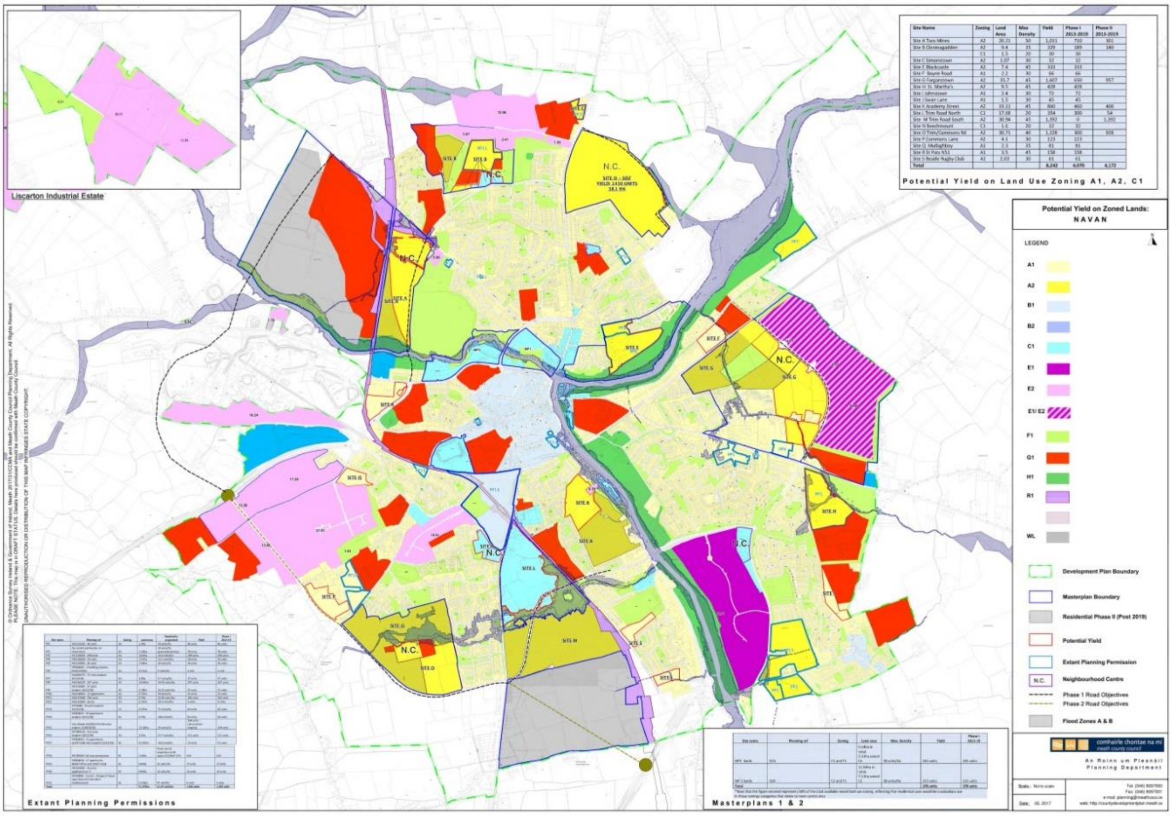


Figure 5-13 Navan Development Plan

The total growth in Navan was established by furnessing the 2017 base year matrices to the forecast 2022 and 2037 target trip ends. As part of this exercise the matrix totals were doubly constrained to the mean of the origin and destination forecast trip end totals. Table 5-8 below presents the matrix totals for Navan's realistic growth scenario.

Table 5-8 Total Growth in Navan (vehicles)

Matrix	2011	2018	2033	Growth 2011 - 2018	% Growth	Growth 2011 - 2033	% Growth
AM LV	9866	10489	13278	624	6%	3412	35%
AM HV	611	670	870	59	10%	259	42%
PM LV	11037	11707	15085	670	6%	4048	37%
PM HV	383	419	541	36	9%	158	41%

5.5 Traffic Impacts

5.5.1 Opening Year (2022)

The forecast AADT flows on the road network within the study area were extracted from The Navan Traffic Model for the following scenarios:

- 2022 Do-Minimum; and
- 2022 Do-Something.

The AADT traffic flows for the Proposed Road Development were extracted from the model and the opening year values presented in Table 5-9.

Table 5-9 AADT Values for the Proposed Road Development – Opening Year (2022)

Link	Direction	2022 Do-Something
Proposed Road Development (LDR4)	North Bound	3138
	South Bound	2841

Forecast traffic volumes on the existing road network for the Do-Minimum and Do-Something Opening Year (2022) scenarios are shown in Table 5-10. Traffic flows (with AADT values rounded to the nearest 50) in each of these scenarios are illustrated graphically in Figure 5-14 and Figure 5-15.

Table 5-10 Opening Year (2022) AADT

ID	Location	Base	DM 2022	% change between DM and Base	DS 2022	% change between DS and Base
1	R147, West of R147/N51 Rbt	12479	13233	6.0%	12599	1.0%
2	N51, South of R147/N51 Rbt	9548	9871	3.4%	10196	6.8%
3	N51, East of R147/N51 Rbt	15869	16894	6.5%	12491	-21.3%
4	N51, at River Blackwater crossing	18197	19072	4.8%	13516	-25.7%
5	L7418 Tara Mines Road, around Navan Retail Park	3813	3903	2.4%	4395	15.3%
6	L3409 Ratholdron Road, North of L3409/N51 Jct	7418	7553	1.8%	4264	-42.5%
7	L3409 Ratholdron / Windtown Road, North of L3409/L34094-1 Jct	2064	2065	0.0%	2066	0.1%
8	R162, North of Round'O Jct (R162/N51 Rbt)	10215	10319	1.0%	7900	-22.7%
9	L34094-1 Clonamagadden Road	3084	3285	6.5%	5711	85.2%
10	R162, North of R162/L34094-1 Jct	5474	5825	6.4%	5829	6.5%
11	R162 / Flower Hill at River Blackwater crossing (South of Round'O Jct)	5893	6012	2.0%	5603	-4.9%
12	N51 Athboy Road – M3 Link	11377	11778	3.5%	11453	0.7%
13	R147, East of R147/N51 Jct	10612	11460	8.0%	11250	6.0%
14	N51 Slane Road, East of Round'O Jct (R162/N51 Rbt)	8405	9769	16.2%	9771	16.3%
15	R153 Kentstown Road, East of River Boyne crossing	11149	11738	5.3%	11612	4.2%
16	R147, along River Boyne at rail overbridge	9725	10328	6.2%	10260	5.5%
17	R161 New Road / Trim Road, at rail level crossing	8681	8741	0.7%	8426	-2.9%
18	Commons Road, at rail level crossing	3282	3266	-0.5%	2998	-8.7%
19	Boyne Road	1777	1801	1.4%	1801	1.4%
20	R153 Kentstown Road, East of R153 / Boyne Rd Jct	7886	8527	8.1%	8401	6.5%

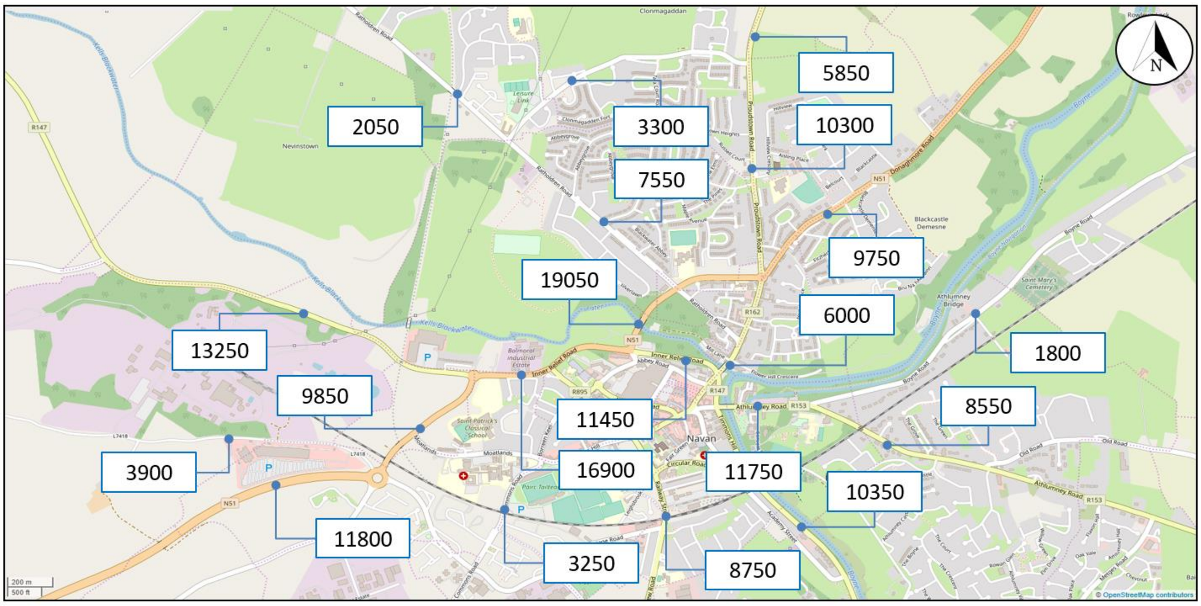


Figure 5-14 Do-Minimum Opening Year (2022) AADT Map

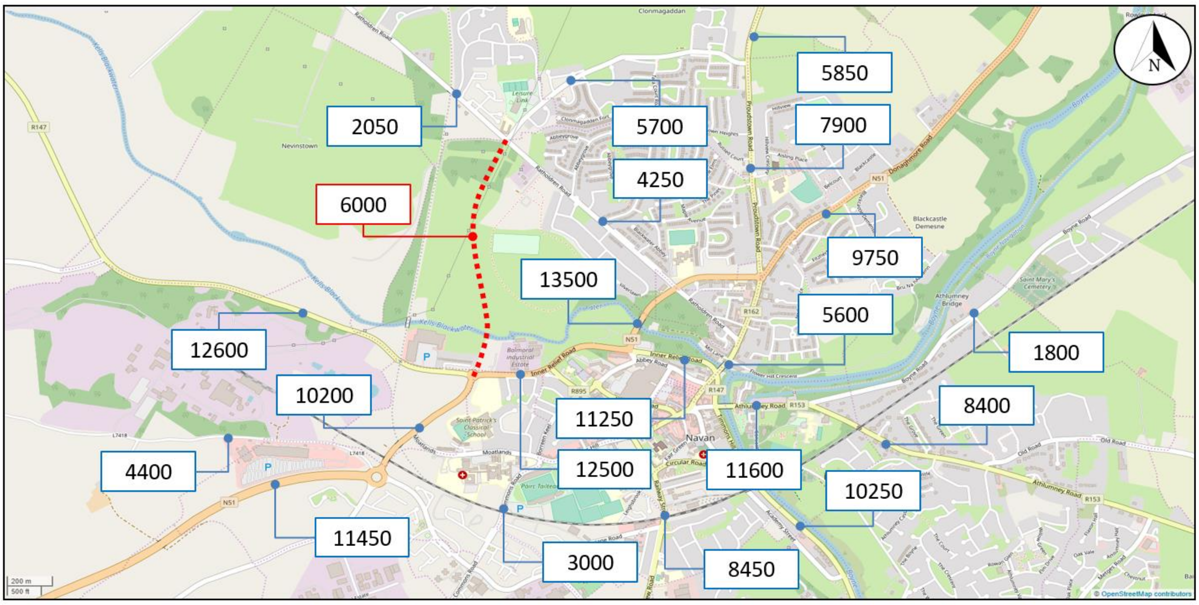


Figure 5-15 Do-Something Opening Year (2022) AADT Map

Figure 5-16 below also illustrates the relative differences in traffic volumes between the Do-Minimum and Do-Something scenarios for the Opening Year (2022); 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.

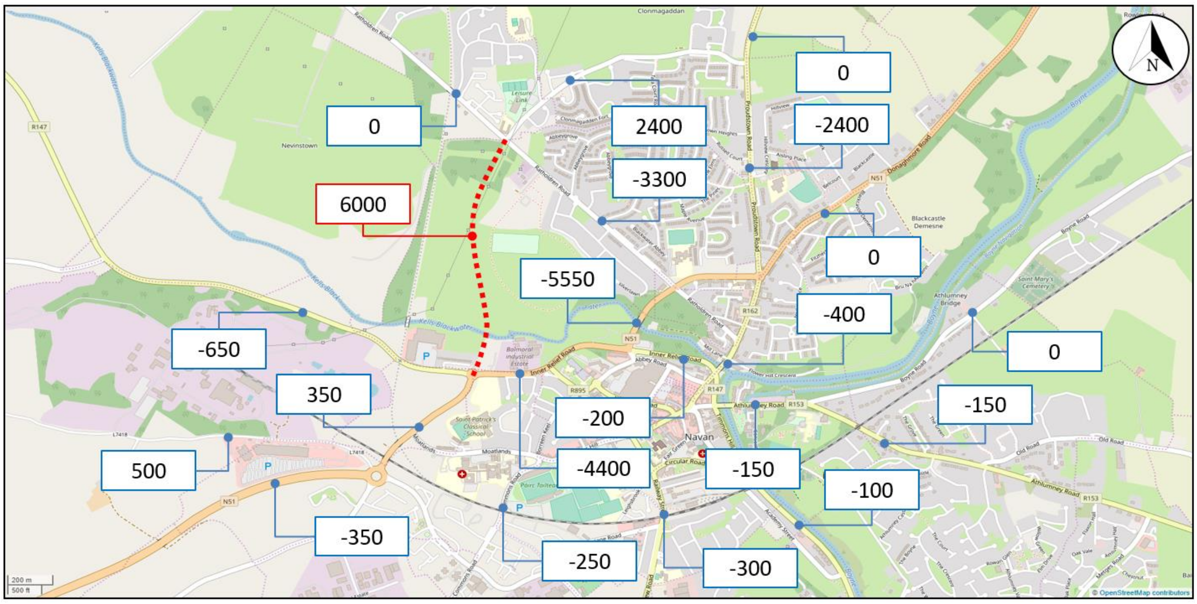


Figure 5-16 Opening Year (2022) AADT Differences between DM and DS

Results for the Opening Year (2022) show that implementation of the Proposed Road Development will cause a substantial decrease in AADTs on the following sections:

- N51 Kells Road;
- N51 section crossing the River Blackwater;
- Ratholdron Road north of Ratholdron Road / N51 junction; and
- R162 north of R162 / N51 junction.

Alongside the above reductions in AADT, it is also observed that there will be increases in AADT on the Clonmagadden Road as a result of the scheme implementation. The Proposed Road Development joins directly to the Clonmagadden Road, which connects the scheme to the R162. This is key benefit of the schemes local connectivity, particularly for traffic seeking to bypass the Navan Town Centre.

Following this conclusion, a preliminary assessment of the Clonmagadden Road / R162 junction was undertaken to consider the changed in traffic distribution using this junction. This assessment indicated that the overall volume of traffic using this junction will remain unchanged as a result of the Proposed Road Development implementation and that the current junction layout would have sufficient capacity to cater for the changes in traffic patterns in the Opening Year (2022).

In summary, the Proposed Road Development substantially decreases the volume of traffic on the existing N51 corridor through the town centre, as traffic is transferred onto the Proposed Road Development, then onto Clonmagadden Road, bypassing Navan Town Centre.

5.5.2 Design Year (2037)

The forecast AADT flows on the road network within the study area were extracted from the Navan Traffic Model for the following scenarios:

- 2037 Do-Minimum; and
- 2037 Do-Something.

The AADT traffic flows for the Proposed Road Development were extracted from the model and the design year values presented in Table 5-11.

Table 5-11 AADT Values for the Proposed Road Development - Design Year (2037)

Link	Direction	2037 Do-Something
Proposed Road Development (LDR4)	North Bound	4629
	South Bound	3927

Forecast traffic volumes on the existing road network for the Do-Minimum and Do-Something Design Year (2037) scenarios are shown in Table 5-12. Traffic flows (with AADT values rounded to the nearest 50) in each of these scenarios are illustrated graphically in Figure 5-17 and Figure 5-18.

Table 5-12 Design Year (2037) AADT

ID	Location	Base	DM 2037	% change between DM and Base	DS 2037	% change between DS and Base
1	R147, West of R147/N51 Rbt	12479	14689	17.7%	13022	4.4%
2	N51, South of R147/N51 Rbt	9548	12738	33.4%	12545	31.4%
3	N51, East of R147/N51 Rbt	15869	19764	24.5%	13241	-16.6%
4	N51, at River Blackwater crossing	18197	24568	35.0%	16866	-7.3%
5	L7418 Tara Mines Road, around Navan Retail Park	3813	5042	32.2%	6594	72.9%
6	L3409 Ratholdron Road, North of L3409/N51 Jct	7418	12045	62.4%	7899	6.5%
7	L3409 Ratholdron / Windtown Road, North of L3409/L34094-1 Jct	2064	4559	120.9%	4601	122.9%
8	R162, North of Round'O Jct (R162/N51 Rbt)	10215	12647	23.8%	8454	-17.2%
9	L34094-1 Clonamagadden Road	3084	3724	20.8%	7426	140.8%
10	R162, North of R162/L34094-1 Jct	5474	6647	21.4%	6692	22.3%
11	R162 / Flower Hill at River Blackwater crossing (South of Round'O Jct)	5893	7776	32.0%	7300	23.9%
12	N51 Athboy Road – M3 Link	11377	14130	24.2%	13900	22.2%
13	R147, East of R147/N51 Jct	10612	14386	35.6%	13736	29.4%
14	N51 Slane Road, East of Round'O Jct (R162/N51 Rbt)	8405	11126	14.1%	11083	31.9%
15	R153 Kentstown Road, East of River Boyne crossing	11149	13802	23.8%	13891	24.6%
16	R147, along River Boyne at rail overbridge	9725	11953	16.6%	11964	23.0%
17	R161 New Road / Trim Road, at rail level crossing	8681	12228	40.9%	11960	37.8%
18	Commons Road, at rail level crossing	3282	5629	71.5%	5543	68.9%
19	Boyne Road	1777	5790	225.8%	5824	227.7%
20	R153 Kentstown Road, East of R153 / Boyne Rd Jct	7886	6990	-11.4%	7118	-9.7%

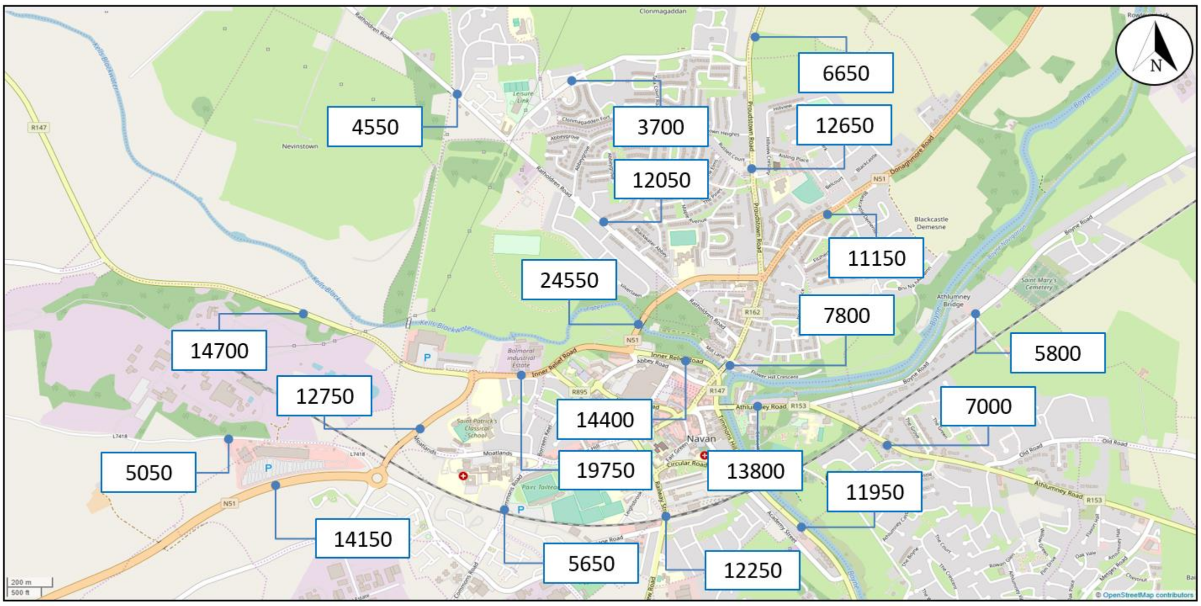


Figure 5-17 Do-Minimum Design Year (2037) AADT Map

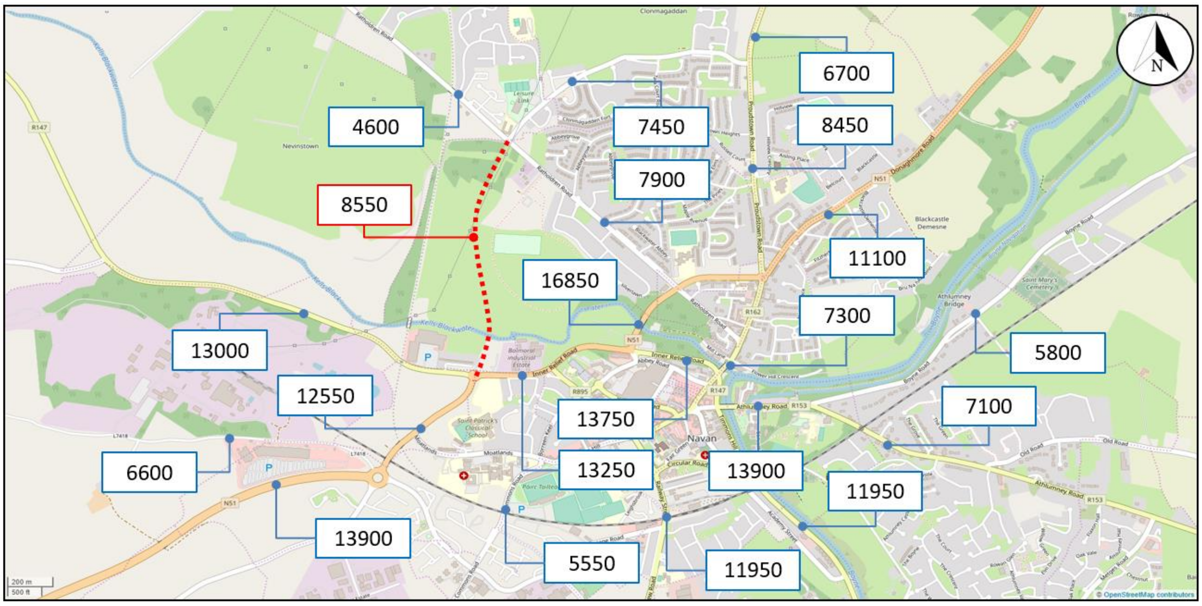


Figure 5-18 Do-Something Design Year (2037) AADT Map

Figure 5-19 below also illustrates the relative differences in traffic volumes between the Do-Minimum and Do-Something scenarios for the Design Year (2037); where the positive figures indicate increased traffic volumes as a consequence of the LDR4 scheme implementation and negative figures indicate reduced traffic volumes as a consequence of the LDR4 scheme implementation.

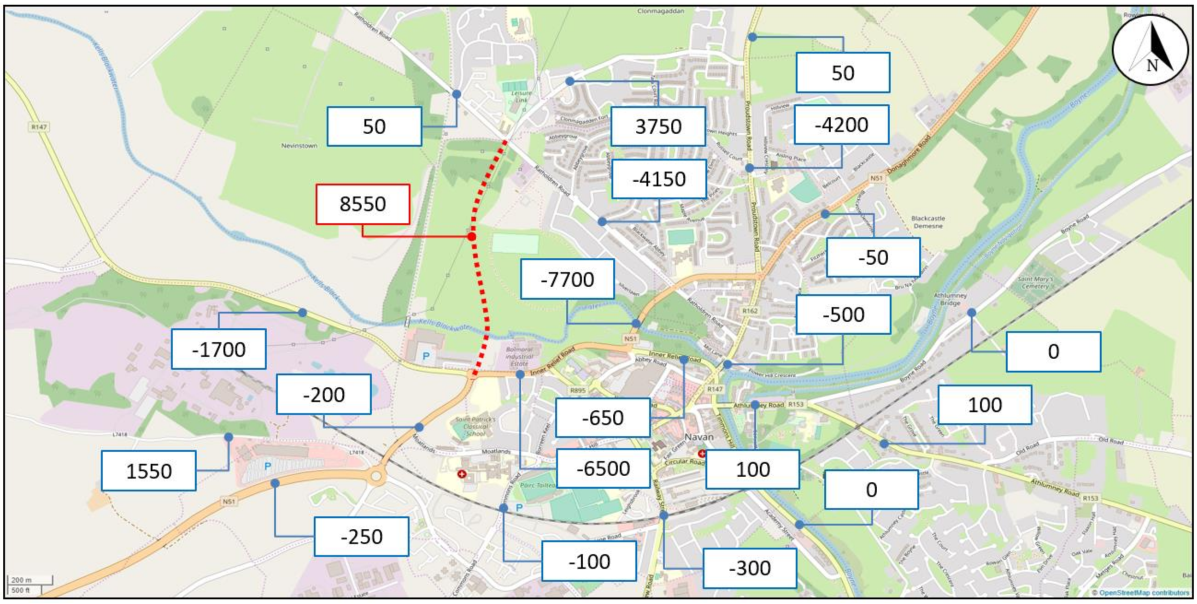


Figure 5-19 Design Year (2037) AADT Differences between DM and DS

Results for the Design Year (2037) show that implementation of the Proposed Road Development will cause a substantial decrease in AADTs on the following sections:

- N51 Kells Road;
- N51 section crossing the River Blackwater;
- Ratholdron Road north of Ratholdron Road / N51 junction; and
- R162 north of R162 / N51 junction.

Alongside the above reductions in AADT, it is also observed that there will be increases in AADTs on Clonmagadden Road as a result of the scheme implementation. The Proposed Road Development joins directly to the Clonmagadden Road, which connects the scheme to the R162. This is key benefit of the schemes local connectivity, particularly for traffic seeking to bypass the Navan Town Centre.

It is worth noting these results are in line with the results for the Opening Year (2022), although the magnitude is amplified by the overall additional traffic which will load the road network.

Similarly to the Opening Year (2022) scenario, a preliminary assessment of the Clonmagadden Road / R162 junction was undertaken. This assessment indicated that the overall volume of traffic using this junction will remain unchanged as a result of the Proposed Road Development implementation. However, as the development plan is realised and the adjacent zoned lands are developed, an assessment of this junction would be required. The assessments undertaken have indicated that an upgrade of this junction as part of the Proposed Road Development is not required and would be premature.

In summary, the Proposed Road Development substantially decreases the volume of traffic on the existing N51 corridor through the town centre, as traffic is transferred onto the Proposed Road Development, then onto Clonmagadden Road, bypassing Navan Town Centre.

5.6 Network Statistics

Network statistics were extracted from the AM and PM Peak hour traffic models and a comparison was made against the Do-Minimum option for the Design Year (2037). The key network statistics comprise the following:

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

Table 5-13 and Table 5-14 outline the key network statistics for the AM and PM Peak Periods respectively. Overall, the tables show that the Proposed Road Development provide benefits for the entire network compared to the Do-Minimum option.

Table 5-13 2037 AM Peak Network Statistics (All Vehicles)

Route Option	Total Vehicle km	Total Network Travel Time (hrs)	Average Vehicle Speed (kph)
2037 Do-Minimum	92441	2054.5	45
2037 Do-Something	92372	2027.9	45.6
Relative Difference	-0.1%	-1.3%	+1.3%

Table 5-14 2037 PM Peak Network Statistics (All Vehicles)

Route Option	Total Vehicle km	Total Network Travel Time (hrs)	Average Speed (kph)
2037 Do-Minimum	105748	2384.9	44.3
2037 Do-Something	105553	2314.6	45.6
Relative Difference	-0.2%	-3.0%	+2.9%

The network statistics outlined above illustrate that the Proposed Road Development provides a reduction in travel time and an increase in average speed throughout the entire Navan modelled road network both in the AM and PM peaks. The Proposed Road Development provides a reduction in travel time between 1.3% and 3.0% for AM and PM peaks respectively, and an increase in average speed between 1.3% and 2.9% for AM and PM peaks respectively.

5.7 Safety Impact

As outlined in previous sections the opening of the Proposed Road Development will lead to the re-routing of traffic from the existing road network onto the proposed link road, with approximately 8,550 AADT using the Proposed Road Development in the Design Year.

The Proposed Road Development will be of a higher safety standard than existing routes and will therefore contribute to a network wide reduction in collisions.

In order to assess the impact of the Proposed Road Development in terms of traffic, a series of traffic models were developed. Firstly, base year (2017) traffic models were developed to represent traffic flows and patterns during the AM peak hour (08:00 – 09:00) and average PM Peak hour (between 17:00 – 18:00). These models were developed, calibrated and validated as per the TII PAG. Following on from this, future year traffic growth for two forecast years (Opening and Design) were established based on the PAG guidance. The traffic growth was then distributed throughout the network based on the land use zonings set out in the NDP. Once future growth was estimated, scheme impacts were assessed by comparing the Do-Minimum scenario (i.e. without the Proposed Road Development) with the Do-Something scenario (with Proposed Road Development). The processes undertaken complied with guidance provided in the TII PAG (TII, 2016).

The impact of the Proposed Road Development in terms of the change in AADT on the road network was produced for key links throughout the study area. The Proposed Road Development will reduce traffic volumes, and associated congestion, in the proximity of the town centre. This reduction in traffic volumes will create a more attractive, safer town centre for vulnerable road users and will improve accessibility to local services and businesses.

An assessment was conducted which indicates that the Proposed Road Development will also provide a reduction in network travel time throughout the entire Navan modelled road network (up to 3.0% at Design Year PM peak).

5.8 References

- TII. (2016). *Project Appraisal Guidelines*, Transport Infrastructure Ireland, Dublin, Ireland.
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, Meath, Ireland.

Chapter 06: Population and Human Health

06

6. Population and Human Health

6.1 Introduction

This chapter in conjunction with the Health Impact Assessment (HIA - Appendix A6-1 contained in Volume 4) describes the potential effects of the construction and operation phases of Proposed Road Development on population and human health. Actual and perceived impacts of the Proposed Road Development on population and human health may arise from various aspects of the Proposed Road Development. These impacts will be dealt with throughout the EIAR. Issues considered in this section include the following:

- Economic activity;
- Social consideration;
- Land-use; and
- Health.

Impacts on population and health, outside of other issues such as air quality, noise and vibration, traffic and landscape, are reflected in this section.

The main potential population and human health impacts from the Proposed Road Development are likely to comprise air emissions, noise, visual and traffic impacts, all of which are dealt with in the corresponding EIAR chapters; Chapter 10 (Air Quality); Chapter 11 (Noise and Vibration); Chapter 12 (Landscape and Visual); and Chapter 05 (Traffic Analysis).

This section sets out the methodology, describes the existing environment, identifies potential effects of the Proposed Road Development on population and human health, considers mitigation measures for predicted effects where applicable, residual effects and also considers cumulative effects and interactions. The HIA considers the potential consequences for health and wellbeing from the construction and operation of the Proposed Road Development.

6.2 Methodology

6.2.1 Study Area

The study area for the Population and Human Health assessment has considered the area of land that encompasses the likely effects of the Proposed Road Development. It should be noted; however, that it is not always possible to determine the catchment area for community facilities. Residents of an area may utilise facilities located within different districts, counties or regions without regard for statutory boundaries. The following sections describe the attributes for the different aspects of this topic.

6.3 Legislation and Guidelines

The appraisal of the Proposed Road Development on population and human health was conducted by reviewing the current socio-economic environment in the areas close to the Proposed Road Development site and the potential impact of the Proposed Road Development on this environment.

The following guidelines were considered while preparing and writing this section:

- EPA: '*Guidelines on The Information to be Contained in Environmental Impact Assessment Reports'* (Draft, May 2017);
- EPA: '*Advice Notes for Preparing Environmental Impact Statements'*, (Draft, September 2015); and
- NRA: '*Environmental Impact Assessment of National Road Schemes - A Practical Guide',* (Revision 1, November, 2008).

6.3.1 Data Sources

Data sources collected and used in the case study to ascertain an understanding of the community were collected by means of the following:

- Primary data sources including that available from the CSO relating to the census;
- Drawings of the Proposed Road Development;
- Other relevant environmental data assessed and considered in other sections within the EIAR;
- A review of relevant documents including the MCDP 2013-2019 (MCC, 2013) and the NDP 2009-2015 (MCC, 2009);
- A review of secondary sources including the Regional Planning Guidelines for the Greater Dublin Area 2010-2022 RPGO (2010), National Spatial Strategy for Ireland 2002-2020 (DHPLG 2002);
- A review of the Local Distributor Road 4, Abbeyland Navan Scheme Feasibility Report and the Route Selection Report;
- MyPlan.ie (Department of Housing, Planning, Community and Local Government in conjunction with Irish Local Authorities); and
- ABP.

6.3.2 Impact Categories and their assessment

The purpose of the Population and Human Health assessment is to identify and assess potential health and wellbeing effects of the Proposed Road Development on the surrounding population, any potential effects of the Proposed Road Development on the local community and users of the road.

Impact categories considered include:

- Journey Characteristics;
- Amenity (Impacts on environmental and residential amenity);
- Severance;
- Population;
- Employment; and,
- Health Demographics.

6.3.2.1 Journey Characteristics

The assessment of journey times and patterns is dependent on journey characteristics such as the journey start and end point, when the journey occurred and if it was a motorised or non-motorised journey. Journey length is considered as the distance of the journey, while duration is the time it takes to complete the journey. New transport routes and facilities can improve connectivity, reduce journey duration and severance, and can have knock on implications on the transport mode used and economic development amongst others.

Positive effects can result from decreases in journey length and duration while negative effects occur where an increase in journey length or duration occurs.

6.3.2.2 Severance

Community severance relates to the degree to which movement and activities within a community are affected by the presence of a road. The definition of severance is not precise but can be considered as "*the separation of residents from facilities and services they use within their community caused by new or improved roads or by changes in traffic flow*". It can be measured as the creation of, or, relief from severance.

Roads can act as barriers, altering journey times and patterns and deterring people from using local community facilities or can remove barriers and facilitate access. New roads can provide relief from severance by reducing traffic volumes, moderating traffic speeds and through the provision of crossing facilities within the design phase of the proposed development or could create a barrier in the form of a new fence, road, increased traffic or the requirement to detour. Severance can also be caused by the demolition of community facilities or through the loss of lands used by the local community.

One of the aims of the severance assessment is to try and understand if the Proposed Road Development will separate the local community from local facilities and services. Groups of particular importance are children, the elderly, disabled persons and people without access to a private vehicle, as these can be particularly vulnerable to disruption of travel patterns and most affected by community severance. However, any potential changes in severance are estimates only.

The assessment generally focuses on potential impacts at a community level rather than for individuals or identifiable properties. Impacts on individual properties are addressed separately in Chapter 10 (Air Quality), Chapter 11 (Noise and Vibration); and Chapter 12 (Landscape and Visual).

6.3.2.3 Describing Potential Effects

The potential effects arising from a development can result in direct, indirect, secondary and cumulative effects on the environment. These potential effects describe the quality of the effect and can be described as positive, neutral or negative/adverse. A description of the quality of effects is outlined in Table 6-1. In addition to the quality of effects, the duration of effects is also considered. A description of the duration of effects is outlined in Table 6-2.

Table 6-1 Describing the Quality of Effects

Quality of Effects	Description
Positive Effect	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).
Neutral Effect	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative/adverse Effects	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

Table 6-2 Describing the Duration of Effects

Duration of Effects	Description
Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects lasting less than a day
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years.
Medium-term Effects	Effects lasting seven to fifteen years
Long-term Effects	Effects lasting fifteen to sixty years.
Permanent Effects	Effects lasting over sixty years
Reversible Effects	Effects that can be undone, for example through remediation or restoration

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

6.3.2.4 Journey Amenity

Amenity value can be considered as “*the relative pleasantness of a journey*” and is concerned with changes in the degree and duration of exposure to traffic and the impact of the road itself. Journey amenity is influenced by factors such as the level of traffic on a road, the proximity of pedestrian and cyclist facilities to the road, visual intrusions along the route and the provision of crossings. Other considerations include the health and general amenity of the local community; this includes community wellbeing.

A perceived improvement in amenity could occur where pedestrians and other road users experience a reduction in road related visual effects or traffic volumes, while a reduction in amenity value could occur following an increase in traffic volumes or road related visual effects. The significance of effects relates to the nature of the environment affected, the duration of the effect, and the probability of its occurrence. It must be considered however that amenity values and changes in amenity values are subjective, changing from one person to the next.

The main consideration is for pedestrians and cyclists; however, amenity considerations also apply to drivers and consider factors such as fear of safety.

6.4 Description of the Existing Environment

6.4.1 Introduction

The following sections outline the existing environment of the Proposed Road Development site. This includes land uses in the surrounding environs, local receptors and information on the wider community such as information on the local population, travel modes used by the local population and travel times. This information is used to provide a baseline of the surrounding community.

6.4.2 Background

Navan is located close to the M3 motorway, the N51 and is serviced by regional roads such as the R147, R153, R161, and the R162, and occupies a central location in County Meath. Navan occurs within the Boyne Valley, an area of outstanding natural beauty and is in close proximity to the hill of Tara. Although relatively compact, it is the largest urban centre in County Meath and is a main service centre for the town's population and surrounding environ.

The River Boyne and the River Blackwater flow through the town, are part of the towns' natural heritage, and provide amenity value to the local area. The narrow winding streets of Navan town are considered consistent with its medieval history and contribute to the character of the town. In recent time there has been substantial residential and commercial development in the area however severance occurs between some areas.

6.4.2.1 Social Infrastructure

Navan town is considered relatively compact. According to the NLTP 2014-2019, the maximum distance from the furthest outskirts to the town centre is 4 km. Despite this, Navan is considered a car orientated town. There are limited dedicated cycle networks within Navan, the road network is not considered cycle friendly, has few dedicated cycle ways, and the current cycle network is fragmented. In addition, the River Blackwater, the River Boyne and areas of greenfield create severance in the area.

The GDA Cycle Network Plan (NTA, 2013) outlines the three existing cycling facilities within Navan. In 2013, cycle provisions were located on the N51 between Kells road and Slane road and on the N51 Navan Inner Relief Road on the local road between the R162 and the Ratholdron road (Figure 6-1). It is noted that since then additional cycle facilities have been provided at several locations within Navan, including: the N51 Slane Road north-east of Round'O junction, R153 Kentstown Road inbound near New Bridge, the R161 Solstice roundabout and approaches, Metges Road and Bóthar Sion.

The GDA cycle network plan (NTA, 2013) outlines a range of proposed interurban and greenway cycle routes as well as local routes throughout Navan (Figure 6-2). Greater connectivity and upgrade of the existing cycle network is required in Navan to increase the number of cycling trip made in the city.

An extensive network of pedestrian paths and facilities occur throughout the town. The importance of increasing the level of trips made by walking within Navan has been highlighted within the NTLP 2014-2019. Walking is viewed within the plan as a green and sustainable form of transport and it is considered that the level of internal trips by foot could increase to 35% with the construction of additional crossing points and the removal of severance.

An additional obligation of the NLTP 2014-2019 is to provide for a new pedestrian and cycle bridge over the River Blackwater. This would provide a connection between local schools and Blackwater Park. An additional bridge could also "*link the town centre to this impressive public open space (green infrastructure) and provide for an area of the town where pedestrians and cyclists can make trips to and from the town centre*".

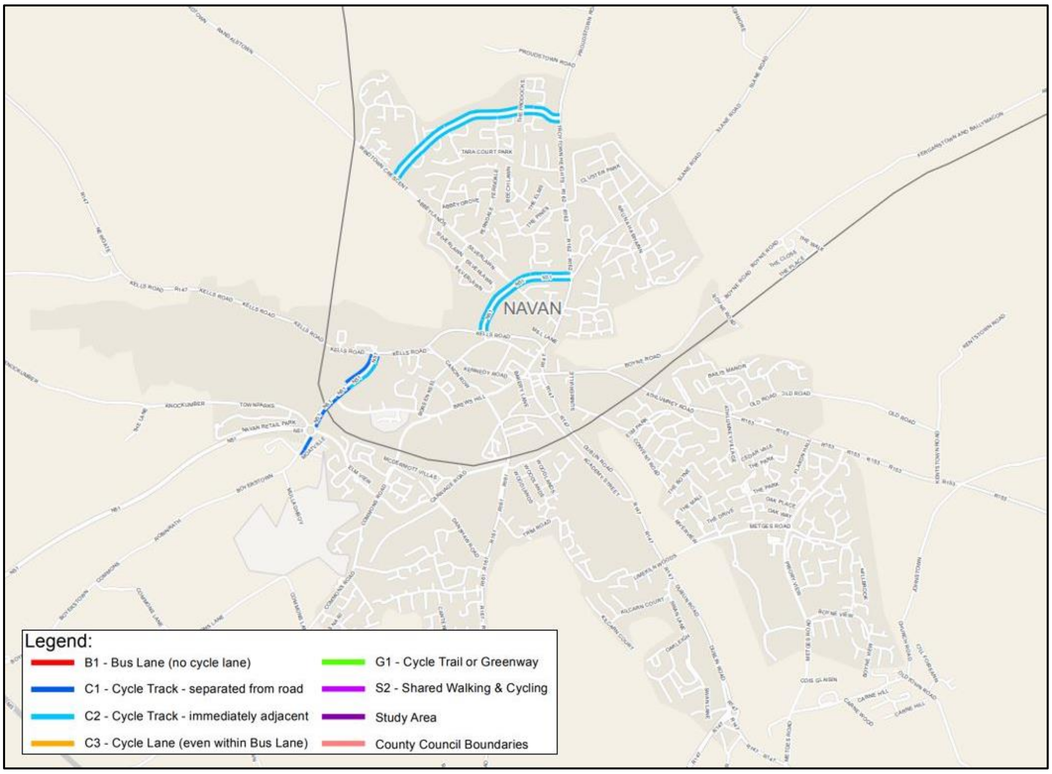


Figure 6-1 Existing Cycling Facilities Map 2013 (GDA Cycle Network Plan, Navan Sheet E12)

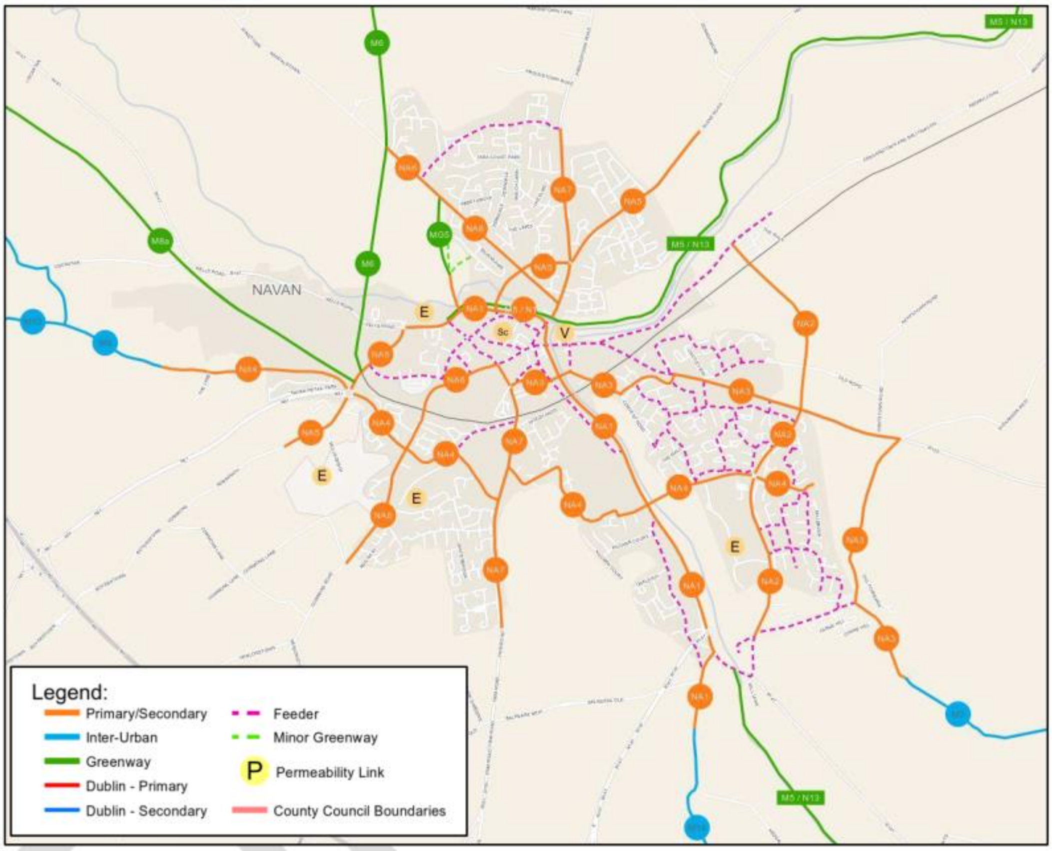


Figure 6-2 Proposed Cycle Network (GDA Cycle Network Plan; Navan Sheet N12)

6.4.2.2 Local Amenity and Community Facilities

There are a variety of schools within Navan and the surrounding environs. St. Patrick's Classical School occurs within c. 200 m of the Proposed Road Development, other school in the local environs include Scoil Mhuire to the south, and Scoil Naomh Eoin to the north.

Navan and its local environs have a good selection of community and sports facilities including Aura Leisurelink, Blackwater Park and Playground, soccer and GAA facilities and the River Blackwater. The NDP 2009-2015 acknowledges the importance of access to recreational facilities in maintianing a healthy lifestyle and the importance of both private and public open space in residential areas.

6.4.2.3 Land Zoning in the Site Environs

The Proposed Road Development is located predominantly in a greenfield area currently designated by Corine Land Cover 2018 as agricultural areas of pasture and areas of artificial surfaces of urban fabric.

Directly to the west of the Proposed Road Development are lands zoned for new residential developments in support of the regional hospital, and to also deliver key road infrastructure in the area. Lands zoned as White Lands and Community Infrastructure (MP11) have been identified in the NDP 2005 - 2015 as the preferred site for the development of a new regional hospital to the west of the Proposed Road Development. Blackwater Park is located to the east of the Proposed Road Development in an area zoned for open space. Lands to the north of the Proposed Development are zoned as Existing Residential, Community Infrastructure and areas of Open Space, while areas zones as High Amenity, Existing Residential, Open Space and Retail, Warehouse Park are located to the south of the Proposed Road Development.

6.4.2.4 Existing Traffic Conditions

Within Navan heavy traffic flows occur on the N51, R147 and the R161. Some of the most congested areas occur at points on the network in proximity to bridge crossings over both the River Boyne and the River Blackwater. There are two crossings over the River Blackwater, the N51 and the R162 (Flowerhill). There is only one south bound crossing over the River Blackwater via the N51 as Flowerhill is a one-way street. Due to the layout of the town and constraints of the rivers, there are few cross-town routes beyond the main N51, R147, and R161. Resulting from this any growth in traffic would impact the main junctions in proximity to the River Boyne and the River Blackwater.

6.4.3 Context

6.4.3.1 The Wider Community

Within this section demographic trends are considered at state, county and local levels. The information considered below is based on the most recent census of the population taken on the 24th of April 2016. The census gathers data for the whole state as well as on a regional scale, and also includes small area population statistics for administrative areas such as counties, cities, towns and electoral divisions. Census information analysed for the purpose of this study included information on population, age profile, employment, social class and health.

County Meath has seen increased population growth over the last fifteen years and experienced the second greatest population increase within the Greater Dublin Area between 2002 and 2011. Navan is the county town and a 'Large Growth Town 1' (as defined in the MCDP 2013 – 2019), located entirely in Meath and as such is considered a primary growth centre in Meath. Within the MCDP 2013-2019 Large Growth Town 1 are considered "*key destination, economically active supporting surrounding area, located on multi-modal corridor in metropolitan hinterland*" with a plan for an ultimate population of 50,000 (MCC, 2013).

The Proposed Road Development is located within Navan Rural Electoral Division and is adjacent to Navan Urban Electoral Division. Census data for these electoral divisions were used to identify community trends within and in proximity to the Proposed Road Development site. These electoral divisions are in some cases combined and compared against the Meath county level and state level census data. Where this has occurred Navan Urban and Navan Rural electoral divisions are collectively referred to as Navan and local environs.

The population in Navan and its local environs has in general seen an expansion over the last ten years. The CSO Census 2016 report Navan rural and Navan Urban electoral divisions to have a combined population of 31,736 persons, representing a 6.4% increase since the 2011 census. Increases were also observed at a county and state level during this time period, as documented in Table 6-3. It is noteworthy that a decrease of 8.6% in the population of Navan Urban was observed between 2006 and 2011; this is in contrast to trends observed at a county and state level. However, a 14.2% increase in population growth was observed between 2011 and 2016. This could be in part due to growth following an economic downturn experienced in previous years.

Table 6-3 Population and Population Changes

Electoral Division	2016	2011	2006	% Change 2011-2016	% Change 2006-2011
Navan Rural	28,117	26,657	23,683	5.5%	12.5%
Navan Urban	3,619	3,168	3,466	14.2%	-8.6%
Navan and Local Environs	31,736	29,825	27,149	6.4%	9.8%
Co. Meath	195,044	184,135	162,831	5.9%	13.1%
State	4,761,865	4,588,252	4,239,848	3.7%	8.2%

Source: CSO, Census 2016; Small Area Population Statistics 2016.

Table 6-4 show the age profiles of the population within the vicinity of the Proposed Road Development site and at a county and national level for 2016. Age profile may act as a useful indicator of the available labour force in an area and the demand for facilities including schools and amenities, as well as future housing requirements and the infrastructure links required to facilitate these amenities.

MCC and Navan and local environs both have youthful populations with greater portions of the population under the age of 18 than in the state as a whole. 31-32% of the population were under 18 in MCC and Navan and local environs compared to 26.3% in the state as a whole. The proportion of the population within the 65+ cohort was lower in Navan and local environs (8.8%) when compared with Co. Meath (10.6%) and the State (13.4%). Within 2016 the largest category of the Navan and local environs population was within the ages of 25-44 at 32.5%, while 31.9% were under the age of 18, compared to 29.5% and 26.3% respectively at a state level. The presence of a young population highlights the importance of considering the future demand for local facilities and the infrastructure required for these facilities.

Table 6-4 Age Profile of the Population in the Vicinity of the Proposed Road Development and at County and State Level (Census 2016)

	0-4	5-12	13-18	19-24	25-44	45-64	65+
Navan Rural	2,444	4,380	2,525	1,680	9,043	5,704	2,341
Navan Urban	286	291	185	260	1,274	867	456
Navan and Local Environs	2,730	4,671	2,710	1,940	10,317	6,571	2,797
Co. Meath	15,736	27,198	16,807	11,556	57,254	45,705	20,788
State	33,1515	548,693	371,588	331,208	1,406,291	1,135,003	637,567

Source: CSO, Census 2016; Small Area Population Statistics 2016.

According to the MCDP 2013-2019, the population of Meath County is forecast to increase to 210,260 with a household allocation of 95,458 by 2022 (MCC, 2013). As Navan is considered a ‘Large Growth Town 1’ it is likely Navan will also see a continued increase in population. Within the MCDP Plan 2013-2019 Navan has a household allocation of 3,984 within this time period (MCC, 2013). As the town grows there is potential for increases in traffic congestion arising from increased demand on existing road networks.

Table 6-5 shows the number of houses that have been built and the years in which they were built. As the populations within Navan and local environs and within County Meath as a whole have grown, this has generally been reflected in the number of houses being built across those years. The figures revealed that 35% of the housing stock with Navan and local environs were built between 2001 and 2010. The percentage of housing built dropped significantly from 2011 to the present; this trend was also observed at a county and state level and is likely related to the recent economic downturn in the country. It is probable however that as the economy continues to recover and as the population continues to increase, the number of houses required and the requirement for associated facilities and infrastructure will rise. A range of areas have been zoned for new residential development within the NDP 2009-2015, including an area west of the Proposed Road Development.

Table 6-5 Houses Built at Different Times (Census 2016)

Electoral Division	2011 or later	2001-2010	1991-2000	1981-1990	1961-1980	Pre 1961	Not Stated
Navan Rural	89	3513	2154	589	1846	429	442
Navan Urban	23	242	270	92	227	417	246
Navan and Local Environs	112	3755	2424	681	2073	846	688
Co. Meath	1537	22515	10524	5426	11342	9358	3159
State	33436	431763	240811	171044	329514	376975	114122

Source: CSO, Census 2016; Small Area Population Statistics 2016.

The growth in population within Meath and Navan and local environs has the potential to increase the cohort of people in work within the county. In 2016, the total population documented in the Census as “at work” in the state was 2,006,641; of this 12,920 of the people living within Navan and local environs were documented as “at work”. The proportion of the labour force unemployed within Navan and local environs in 2016 was approximately 15%. Table 6-6 shows that people working in managerial or technical positions comprised the largest category of social class within this area. This trend is similar to that observed at both a county and state level.

The Economic Development Strategy for County Meath 2014-2022 aims to achieve a predicted level of employment growth by 2022. This includes the addition of 7,500 jobs and includes broadening Meath’s economic base through diversification and the growth of indigenous and foreign enterprises. It is evident from the MCDP 2013-2019 that the county is working towards becoming a key economic driver within the Greater Dublin Area and strives to strengthen and diversify opportunities in both rural and urban areas through strengthening existing economic opportunities and through diversification to widen Meath’s economic base (MCC, 2013).

Table 6-6 Social Class (Census 2016)

	Professional	Managerial/ Technical	Non - Manual	Skilled	Semi - skilled	Un - skilled	Other
Navan Rural	1779	7661	5301	4851	3343	1015	4167
Navan Urban	137	682	560	625	600	187	828
Navan and Local Environs	1916	8343	5861	5476	3943	1202	4995
Co. Meath	14,937	59,428	35,914	31,769	20,155	7,084	25,757
State	386,648	1,336,896	837,145	671,890	501,103	170,391	857,792

Source: CSO, Census 2016; Small Area Population Statistics 2016.

The main areas of employment in Navan and local environs are located within Navan Town. Some of the largest employers within the town include, MCC, Tara Mines, and the businesses within the IDA Business Park on the eastern edge of Navan. Many of the population resident in Navan and local environs commute to locations outside of the area for employment; this is indicated by the time it takes to travel for work or school outlined in Table 6-7. The data show that over 23% of people resident in Navan and local environs commute for over 45 minutes to get to their place of work, school or college. This figure is similar to that observed for County Meath as a whole (>22%) but higher than that observed at a state level (14%). This demonstrates the draw from Navan and local environs and County Meath as a whole to Dublin City and other towns for employment and highlights the importance of infrastructure relevant to commuters.

Table 6-7 Travel Time to Work, School or College (Census 2016)

	Under 15 mins	15-29 mins	30-44 mins	45-60 mins	1-1 ½ hours	>1 ½ hours	Not Stated
Navan Rural	5795	4805	2624	1501	1952	780	121

	Under 15 mins	15-29 mins	30-44 mins	45-60 mins	1-1½ hours	>1½ hours	Not Stated
Navan Urban	740	488	259	123	186	96	209
Navan and Local Environs	6535	5293	2883	1624	2138	876	330
Co. Meath	39,464	30,434	21,010	10,340	13,886	4,775	7,714
State	956,370	853,885	511,843	174,254	179,233	67,066	219,899

Source: CSO, Census 2016; Small Area Population Statistics 2016.

NLTP 2014-2019 highlights Navan as a car oriented town. This is also revealed in Table 6-8, which shows the mode of transport most commonly used for travel to work, school and college is by private vehicle and as a passenger within a private vehicle. Within Navan and local environs 66.6% of the population travel by private vehicle as a passenger within a private vehicle, this is slightly lower to that observed at a county level (69%) and slightly higher than at a state level (64%). Journeys that occur by foot by the population within Navan and local environs is higher than that observed at a county or state level, 19% of the population in Navan and local environs travel by foot compared to 12.8% for Meath County and 14.4% at state level. This may reflect the short distance between some residential areas to the town centre or locations of work or education.

The portion of the population using bicycles as their mode of transport is similar between Navan Rural and urban (approximately 1.3%), this is higher than that observed within county Meath as a whole (0.9%) but lower than that observed at a state level (2.8%). This is likely influenced by limited dedicated cycle networks within Navan at present, however plans are set out within The GDA, Cycle Network Plan for improvements to cycle facilities within Navan and the surrounding environ. The Proposed Road Development also includes plans for additional pedestrian and cyclist facilities along the mainline of the development.

It is noteworthy that the MCDP 2013-2019 looks to "*develop Navan as a national cycling hub town on the National Cycling Network and a significant hub in the Boyne Valley for Cycling and Walking* (MCC, 2013)." In addition, the council is keen to promote Navan as a primary centre of employment in the county, creating employment opportunities within easy distance of the populations' homes with the intention of reducing levels of commuting in the area.

Table 6-8 Travel Mode to Work, School or College (Census 2016)

	Foot	Bicycle	Bus or Coach	Train	Car / Van Driver	Car Passenger	Other	Not Stated	Total
Navan Rural	3315	247	1661	49	8538	4106	55	607	18578
Navan Urban	612	29	185	6	865	267	8	129	2101
Navan and Local Environs	3927	276	1846	55	9403	4373	63	736	20679
Co. Meath	16,377	1,133	14,972	1,943	63,210	24,808	878	4,302	127,623
State	426,221	82,123	313,097	82,627	1,330,751	570,254	20,482	136,995	2,962,550

Source: CSO, Census 2016; Small Area Population Statistics 2016.

6.4.3.2 Health

The MCDP 2013-2019 sets out a list of core principles, one of which is particularly relevant to the Proposed Road Development in the context of health and wellbeing: "*Core Principle 2: To facilitate the development of sustainable and socially inclusive communities which generate pride, a sense of place, and a healthy lifestyle; are safe, well connected, well served, environmentally sensitive, thriving and well designed*" (MCC, 2013).

The proportion of the population reporting 'bad or very bad' health was lower in Navan and environs (1.4%) and at a county level (Meath 1.2%) than at a national level (1.6%). The proportion of the population reporting 'very good or good' health was higher in Navan and Environs (89%) and at a county level (Meath 89.6%) than documented at state level (87%). At an electoral division level those reporting 'very good or good' health was lower in Navan Urban (82.5%) than observed at a county or state level (County Level (Meath) 89.6%, state level 87%).

Table 6-9 General Health Profile of the Population (Census 2016)

	Very Good	Good	Fair	Bad	Very Bad	Not Stated
Navan Rural	17715	7550	1826	306	57	663
Navan Urban	1721	1266	387	87	9	149
Co. Meath	123170	51649	13037	2019	395	4774
State	2827544	1316467	382905	62697	13738	158514

Source: CSO, Census 2016; Small Area Population Statistics 2016.

Health Profile

Data are released at the national and county level depicting the health profile of an area using various metrics. The data released by the Department of Health with the '*Health in Ireland Key trends 2018'* report (Department of Health, 2018) provides summary statistics on health and health care over the past ten years on selected trends and topics at a national level. The report identified that transport accident mortality rates have fallen by 43% between 2008 and 2017. The overall mortality rate has reduced by 14.9% since 2008. This increase in life expectancy is due to significant reductions in major causes of death from stroke (-39%), breast cancer (-16%), suicide (-26%) and pneumonia (-39%). There have been improvements seen in survival rates from breast, cervical, colon and rectal cancer in the last 15 years.

The Health Service Executive (HSE) also publishes health profiles at a regional level, the most relevant of which is for Meath where the Proposed Road Development is located.

In addition, the CSO publishes the Irish Health Survey, which presents health data for Ireland as a whole, as well as a breakdown by regions (the Mid-East being where the Proposed Road Development is located). Key health indicators are outlined for Meath (and the Mid-East where relevant) below:

- Birth and infancy:
  - The birth rate in Meath equates to 17.2 births per 1,000 residents, which is slightly above the national average (15.8).
  - Birth rates in women aged 20 years or younger in Meath are 9.1 per 1,000 residents, slightly below the national average (12.3).
  - Breastfeeding rates are almost identical for Meath (46.5) and national average (46.6) per 1,000 residents.
  - The neonatal mortality rate in Meath is 3.4 per 1,000 residents, slightly above the national average (2.7).
  - The infant mortality rate in Meath (4.7 per 1,000 residents) is also slightly higher than the national average (3.5).
- Mental health:
  - The Ireland Health Survey, released in 2015, shows that within the Mid-East, rates of depression are broadly in line with the national average. Rates of depression are the same at both the regional and national levels, with 3% residents recorded as suffering from severe depression, 5% from moderate depression, and 18% from mild depression.
  - In-patient admission mental health admissions are lower in Meath (272.6 per 100,000 residents) than at the national level (413.9 per 100,000 residents).
- Cancer: The cancer mortality rate for Meath residents equates to 159.4 per 100,000 residents. This rate is somewhat lower than the Irish average, which is equivalent to 175.6 per 100,000 residents.
- Deaths from heart disease and stroke: Deaths as a result of heart disease and stoke are somewhat lower in Meath (162.6 per 100,000 residents) compared to national average (182.2 per 100,000 residents).
- Deaths from respiratory disease: Deaths as a result of respiratory disease are slightly lower in Meath (60.5 per 100,000 residents) than it is for Ireland on average (64.9 per 100,000 residents).
- Smoking and alcohol intake:

  - The Ireland Health Survey shows that in the Mid-East region and within Ireland as a whole, 15% of residents aged over 15 years old smoke daily.
  - In the Mid-East region, 52% of the population aged 15 years and over drink alcohol at least once a week, in line with the national average (53%).
  - The proportion of Mid-East residents aged 15 years and over drinking six units or more of alcohol per week is slightly lower (13%) than for Ireland as a whole (16%).
- Obesity: The Ireland Heath Survey notes that BMI rates are broadly similar at Mid-East and country wide levels: 33% of the Mid-East population aged 15 years or older are considered as overweight (against 35% at the national level), and 20% as obese (against 18% at the national level).

6.4.3.3 Future Baseline

A planning search of granted and pending planning applications made within the vicinity of the site (approx. 200 m of the Proposed Road Development site boundary) within the last five years was completed by consulting, the myplan website. The relevant planning applications and outcomes are listed in Table 6-10. Withdrawn and incomplete planning applications were not included.

Table 6-10 Planning Applications made within the Vicinity of the Proposed Road Development site

Planning Reference Number	Development Address	Brief Development Description	Grant Date
NA181543	Moathill Navan Co. Meath	The proposed development will consist of the demolition of an existing vacant single storey dwelling and associated shed (total c.165.7sqm) and the construction of 74 no. apartment units in 2 no. 5 storey blocks over partial basement with combined gross floor area of c.7308.3 sqm (excluding c. 405sqm basement) and a maximum overall height of c. 17m OD. The proposed apartments will include 13 no. 1 bed units, 60 no. 2 bed units, and 1 no. 3 bed unit; associated plant; landscaped public open space; 95 no. car parking spaces; 86 no. bicycle spaces; 2 no. bin stores; ESB Substation; drainage arrangements; 3 no pedestrian access/egress onto footpaths along the N51 and R147; and associated boundary treatments and site development works, vehicular access to the proposed development will be through the residential scheme permitted on lands to the south of the subject site (Reg Ref: NA151301)	July 2019
NA171476	Balmoral Estate, Kells Road, Navan, Co. Meath	Demolition of existing single and two storey warehouse buildings; Construction of a 6 no. storey mixed use building over basemen: Provision of a discount food store at ground floor level to include all ancillary areas; provision of a 135 sq.m retail unit at first floor level (south) and c. 5,412 sq.m of office/medical floor space from first to fifth floors; landscaped surface car park (90 no. car parking spaces, 70 no. bicycle parking spaces, goods delivery/reception area; provision of a basement car park to serve the medical/office uses; reconfiguration of internal road and provision of ramp to basement of proposed development; Upgrades to the existing footpath along Kells Road and provision of a landscape plaza area at the junction of the Kells Road and the existing access road to Balmoral Industrial Estate; provision of 7 sq. m of illuminated signage located on the northern and eastern elevation; all associated and ancillary site development and landscaping works.	
NA180163	Balmoral Estate, Kells Road, Navan, Co. Meath	The upgrading, reconfiguration and change of use of existing car showroom and retail units to provide for 2 no. car showrooms (781 sq.m), workshop (563 sq.m.), parts store (150 sq.m.) and ancillary staff facilities and public toilet (109 sq.m.) The proposed development will also include: 2 no. free standing double sided signs, upgrades to the existing signage and shopfronts including new glazing and cladding, reconfiguration of the existing car park and yard to provide for 92 no. car parking spaces, concrete paved forecourt area and reconfiguration of internal road. The proposed development includes all engineering works, landscaping works, boundary treatments and site development works on the approx. 0.70 hectare site.	

Planning Reference Number	Development Address	Brief Development Description	Grant Date
NA151301	Moathill, Navan, Co. Meath	The proposed development will consist of 99 no. residential units comprising 32 no. duplex/apartments and 67 no. 2 storey detached and semi-detached houses. The development will also include, a 2 storey crèche with play area, bin shelters, bicycle parking and car parking spaces, 2 no. landscaped public open spaces, a footpath and cycleway along the N51 National Road, a new vehicular access from the N51 National Road and associated revised junction layout, and all associated site and drainage works.	June 2016
NA160363	Windtown, Navan, Co. Meath	The proposed development will consist of a new single storey support services building with car parking, connect to existing entrance to public road and connect to existing mains water, mains sewerage and surface water with ancillary site works.	July 2016
NA161020	Ratholdron Old, Abbeyland, Navan Co. Meath	Construction of 6 no. dwelling houses consisting of 3 no. semi-detached blocks, connection to public water main, public sewer and associated site development and ancillary works including development of a vehicular entrance and service road, open space provision, all landscaping works, site boundary treatment and associated drainage works. Significant further information/revised plans submitted on this application	April 2017
NA171232	Nevinstown, Navan, Co. Meath	Ore reserves will be mined sequentially over the lifetime of the operation. The resultant tailings waste will be accommodated in the existing tailings facility. Mining will follow a cyclic pattern resulting in the removal of ore from underground, hoisting to surface for processing followed by the filling of the extraction voids using cemented backfill. The surface characteristics and features of the Nevinstown townland will not be altered by mining activity. There will be no additional above ground structure/infrastructure associated with the development.	October 2018
NA150427	Blackwater Retail Park, Navan, Co. Meath	The proposed development will consist of the construction of a single storey Coffee Shop and a single storey Drive Thru Restaurant including associated Drive Thru Lane, external yard and bin store. The proposed development also includes signage on the elevations of the building, external seating areas, minor alterations to the existing carpark, alterations to the eastern boundary and all ancillary site development site services and hard and soft landscaping works.	August 2015
NA140992	St. Patrick's Classical School, Moatlands (Kells Road), Navan Co. Meath.	The development will consist of the demolition of part of existing structure and construction of a fully serviced single storey extension to the existing school containing 1 no. woodwork room together with ancillary stores, plant, circulation space and associated works	February 2015
NA140993	St. Patrick's Classical School, Moatlands (Kells Road), Navan Co. Meath	The development will consist of the demolition of part of existing structure and construction of a fully serviced 2 storey extension to the existing school containing 1 no. music/drama room and 1 no. science laboratory and preparation room together with ancillary stairs, stores, circulation spaces and associated works	February 2015

Source: www.myplan.ie

Table 6-11 Part 8 Planning Applications made within the Vicinity of the Proposed Road Development site

Planning Reference Number	Development Address	Brief Development Description
P8/19005	Blackwater Park, Windtown Road, Navan, Co. Meath	The construction of single storey changing room facilities comprising of office area, 2 no. changing rooms, separate male, female & disabled toilets and 2 no. store rooms. One part of the building is plastered externally while the other part has facing brick finish. Roof is finish in tapered zip-lock aluminium standing seam roofing sheets.
P8/18012 *	Blackwater Park, Navan, Co. Meath	The development will consist of installation of lighting around the existing looped walkway and within the carpark at Blackwater Park, Navan, Co.

Planning Reference Number	Development Address	Brief Development Description
		Meath. The proposed lighting columns consist of 6 No. 7M columns and 44 No. 6M columns. The columns are standard galvanised public lighting columns. Works will also include associated ducting and foundations for lighting columns.
P8/13007 and P8/13008	Navan	Shared pedestrian and cycle greenway facility along the disused Navan to Kingscourt rail line. The proposed greenway facility commences at Blackwater Park, Ratholdron Road, Navan and terminates at Kingscourt, Co. Cavan. The existing rail line commences in the administrative area of Meath County Council at Simonstown, Navan and continues as far as the townland of Boynagh, south of Kingscourt.

** Part 8 Planning Applications identified during the planning search that it has been fully built at the time of submitting the EIAR.*

6.4.4 Summary

As already noted above Navan is a compact town, is the largest urban centre in County Meath and is a main service centre for the town's population and surrounding environ. The River Boyne and the River Blackwater traverse Navan Town, and this in conjunction with areas of greenfield create severance to residential areas and amenities north of the town. Due to the layout of the town and constraints of the rivers, there are few cross-town routes. This results in traffic congestion at points on the road network in proximity to bridge crossings over both the River Boyne and the River Blackwater.

As highlighted by the CSO data above, the population in Navan and the surrounding environ is a youthful population that is increasing and is projected to increase further. It is likely that traffic congestion will increase at points on the road network within Navan if the town's population increased as predicted. As such it is important to consider potentially high traffic volumes that could occur into the future in combination with restrictions in connectivity between the north and south of the River Blackwater. High traffic volumes can be of particular hindrance to vulnerable subsets of the population such as children, the elderly and the people with disabilities. An increase in population will also potentially increase the requirement for greater connection throughout Navan and the surrounding environs and highlights the requirement for additional modes of transport such as cycle and pedestrian facilities.

The NDP 2009-2015 looks to improve connectivity through the transportation network, and to improve facilities for sustainable transport modes such as walking and cycling. The creation of a more connected town and accommodation of additional modes of transport will be required to fulfil some of the objective set out in regional and local strategy's and plans. Chapter 7: Infrastructure of the NDP 2009-2015 considers in relation to the construction of the Proposed Road Development "*This road will improve access to lands in the north of the town between the Ratholdron Road and the Kells Road including Clonmagaddan SDZ. It will also reduce traffic congestion at the Round'O junction and in the Town Centre."* The NLTP 2014-2019 also notes the capacity of the N51 between Ratholdron Road and the R147 as a potential constraint to the development of north Navan and considers the Proposed Road Development necessary to facilitate the planned growth in this area (Section 6.3 of the NDP 2009-2015).

6.5 Assessment of Impacts

6.5.1 Introduction

The Proposed Road Development will provide a multimodal link for cyclists, pedestrians and traffic and will also provide access to lands in the north of Navan town that currently experience a degree of severance. In addition, the Proposed Road Development will further provide a corridor between the north of Navan and the M3 motorway, reducing congestion to the Round'O junction and the town centre. This will improve the segregation of regional through-traffic and locally generated trips from across Navan town.

The Proposed Road Development is expected to decrease the volume of traffic on the existing N51 corridor through the town centre, as traffic is transferred onto the Proposed Road Development, then onto Clonmagadden Road, bypassing Navan Town Centre.

Provision for NMUs has been incorporated into the design of the Proposed Road Development.

Provisions for NMUs include:

- Two new signalised junctions at the scheme termination points, L3409 Ratholdron Road and R147 / N51 Kells Road, both incorporating right turn lane and pedestrian/cycle crossings;
- Pedestrian and cycle facilities, including 2 accesses to the Blackwater Park;
- One single span river bridge over the River Blackwater.

The potential community effects and potential severance effects resulting from the Proposed Road Development are considered below. Effects are considered during both the construction and operation phase.

6.5.2 Construction Phase

Information regarding the potential effects on Air Quality is covered in Chapter 10, Climate in Chapter 16, Noise and Vibration in Chapter 11, Traffic Analysis in Chapter 5, Landscape and Visual in Chapter 12 and Material Assets in Chapter 14. Health determinants are addressed with the HIA (Appendix A6-1 contained in Volume 4).

6.5.2.1 Journey Characteristics

In general, the Proposed Road Development traverses a greenfield site of agricultural lands. The Traffic Analysis (Chapter 5) expects the Proposed Road Development can be constructed without significant effects on the existing road network. However, there are likely to be traffic management impacts during the construction of the side road realignments and the at-grade junctions. It is expected that any effects to journey characteristics during the construction phase would be at a local scale and would be temporary to short term in duration.

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. All temporary diversions, 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).

6.5.2.2 Amenity

The general amenity at local residential properties at Blackwater Park estate will potentially be affected by regular construction works and the demolition of the OPW building. Further assessment of this residential area is considered in Chapter 10 (Air Quality), Chapter 11 (Noise and Vibration), and Chapter 12 (Landscape and Visual).

Construction plant and traffic will potentially distract motorised and non-motorised uses from available amenity views at the junctions at the Ratholdron Road and Clonmadden Road, and at the N51 and existing R147. Any effects experienced will be restricted to a local scale and will be temporary and short term in nature.

Overall it is expected the construction phase of the Proposed Road Development will have a short-term negative effect on the amenity of motorised and NMUs of existing junctions within the Proposed Road Development boundary.

6.5.2.3 Severance

During construction, temporary severance issues may occur due to disruption to existing road usage. It is anticipated that diversions or other relevant access points will be provided where temporary closures are required. All temporary diversions, 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).

There will be severance of an access track located in proximity to the proposed junction on Ratholdron Road; however, provisions have been included during the design phase to realign this access route, maintaining access via a slight detour; this has the potential to have a neutral effect on users of the access track.

The traffic management plans and diversions to be implemented at the interface between the works and traffic will be the contractor's responsibility. Issues relating to temporary closures of roads and PRoWs will be defined in the TMP produced by selected contractors.

The main alignment of the Proposed Road Development will traverse through an area of greenfield between the Navan and Kingscourt rail line and Blackwater Community Park. Some permanent loss of land will occur on the western extent of Blackwater Community Park, equating to approximately 1.76 ha which is 6.5% of the total area of the park (total size of Blackwater Park 27.2 ha). In addition, temporary land take to facilitate the construction of the earth bund and pedestrian connection between the Proposed Road Development and the existing park will be 0.75ha. This section of the park is accessible through informal pathways and is sometimes used by dog walkers and runners who go off the sealed walkway and onto the outer unsealed walkway. Other land uses where temporary and / or permanent loss of land is expected to occur include Public Road, Recreational Road, Commercial Property, Agricultural Land and Private Access (further information is available in Section 4.10 of Chapter 4 (Description of the Proposed Road Development) and Chapter 14 (Material Assets) of this document).

Overall it is expected the construction phase of the Proposed Road Development will have a short-term negative effect on severance however additional access is proposed and the use of Blackwater Community Park will continue throughout the construction phase, as such no access restrictions are expected.

6.5.2.4 Population

The construction phase of the Proposed Road Development is unlikely to have any direct effects on the population of Navan and its surrounding environ. Given the size, nature and duration of construction of the Proposed Road Development it is expected the workforce required for construction will predominantly travel within County Meath to the construction site. The accessibility of the site for commuting is likely to mean that the potential workforce will commute to the Proposed Road Development site.

Overall it is expected the construction phase of the Proposed Road Development will have a neutral effect on population of Navan and the surrounding environs.

6.5.2.5 Employment

Given the size, nature and duration of construction of the Proposed Road Development the construction phase of the Proposed Road Development will potentially create small scale temporary employment within the surrounding area.

Overall the construction phase of the Proposed Road Development has the potential to have a short term neutral to positive effect on employment.

6.5.2.6 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 are expected to result in some temporary residual air quality, noise and neighbourhood amenity impacts, which have the potential to affect physical and mental health. The closest receptors to any construction-related activity would be Blackwater Park and residential/commercial properties located on streets adjacent to the periphery of the works area to the north and south. Given the likely methods of work, scale and materials involved in the construction phase, it is considered that with good site practice, impacts from construction works would be managed to an acceptable level.

Changes in access to services, community facilities, open space and recreation facilities have the potential to affect health and wellbeing by impacting on community welfare, cohesion, mental health and physical activity. During construction, the Proposed Road Development will result in some temporary closures and/or diversions of some main roads and Non-Motorised User routes. However, it is expected that diversions/other relevant access points are to be provided.

Material Assists (Chapter 14) evaluates the potential impacts of the Proposed Road Development on economic assets such as the electricity network, telecommunications, gas distribution and water supply amongst others. Chapter 14 identified some infrastructure works are required as part of the Proposed Road Development. The provision for new overhead electricity lines and cables, which could result in a suspension of services during construction and diversion works, transfer existing cables to new poles or underground ducts where conflicts occur, could potentially disrupt telecom services in the local area. Additionally, water supply could be suspended temporarily during excavation works for realignment at the proposed north and south junction. However, utility service suspensions were identified to be temporary and residual effects considered imperceptible. Disruption to electricity, gas, telecommunications, clean water supply and drainage have the potential to impact on the physical and mental health of a population. However, as the service suspensions are likely to temporary the effect on human health is likely to be neutral.

Major accidents and disasters (MADs) can result in illness, injury or loss of life to a population either directly or indirectly. Chapter 15 (Major Accidents and Disasters) has considered a number of potential accidents and disasters that could result from or affect the Proposed Road Development. These included flood events, air quality events, utilities failure, and major transport accidents. It was concluded that no major accident and disaster risks were identified that would require additional consideration within the EIAR. The consideration of embedded measures and compliance with legislation and best practices has demonstrated that the risks associated with MADs in the context of the Proposed Road Development are sufficient for all risks.

Overall it is expected the construction phase of the Proposed Road Development will have a neutral effect on health.

6.5.3 Operation Phase

Information regarding the potential effects on Air Quality is covered in Chapter 10, Climate in Chapter 16, Noise and Vibration in Chapter 11, Traffic Analysis in Chapter 5, Landscape and Visual in Chapter 12 and Material Assets in Chapter 14. Health Determinants are addressed with the HIA (Appendix A6-1).

6.5.3.1 Journey Characteristics

The Traffic Analysis (Chapter 05) identified the implementation of the Proposed Road Development will cause a significant decrease in AADT on the N51 Kells Road, the N51 section crossing the River Blackwater, the Ratholdron Road north of Ratholdron Road / N51 junction, and the R162 north of R162 / N51 junction and an increase on the Clonmagadden Road as it joins directly to the Proposed Road Development.

The Proposed Road Development is expected to substantially decrease the volume of traffic on the existing N51 corridor through the town centre, as traffic is transferred onto the Proposed Road Development, then onto Clonmagadden Road, bypassing Navan Town Centre.

The Proposed Road Development is also expected to reduce network travel time, traffic volumes, and associated congestion, in the proximity of the town centre, potentially creating a more attractive, safer town centre for vulnerable road users and improved accessibility to local services and businesses.

Overall the Proposed Road Development has the potential to have a positive effect on journey characteristics.

6.5.3.2 Amenity

During operation the Proposed Road Development will be of amenity benefit due to the provision of a pedestrian footpath and a cycle track on both sides of the carriageway. The addition of new pedestrian footpaths and cycle tracks along the mainline of the Proposed Road Development will improve connectivity and will also potentially provide a safer and more pleasant journey for motorised and NMUs. The pedestrian footpaths and cycle facilities have the potential to encourage greater pedestrian and cycle activity, this in turn could have knock on effects of the health profile of the local community. The pedestrian footpaths and cycle tracks will also provide additional access to Blackwater Community Park. This has the potential to have a long term, positive effect on users of the Proposed Road Development.

Effects of a visual nature on Blackwater Park residents have been considered in Chapter 12 (Landscape and Visual), while Noise and Vibration effects are addressed in Chapter 11.

6.5.3.3 Severance

During operation all existing footpath routes will be maintained and additional footpaths and cycle tracks have been incorporated into the design of the mainline of the Proposed Road Development. The addition of footpaths and cycle tracks along the proposed mainline will provide an additional crossing over the Blackwater River and will potentially increase connectivity between Navan town, St Patricks Classical School, residential areas such as Blackwater Park residential area, Dean Cogan Place and a number of areas north of the River Blackwater, as well as community facilities north of the River Blackwater such as Blackwater Community Park. The Proposed Road Development will also include an additional motorised and non-motorised user crossing point of the Blackwater River as well as additional pedestrian crossings, providing supplementary access points to the existing Blackwater Community Park. The additional crossing over the River Blackwater and provision of cyclist and pedestrian facilities provided by the Proposed Road Development has potential to have a long term, positive effect on users of the Proposed Road Development.

6.5.3.4 Population

The operational phase of the Proposed Road Development is considered unlikely to have a direct effect on population. The Proposed Road Development will indirectly facilitate access to zoned lands for residential development to the west of the Proposed Road Development as outlined within the NDP 2009-2015. The Proposed Road Development will also facilitate connectivity between existing residential areas north and south of the River Blackwater and between Navan town and the northern extremity of the town. This has the potential to have a slight, positive, indirect effect on the local population.

6.5.3.5 Employment

There will be no direct increase in employment resulting from the operation of the Proposed Road Development. The Proposed Road Development will provide indirect access to areas zoned for enterprise and employment within the NDP 2009-2015 and will increase connectivity between lands in the north of Navan and Navan town. This has the potential to have a slight, positive, indirect effect on the local population.

6.5.3.6 Health

According to the World Health Organisation (WHO) green urban areas including spaces such as parks and sports fields, woodlands and natural meadows physical activity and relaxation, form a refuge from noise, provide safe routes for walking and cycling for transport purposes as well as sites for physical activity, social interaction and for recreation and are important for mental health[1]. Urban green areas provide many public health benefits through diverse pathways, such as psychological relaxation and stress reduction, enhanced physical activity, and mitigation of exposure to air pollution, excessive heat, and noise as well as other harmful factors in the urban environment(WHO 2016). Urban environments that are aesthetically pleasing and landscaped have been shown to encourage people to explore and access their local community by foot or bicycle when compared to the same urban space prior to renovations. Urban environments that lack public gathering places have also been found to encourage sedentary living habits.

During operation, the Proposed Road Development will provide public footpaths and cycle tracks which will likely encourage walking and cycling. These facilities will provide links to surrounding residential areas and existing leisure routes, which in turn promotes active and healthy lifestyles. They will provide important links for sustainable travel to surrounding residential areas and existing leisure routes. In addition, the reduction in through-traffic in the surrounding areas as a result of the Proposed Road Development will likely enable the better freedom of movement for pedestrians. This will likely result in a positive effect on population and human health by encouraging more people to access the area by foot or by bicycle which potentially resulting in increased physical activity of the local population.

The Proposed Road Development is likely to decrease the volume of traffic on the existing N51 corridor through the town centre, as traffic is transferred onto the Proposed Road Development. The improved traffic flows would be expected to improve air quality and reduce noise and neighbourhood amenity impacts in the town centre.

As set out in Chapter 11: Noise and Vibration, the NRA 2004 Guidelines has set a recommended target criterion for road traffic noise from all national road schemes of 60dB L_{den} (free field). The criterion applies to existing noise receptors in both the opening and design year (15 years after opening of the Proposed Road Development). The guidelines requires road noise traffic levels impacts to be assessed in terms of the L_{den} indicator, which is that used for the assessment and management of environmental noise in accordance with the Environmental Noise Directive, 2002/49/EC. L_{den} is the 24 hour average noise level with a 10 dB penalty added to the night-time levels between 2200 and 0700 hours and a 5 dB penalty added to the evening levels between 1900 and 2200 hours to reflect people's extra sensitivity to noise during the night and the evening.

Mitigation measures are only deemed necessary when the following three conditions are satisfied at sensitive receptors in either opening or future years:

a. the combined expected maximum traffic noise level, i.e. the relevant noise level, from the Proposed Road Development together with other traffic in the vicinity is greater than the design goal;

b. the relevant noise level is at least 1dB more than the expected traffic noise level without the Proposed Road Development in place;

c. the contribution to the increase in the relevant noise level from the Proposed Road Development is at least 1dB.

Two residential properties were predicted to exceed the NRA’s design criteria prior to mitigation; however, the use of low noise road surfacing materials and the installation of a noise barrier will result in these residential receptors complying with the aforementioned criteria. An assessment of air quality and noise is presented in Chapters 10 and 11.

MADs can result in illness, injury or loss of life to a population either directly or indirectly. Chapter 15 (Major Accidents and Disasters) has considered a number of potential accidents and disasters that could result from or affect the Proposed Road Development. These included flood events, air quality events, utilities failure, and major transport accidents. It was concluded that no major accident and disaster risks were identified that would require

[1] https://www.who.int/sustainable-development/cities/health-risks/urban-green-space/en/

additional consideration within the EIAR. The consideration of embedded measures and compliance with legislation and best practices has demonstrated that the risks associated with MADs in the context of the Proposed Road Development are sufficient for all risks.

A HIA considering the potential consequences for health and wellbeing from the construction and operation of the Proposed Road Development is presented in Appendix A6-1.

Overall it is expected the Proposed Road Development will have a positive medium to long term effect on health.

6.6 Mitigation and Monitoring Measures

Mitigation measure during construction should include:

- Clear signage of any temporarily diversions to existing motorised and non-motorised routes (including pedestrians and cyclists);
- Maintain access for NMUs to community assets with minimal disruption as far as is possible, where diversion are required NMUs should be considered and facilitated to continue their journey with minimal disruption as far as possible. This should include provisions for vulnerable NMUs such as the elderly and school children;
- Road surfaces in the proximity of the construction site are to be kept clear of mud and debris as much as is possible; and
- Road closures and restrictions should be planned in agreement with the appropriate stakeholders.

Mitigation measure during operation should include;

- Landscape mitigation planting should be as outlined within Chapter 12 (Landscape and Visual Impact Assessment);
- Route uncertainty should be minimised as much as is possible by the provision of appropriate signage designed and sited in accordance with appropriate standards;
- Surface water runoff is to be managed appropriately in accordance with best practice standards;

The impacts of the Proposed Road Development on humans from Chapter 5 (Traffic Analysis), Chapter 10 (Air Quality), Chapter 11 (Noise and Vibration), and Chapter 12 (Landscape and Visual), and their respective mitigation measures, are addressed in detail in their respective sections.

6.7 Cumulative Impacts

A planning search of granted and pending planning applications made within the vicinity of the site (approx. 200 m of the Proposed Road Development) within the last five years is presented herein. If the construction of housing development is occurring when the Proposed Road Development is under construction there is potential for cumulative impacts such as impacts on dust, noise and air quality.

Cumulative interactions occur between this section, Chapter 5 (Traffic Analysis), Chapter 10 (Air Quality), Chapter 11 (Noise and Vibration), and Chapter 12 (Landscape and Visual).

6.8 Residual Impacts

6.8.1 Construction Phase

No change in effect is anticipated during the construction phase given the nature of the predicted temporary impacts, their localised nature and mitigation measures usually implemented through the CEMP. Mitigation measures such as traffic control, road cleaning and signage are likely to reduce construction phase impacts.

6.8.2 Operation Phase

The Proposed Road Development will potentially have a net positive effect on the surrounding community. The Proposed Road Development will likely reduce traffic volumes within Navan and at points of traffic congestion on the existing network at crossings of the River Blackwater, potentially improving journey amenity and characteristics for drivers and NMUs. There is also the potential for improvement in general amenity for motorised and NMUs and a reduction in severance between Navan town and areas north of the River Blackwater. 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 town and surrounding environs. This also has the potential to indirectly improve physical exercise and health in environs surrounding the Proposed Road Development.

The additional bridge crossing over the River Blackwater has the potential to improve connectivity between lands north and south of the River Blackwater making community facilities north of the River Blackwater more easily accessible. This improved connectivity will in turn potentially facilitate greater social interaction resulting from new connections between residential areas north and south of the River Blackwater.

6.9 Difficulties Encountered

No significant difficulties were encountered when compiling information for this section. It should be considered however; three years have now passed since the last census (2016).

6.10 Summary

One of the core principles of the MCDP 2013-2019 is to facilitate inclusive communities that are safe, well connected, well served and well-designed MCC (2013). An obligation of the NLTP 2014-2019 is to provide for a new pedestrian and cycle bridge over the River Blackwater, providing a connection between local schools and Blackwater Park.

The Proposed Road Development contains provisions of potential benefit to NMUs such as, one single span river bridge over the River Blackwater, pedestrian and cycle facilities, including 2 accesses to the Blackwater Park, two new signalised junctions at the scheme termination points, L3409 Ratholdron Road and R147 / N51 Kells Road, both incorporating pedestrian/cycle crossings and provides connectivity between areas north and south of the River Blackwater.

During operation, there will be increased connectivity between areas north and south of the River Blackwater. This could potentially increase use of community facilities north of the River Blackwater in proximity to the Proposed Road Development and could potentially have a positive indirect effect on connectivity, and public health. Connectivity will be increased between areas such as Navan town, St Patricks Classical School, residential areas such as Blackwater Park residential area, and community facilities north of the River Blackwater such as Blackwater Community Park and the Aura Leisure Centre.

It can be seen from the census data included herein that the health of the population in Navan and its local environs is considered to be ‘very good’. The addition of pedestrian and cyclist facilities within the design of the Proposed Road Development will potentially encourage the use of additional travel modes with potential positive knock on effects for the heath profile of the local population.

The Proposed Road Development and the associated pedestrian and cyclist provisions are in line with principles and obligations set out with the MCDP 2013-2019, NDP 2009-2015 and the NLTP 2014-2019.

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 short term in nature. Overall it is considered the Proposed Road Development will have a net positive effect.

A HIA considering the potential consequences for health and wellbeing from the construction and operation of the Proposed Road Development is presented in Appendix A6-1.

6.11 References

- CSO. (nd). Census (2011), *Small Area Population Statistics Sapmap*. Central Statistics Office [Online]. Available at: http://census.cso.ie/sapmap_2011/ [Accessed August 2018].
- CSO. (nd). Census (2016), *Small Area Population Statistics Sapmap*. Central Statistics Office [Online]. Available at: http://census.cso.ie/sapmap/ [Accessed August 2018].
- CSO. (nd). Census (2016), *Sapmap Area: Electoral Division Navan Rural* [Online]. Available at http://census.cso.ie/sapmap2016/Results.aspx?Geog_Type=ED3409&Geog_Code=2AE19629189213A3E055000000000001 [Accessed August 2018].

- CSO. (nd). Census (2016), *Sapmap Area: Electoral Division Navan Urban,* Central Statistics Office [Online]. Available at http://census.cso.ie/sapmap2016/Results.aspx?Geog_Type=ED3409&Geog_Code=2AE19629189313A3E055000000000001 [Accessed August 2018].
- CSO. (nd). Census (2016) *Sapmap Area: County Meath,* Central Statistics Office [Online] Available at http://census.cso.ie/sapmap2016/Results.aspx?Geog_Type=CTY31&Geog_Code=2AE19629149413A3E055000000000001 [Accessed August 2018].
- CSO. (nd). Census (2016) *Sapmap Area: State,* Central Statistics Office [Online] Available at http://census.cso.ie/sapmap2016/Results.aspx?Geog_Type=S&Geog_Code=S [Accessed August 2018].
- Department of Health (2018). *Health in Ireland, Key Trends 2018*. Prepared by the Government of Ireland, Department of Health. Available on line at https://assets.gov.ie/9441/e5c5417ee4c544b384c262f99da77122.pdf
- EPA, (2002). *EPA Guidelines on the information to be contained in Environmental Impact Statements*; (March 2002); Environmental Protection Agency, Wexford, Ireland.
- EPA, (2017). *Guidelines on the information to be contained in Environmental Impact Assessment Reports*; (Draft August 2017); Environmental Protection Agency, Wexford, Ireland.
- NTA. (2013). *Greater Dublin Area Cycle Network Plan (December 2013*). National Transport Authority. Available online at https://www.nationaltransport.ie/publications/transport-planning/gda-cycle-network-plan/ [Accessed August 2018].
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, Meath, Ireland.
- MCC (2013). *Meath County Development Plan (2013-2019)*. Meath County Council, Meath, Ireland.
- DHPLG. (2002). *National Spatial Strategy of Ireland 2002-2020*. Department of Housing Planning and Local Government Available online at: http://www.kildare.ie/CountyCouncil/Publications/SpatialStrategy/LinkToDocument,6109,en.pdf [Accessed August 2018].
- Planning Permission Applications Available Online at: https://housinggovie.maps.arcgis.com/apps/webappviewer/index.html?id=9cf2a09799d74d8e9316a3d3a4d3a8de [Accessed August 2018].
- RPGO. (2010). *The Regional Planning Guidelines for the Greater Dublin Area 2010-2022*. Regional Planning Guidelines Office, Dublin Regional Authority, Mid-East Regional Authority. Available online at: http://emra.ie/dubh/wp-content/uploads/2015/02/Greater-Dublin-Area-Regional-Planning-Guidelines-2010-2022-Volume-I.pdf [Accessed August 2018].
- WHO. (2016). *Urban green spaces and health*. Copenhagen: WHO Regional Office for Europe, 2016. Available online at http://www.euro.who.int/__data/assets/pdf_file/0005/321971/Urban-green-spaces-and-health-review-evidence.pdf?ua=1

Chapter 07: Biodiversity

07

7. Biodiversity

7.1 Introduction

This Chapter assesses the ecology of the receiving environment for the Proposed Road Development. The Biodiversity Chapter quantifies and assesses the potential effects of the Proposed Road Development on biodiversity i.e. flora and fauna, collectively known as biodiversity. The Biodiversity Chapter sets out to:

- Describe the baseline ecology of the receiving environment (i.e. desk studies and field surveys);
- Identify and describe all potentially significant ecological effects associated with the Proposed Road Development;
- Ensure 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 impacts';
- 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 impacts; and
- Detail monitoring measures required to verify predictions regarding performance of mitigation measures, and to inform amended or mitigation as required.

7.1.1 Legislation, Policy, and Guidelines

Legislation, policy and guidelines relevant to the assessment of biodiversity are outlined in this section. The reader is referred to Chapter 1 for reference to the Environmental Impact Assessment Directive 2014/52/EU.

7.1.1.1 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 SPA and SAC are referred to as 'European sites' and form part of the Natura 2000 site network.

7.1.1.2 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, SAC and SPA form a pan-European network of so-called 'European sites' for nature conservation (also known as Natura 2000 sites).

7.1.1.3 European Union Water Framework Directive

The WFD (Council Directive 2000/60/EC) 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.

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 (DoHGLP, 2018; 'the RBMP'). 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.

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 Boyne CMU[2].

7.1.1.4 National Legislation

Relevant European legislation to ecological protection is transposed in the context of the Proposed Road Development by The 'Roads Acts' (collectively 1993 S.I. 14/1993 as amended, Roads Act 2007 S.I. 34/2007 as amended & Roads Act 2015 S.I. 14/2015 as amended), the 'Planning Acts' (The Planning & Development Act 2000 S.I. 30/2000 as amended, the Planning and Development (Amendment) Act 2010 S.I. 30/2010 as amended, The Planning & Development (Amendment) Act 2010 S.I 16/2018 as amended), and the 'Planning Regulations' (Planning & Development Regulations 2001-2018, as amended).

The primary domestic statutes in the Republic of Ireland providing for wildlife protection are the Wildlife Act 1976 S.I. 39/76 as amended and the Wildlife Act 2000 S.I. 38/200 as amended, (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 NHAs (pNHAs) 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.

The Wildlife Acts provide protection to species not listed under the EU Habitats Directive (i.e. 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.

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 afforded legal protection 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.

7.1.1.5 Policy

In addition to the policy framework set out in Chapter 2 (Description of the Proposed Road Development), this section lists policy at national level and below of relevance to biodiversity.

National Plans:

- National Biodiversity Plan 2017-2021 (NPWS, 2017); and,
- Project Ireland 2040 NPF (NPF, 2018).

Other Plans:

- RSES for the Eastern and Midland region[3];
- County Meath Biodiversity Action Plan (BAP) 2015-2020[4];

[2] Available online at https://www.catchments.ie/maps/ Accessed September 2019
[3] Available online at https://emra.ie/regional-strategies/rses/ Accessed August 2019.
[4]Available online at https://www.meath.ie/system/files/media/file-uploads/2019-06/County%20Meath%20Biodiversity%20Plan%202015-2020.pdf Accessed August 2019.

- MCDP 2013 – 2019 as varied; and
- NDP 2009-2015 (which has been extended until 2019, despite the name of the plan), (Incorporating Variation 1, Variation 2 and Variation 3).

7.1.1.6 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 the:

- EPA's *'Advice Notes on Current Practice (in preparation of Environmental Impact Statements* (EPA, 2003);
- EPA's *'Guidelines on the information to be contained in Environmental Impact Statements* (EPA, 2002);
- EPA's *'Draft Revised guidelines on the information to be contained in Environmental Impact Statements* (EPA, 2015);
- Draft 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 NPWS on mitigation for bats (NPWS, 2006), and the extensive guidance available for other ecological topics from the NPWS online[5];
- Various NRA guidance from the 'Environmental Planning and Construction Guidelines series' including the *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA[6], 2009a);
- Chartered Institute of Ecology and Environmental Management (CIEEM) *Guidelines for Ecological Impact Assessment in the UK and Ireland* (CIEEM, updated September 2019); and,
- Other guidance (i.e. to inform field surveys) referenced throughout this Chapter as relevant.

7.2 Methodology

This section describes the methodologies employed during the preparation of the Biodiversity 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.

7.2.1 Zone(s) of Influence and Study Areas

The zone of influence (ZoI) for a project (or "spatial extent of the impact" as described in Annex III (3) of the new EIA Directive 2014/52/EU) is the area over which ecological features may be subject to significant effects 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 River Boyne and River Blackwater SAC (Site Code: 2299) and the River Boyne and River Blackwater SPA (Site Code: 4232) at the River Blackwater crossing.

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. 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 draft EPA guidance (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.

[5] Available at https://www.npws.ie/development%20consultations#6.%20Conservation%20objectives. Accessed August 2019.
[6] The National Roads Authority has been subsumed into Transport Infrastructure Ireland since the publication of this guidance.

In the context of determining the ZoI for potential pollution effects from the Proposed Road Development, a conservative approach has been adopted, assuming that the ZoI includes all areas downstream of the Proposed Road Development, which are within the same CMU[7].

Field survey for the ZoI for potential pollution effects, which included the entire downstream surface CMU, were not carried out where land access was not available for the extent of the ZoI.

Desktop survey areas for the Proposed Road Development correspond, as a minimum, to the ZoI of potentially significant effects for each ecological feature.

In this Chapter, the desk study area for cumulative effects is considered for the extent of the ZoI for the Proposed Road Development.

As recommended by CIEEM (2018; updated September 2019), professionally accredited or published studies are used to determine ZoI. Having considered the Proposed Road Development, ZoI have been estimated for habitats and flora (Table A7-1-1, Appendix A7-1) and fauna species and their associated habitats (Table A7-1-2, Appendix A7-1).

7.2.2 Desk Study

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 species held online by the NPWS[8] and the National Biodiversity Data Centre (NBDC)[9];
- 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), and associated digital shapefiles obtained from the NPWS Research branch;
- Information on ranges of mobile Special Conservation Interest populations in the Irish Bird Atlas;
- 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 ecology in the Boyne 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, O'Regan et al., 2010 for butterflies, King et al., 2011 for fish and amphibians; Lockhart et al., 2012 for bryophytes; Wyse Jackson et al., 2016 for vascular plants);
- Habitats and species identified in the Draft County Meath Biodiversity Action Plan 2015-2020 (Meath County Council, 2015a);
- The report from the 'County Meath Wetland and Coastal Survey' (MCC, 2010);
- The report from the 'Survey of rare/threatened and scarce vascular plants in County Meath' (BEC Consultants, 2006);
- Information on the identification, and conservation condition of Priority Annex 1 alluvial forest habitat (EU code 91E0) in Ireland from Perrin et al. (2008), and O'Neill and Barron (2013);
- Information on the identification, and conservation condition of the EU Annex 1 listed habitat hydrophilous tall herb fringe communities (EU code 6430) in Ireland from O'Neill et al. (2013);
- Data on water quality in the surface water catchment within which the Proposed Road Development is located (i.e. the Boyne CMU identified in the RBMP for Ireland (DoHGLP, 2018))[10]; and,
- Data on the extent and vulnerability of local groundwater bodies[11].

The following ecological records were excluded from the baseline of the EIAR:

[7] As a precautionary measure, a reasonable worst-case ZoI for water pollution from the Proposed Road Development site is considered to be the downstream surface water catchment. In this report the surface water catchment is defined at the scale of CMU as adopted in the River Basin Management Plan (RBMP) for Ireland 2018-20121 (DoHGLP, 2018).
[8] Available online at www.npws.ie [Accessed September 2019].
[9] Available online at maps.biodiversityireland.ie [Accessed September 2019].
[10] Available online at: https://www.catchments.ie/maps/ [Accessed September 2019].
[11] Available online at: https://gis.epa.ie/EPAMaps/ [Accessed September 2019].

- Records greater than 5 km from the Proposed Road Development;
- Records greater than 50 years old;
- Records of species identified as Regionally Extinct in national Red Lists;
- Any species listed as Least Concern on Irish Red Lists;
- Any species of marine habitats (i.e. habitat range outside the ZoI of the Proposed Road Development); and
- The locations of Annex 1 hydrophilous tall herb fringe habitat monitored by the NPWS (O'Neill et al., 2013) and the locations of Annex 1 alluvial forests monitored by the NPWS (O'Neill and Barron, 2013) were reviewed to determine the presence of such habitats within the ZoI of the Proposed Road Development.

7.2.3 Consultation

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.

7.2.3.1 Bat Conservation Ireland

BCI were consulted in July 2017. On 20 July 2017, BCI responded with records from their database for:

- Car-based Bat Monitoring Scheme 2003-2015;
- All Ireland Daubenton's Bat Waterways Scheme 2006-2015;
- Brown Long-eared Bat Roost Monitoring Scheme 2007-2015;
- BATLAS 2010;
- Landscape conservation for Irish bats and species-specific roosting characteristics (Lundy et al., 2011); and,
- Ad-hoc bat records.

It is highlighted here that the BCI provides records for foraging and commuting bats but does not share locations of known roosts which are classified as sensitive information.

7.2.3.2 Meath County Council (Heritage Officer)

MCC's Heritage Officer was consulted by email in October 2017 and again in August 2018, to request any additional data to that already obtained in the desk study. The Heritage Officer advised that the assessment should have regard to the reports: 'County Meath Wetland and Coastal Habitats Survey' (MCC, 2010), and the 'County Meath Tree, Woodland and Hedgerow Survey' (Smith et al., 2011).

7.2.3.3 National Parks and Wildlife Service (Research Branch)

The NPWS Research Branch was consulted on 13 August 2018 to request records of rare or protected flora or fauna within 5 km of the Proposed Road Development. On 21 August 2018, the NPWS Research Branch responded with ecological records in excel format, as well as the survey report (Cummins et al., 2010) for the NPWS kingfisher survey of Irish SAC rivers (including the Boyne and Blackwater SAC, which was not designated a SPA in 2010). Relevant records provided by the NPWS are included in the tables in Section 7.3.3. The NPWS also provided links to online GIS resources for the site-specific Conservation Objectives of European sites and advised that other consultees could be contacted for additional records; namely Inland Fisheries Ireland, Birdwatch Ireland, and Bat Conservation Ireland.

The NPWS was contacted again on 29 November 2019 to provide an update on progress of the scheme, as well as an update on the scheme layout and design.

7.2.3.4 Inland Fisheries Ireland

IFI was contacted on 8 August 2018 to request records of fish in the waters of the River Blackwater adjacent and downstream of the Proposed Road Development site. On the 19 September 2018, IFI responded, stating that atlantic salmon *Salmo salar* and lamprey species *Lampetra* spp. occur in the 'Kells Blackwater' River (i.e. the Blackwater River in the ZoI of the proposed works; this name refers to the WFD sub-catchment). IFI stated that no recent electrofishing surveys have been carried out on the Kells Blackwater River. IFI also provided a report

(Gallagher et al., 2016) on relevant species to this Biodiversity Chapter (EIAR) which includes data on larval lamprey in the overall Boyne catchment.

The IFI was contacted again on 29 November 2019 to provide an update on progress of the scheme, as well as an update on the scheme layout and design.

7.2.3.5 BirdWatch Ireland

Birdwatch Ireland was contacted on the 4 September 2018. Data regarding kingfisher within the area were requested. No response had been received at the time of writing this report.

7.2.4 Referencing and Naming Conventions

Vascular plant nomenclature follows that of the Botanical Society of Britain and Ireland's *Checklist of the Flora of Britain & Ireland*[12] and as such, any name changes since 2007 (including Stace, 2019) are not included. Bryophyte nomenclature follows the 2009 *Checklist of British and Irish bryophytes* (2009) available online from the British Bryological Society[13].

Throughout this Chapter, references to web resources not associated with a published report (e.g. online databases) are referenced in footnotes. 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 in Section 7.12.

7.2.5 Field Study

All surveys were carried out having regard to published guidance including, but not limited to, the NRA's (2009a) *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.

7.2.5.1 Habitats and Flora Survey

7.2.5.1.1 Heritage Council Habitat Classification

Surveys were carried out on 20 July and 10 August 2017, 28 August 2018, 10 July 2019 and 25 May 2020. Habitats were classified using the Heritage Council's classification system (Fossitt, 2000). Habitat mapping was carried out with regard to guidance in line with Smith et al., (2011). The information collated from the survey was used to ascribe a value to habitat features following the valuation examples in the NRA (2009a). The information also directed further habitat and species-specific survey work to inform this Chapter. Habitat surveys were carried out to record dominant species, indicator species for different habitat types or conditions, rare or declining species identified on relevant Irish Red Lists (Lockhart et al., 2012; Wyse et al., 2016), or 'scheduled' invasive species.

7.2.5.1.2 Annex 1 Habitat Classification

Field surveys undertaken in July 2017 identified the EU Annex 1 listed habitat hydrophilous tall herb fringe communities (EU Code 6430) within the River Blackwater floodplain, located within the boundary of the River Boyne and Blackwater SAC, and within the ZoI of the Proposed Road Development. This habitat was identified using the positive indicator species lists in O'Neill and Baron (2013), and information on vegetation communities from the latest NPWS Conservation Status Assessment available at the time of writing (NPWS, 2019b).

In order to determine the (local) conservation status of habitat areas, monitoring 'stops' (eight in total) were recorded throughout this habitat using the assessment criteria published by the NPWS (O'Neil and Barron, 2013). At each stop, pass/fail was recorded for each of eight criteria[14]. Following O'Neill and Barron (2013), the habitat was considered in unfavourable condition if a monitoring stop failed a single criterion. All stops were either within the footprint of the Proposed Road Development or within approximately 50 m of the Proposed Road Development.

[12] Available online at https://bsbi.org/resources Accessed August 2019.
[13] Available online at http://www.britishbryologicalsociety.org.uk/ Accessed August 2019.
[14] Total no, of positive indicator species named in O'Neill et al. (2013) (pass = ≥3); cover of non-native species (pass=≤1%); Cover of negative indicator species named in O'Neill et al. (2013) (pass=≤33%); Collective cover of scrub, bracken and heath (pass=≤5%); indicator species cover (pass=≥40% cover); mean (mode) herb height (pass=≥50cm); cover of bare soil (pass= ≤10%); areas showing serious grazing or disturbance (pass=≤20 m^2).

The EU Annex I priority listed habitat, alluvial forest (EU Code: 91E0) was identified within the ZoI of the proposed works. This priority habitat is a Qualifying Interest (QI) of the River Boyne and River Blackwater SAC. To record more detail for this habitat, each woodland parcel was attributed to a specific woodland type in the Irish Semi-Natural Woodland Survey (SNWS) (Perrin et al., 2008) where the SNWS provides a percentage Annex 1 habitat fit for each woodland type. Species lists were collected for canopy, field, and ground layers within the Annex 1 habitat. Given the highly fragmented nature of the Priority Annex 1 alluvial forest in the vicinity of the Proposed Road Development (comprising a single species canopy in the only two instances within approximately 25-50 m); a single monitoring stop was carried out at each following O'Neill and Barron (2013).

7.2.5.2 Bat Surveys

In order to determine the level of bat activity and bat usage of the Proposed Road Development, a range of surveys were carried out and are summarised in Table 7-1.

Table 7-1 Summary of bat surveys conducted to inform this chapter

Survey	Dates
Preliminary ground level roost assessment	20 July 2017, 28 August 2018 and 25 May 2020
Bat activity surveys throughout ZoI	20 July and 16 August 2017
Static bat detector surveys throughout ZoI	20 July to 21 September 2017
Bat (dusk) emergence survey of the former farm shed structure at northern end of Proposed Road Development ('Low' suitability; single survey)	16 August 2017
Bat (dusk) emergence survey of Office of Public Works (OPW) buildings proposed for demolition at southern end of Proposed Road Development ('Negligible suitability; single survey on precautionary basis)	28 August 2018

Preliminary Ground Level Roost Assessment

A preliminary ground level roost assessment was carried out during daylight hours, using close-focusing binoculars on 20 July 2017, 28 August 2018 and 25 May 2020. These surveys aimed to identify Potential Roosting Features (PRF) for bats in any trees likely to be felled and in a structure proposed for demolition. Any PRF potentially impacted by light spill from the Proposed Road Development were assessed.

Trees were assessed for the presence of PRF in cavities, frost cracks, trunk and branch splits, rot holes, and hollow sections of trunks and branches. 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. The loft spaces of the multi-storey (derelict and condemned) OPW buildings, which are proposed for demolition, were accessed.

The results were used to grade trees and structures as having Negligible, Low, Moderate, or High suitability for roosting bats in accordance with the Bat Conservation Trust's (BCT) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (Collins, 2016).

Bat Activity

Bat activity surveys were conducted within the Proposed Road Development and surrounding area. A pre-determined transect route around the Proposed Road Development and surrounding area was walked a total of three times over two nights on 20 July and 16 August 2017.

Bat activity surveys were broadly based on survey methods in line with Collins (2016). A dusk activity survey in July 2017 commenced at sunset and ended a minimum of two hours after sunset. The dusk activity survey in August 2017 commenced approximately 2 hours after sunset as it was carried out following a dusk emergence survey of the former farm shed structure to assess for the potential presence of bats onsite. Surveyors listened for bats using Batbox Duet and Peterson D-240x detectors with headphones; bat calls were recorded on a Roland recorder. Upon hearing a bat, surveyors made an attempt to identify the direction and height of bat flight, and any notable bat behaviour (e.g. foraging or commuting). Any additional bat activity recorded while walking between points was also noted.

Table 7-2 Dates and timings of bat activity surveys

Date	Sunset Time	Start time of survey	End time of survey
20 July 2017	21:40	21:40	23:40
16 August 2017	20:53	22:37	00:40

Weather details including temperature, wind, and rain, were recorded during each survey.

Static Bat Recordings
One static bat detector (Song Meter 2+ (SM2)) was used to capture bat activity at six locations in semi-natural habitats across the ZoI of potential impacts (river floodplain, hedgerow, and wooded habitats) where elevated bat activity was expected relative to intensely managed habitats (e.g. improved grassland and built areas). The static detectors were installed for a total of 63 nights from 20 July to 21 September 2017.

Bat recordings were analysed using Kaleidoscope Pro (version 4.3.1), and/or BatSound (version 4.03) and confirmed with manual assessment.

Bat Emergence

Having regard for BCT guidance (Collins, 2016) for structures of low suitability, a single emergence survey was carried out:

- 16 August 2017, by two surveyors of a farm shed (has since been demolished by the landowner as of 25 May 2020) at the northern end of the Proposed Road Development footprint; and,
- 28 August 2018 of the OPW buildings to be demolished at the southern end of the Proposed Road Development footprint.

Photographs of these structures are provided in Appendix A7-2. Survey timings are presented in Table 7-3.

Table 7-3 Dates and timings of bat emergence surveys

Structure (s)	Date	Sunset Time	Start time of survey	End time of survey
Farm shed (former building)	16 August 2017	20:53	20:37	22:37
OPW Buildings	28 August 2018	20:29	20:14	22:00

Building features identified during the preliminary ground level roost inspections as having suitability for bat access and/or roosting, were prioritised during the emergence surveys.

Bat detectors were used to detect emerging bats and to record bat calls for ex-situ analysis. ‘Batbox Duet’ and ‘Peterson’ D-240x detectors were used on 16 August 2017. Two ‘BatLogger’ (model ‘M’) detectors were used on 28 August 2018. Weather details including temperature, wind, and rain were recorded during each survey.

Ex-situ, a UK research report into the impact of lighting on bats (Stone, 2013) was used to categorize bats recorded (including all Irish species), with reference to their potential relative sensitivity to lighting impacts (from Low to High).

7.2.5.3 Badger Survey

The Proposed Road Development and wider ZoI were searched for evidence of badger on 22 and 23 November 2017, 18 May 2018. An update survey was carried out on 10 July 2019, to verify the status of a badger sett identified during GI works for the Proposed Road Development and an additional survey was undertaken on 25 May 2020.

The badger survey methodology followed Harris et al. (1989) and guidance from the NRA (2006a). The survey recorded the status of holes (used or disused) and direction of tunnelling. Areas up to 150 m from abutments were searched for badger setts to account for the potential effect of piling. Any signs of badger activity were noted, including the presence of setts (classified as potential main, annex, subsidiary or outlier setts), foraging evidence, hairs (snagged along runs), faeces, tracks and prints.

7.2.5.4 Otter Survey

Watercourses, drainage ditches and wetland habitats within the Proposed Road Development and wider ZoI were assessed for otter *Lutra lutra* on 22 and 23 November 2017; and 25 May 2020. The survey methodology took cognisance of guidance which follows NRA (2006b) 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.

7.2.5.5 Bird Survey

Breeding kingfisher *Alcedo atthis*

Kingfisher is listed under Annex 1 of the Birds Directive and was recorded within the ZoI of the Proposed Road Development. Kingfisher is an SCI of the River Boyne and Blackwater SPA. Vantage point surveys were conducted for kingfisher on 13 April, 1 May, 18 May, and 12 June 2018 following the NRA guidelines (NRA, 2009a). An additional walkover survey encompassing shortened vantage point watches was undertaken on 25 May 2020. A viewing point was selected that offered maximum views of the River Blackwater at the Proposed Road Development river crossing. Kingfisher activity was recorded for a period of two hours after dawn (e.g. including if applicable, tunnelling of nest sites, feeding, use of perching posts, or territorial behaviour).

Other Breeding Birds

Breeding birds within the Proposed Road Development and wider ZoI were surveyed on 20 July 2017, 13 April, 1 May, 18 May, and 12 June 2018 having regard for the methodology of the Common Bird Census (Gilbert et al., 2012). Breeding birds were resurveyed on 10, 11, 12, and 17 July 2019. The survey period coincided with GI works for the Proposed Road Development to inform avoidance mitigation to protect nesting birds from the proposed works. The Proposed Road Development was walked so that a surveyor came within 50 m of all potential nesting features. All aural and visual registrations were recorded in the field and plotted on a map.

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). Breeding evidence was recorded in line with the British Trust of Ornithology (BTO) breeding status codes[15].

Having regard for the methodology in Hardey et al. 2013, suitable (mixed woodland) breeding habitat adjacent to the OPW buildings was checked for sparrowhawk occupancy (i.e. presence of birds) during vantage point watches from the opposite riverbank on 13 April, 1 May, 18 May, and 12 June 2018.

Potentially suitable (mixed woodland) breeding habitat (based on tree preferences in Hardey et al. 2013) were also checked on the 18 May 2018 from ground level. This involved searching for droppings and feeding remains, or shed feathers beneath potential nest sites, using close-focussing binoculars to identify potential presence of incubating birds (including down on nest rims), as well as listening for alarm-calling adults and/or begging chicks.

7.2.5.6 Other Protected and Notable Species

During walkover surveys of the Proposed Road Development and wider ZoI, the potential was also noted for habitats of other protected fauna species to occur including common frog, smooth newt *Lissotriton vulgaris,* hedgehog *Erinaceus europaeus*, stoat *Mustela erminea hibernica*, pygmy shrew *Sorex minutus,* red squirrel *Sciurus vulgaris,* Irish hare *Lepus timidus hibernicus,* common lizard, marsh fritillary butterfly *Euphydryas aurinia* and small blue butterfly. In the case of the latter two butterfly species, searches were made of suitable habitats for the larval food plants of marsh fritillary (devil's-bit scabious *Succisa pratensis*), and small blue (kidney vetch *Anthyllis vulneraria*).

7.2.6 Impact Assessment Methods

7.2.6.1 Baseline Conditions

The 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*

[15] These codes categorise birds present during the breeding season as either 'non breeding' 'possibly breeding', 'probably breeding' or 'confirmed breeding', using a variety of individual status codes. The definitions of these categories are available from the British Trust for Ornithology online at https://www.bto.org/volunteer-surveys/birdatlas/methods/breeding-evidence Accessed September 2019.

descriptions of methodologies employed." Key aspects of the baseline environment identified in draft EPA guidance include context, character, significance, and sensitivity.

7.2.6.2 Valuing Ecological Features

The methodology used to value ecological features is compliant with relevant principles underpinning impact assessment under the New EIA Directive. However, the methodology also has regard for the geographic frames of reference in the NRA's *Guidelines for Assessment of Ecological Impacts of National Road Schemes* (NRA, 2009b).

In conjunction with relevant terminology from draft EPA guidance (2017), the geographic frames of reference employed by the NRA (2009a) (Appendix A7-3) 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 standardise valuations.

Significant ecological features are those valued at Local Importance (Higher Value) or above as per the examples in Appendix A7-3. 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.

7.2.6.3 Potential Impacts

Potential impacts of the Proposed Road Development (both positive and negative) are predicted for all significant ecological features. 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 (EPA, 2017), CIEEM (CIEEM, 2018), and NRA guidelines (NRA, 2009a), potential impacts are characterised by considering the parameters shown in Table 7-4.

Table 7-4 Descriptions of potential impact parameters (adapted from CIEEM, NRA and EPA Guidelines)

Potential Impact Parameter	Description
'Quality' of effects (i.e. positive vs negative)	Positive potential effect – a change that improves the quality of the environment or slows an existing decline in the quality of the environment. Negative potential effect – a change 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 impacted by an effect.
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 effect if it coincides with critical life-stages or seasons e.g. bird nesting season. Outside this period, similar actions may not cause significant effects.
Probability	Draft EPA 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 importance of the outcome of the effects (the consequences of the change). Refer to Section 7.2.6.4 for further details.

Potential impacts may occur during the construction phase (which is taken to also include enabling works such as demolition, vegetation clearance and earthworks) and / or the operational phase of a development. Direct potential impacts 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 potential impacts.

Pollution Impacts

Pollution effects 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.

Cumulative Impacts

In accordance with the revised wording in the New 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 7.2.1, the study area for cumulative effects includes at least the extent of the ZoI from the Proposed Road Development boundary.

Cumulative effects can result from individually insignificant, but collectively significant, actions taking place over time or concentrated in a location. Cumulative effects 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.

7.2.6.4 Determining Impact Significance

According to the 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 (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 effect significance by the NRA (2009a) 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 7-5 compares the qualitative (EPA) versus geographic approaches (NRA and CIEEM) to determining the significance of effects.

Table 7-5 Equating the definitions of significance of effects using a geographic vs. qualitative scale of reference

Geographic Scale of Significance (NRA, 2009a; similar to CIEEM, 2018; updated September 2019[16])	Qualitative Scale of Significance of Effects (EPA, 2017)
Negligible or Local Importance (Lower Value). *Potential effects 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 effects 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 biodiversity impacts 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).

[16] In this Chapter, the categories for different scales of geographic impact significance follow those applied in the NRA (2009a) in preference to CIEEM (2018; updated September 2019), because the latter includes the weakly defined administrative unit "regional".

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 NRA (2009), significant impacts in this Chapter are:

- Impacts affecting features/populations valued at Local Importance (Higher Value) and above; and,
- Impacts likely to be material in decision-making process; and,
- Impacts which affect the conservation status or integrity of the feature/population in question.

7.3 Existing Environment

7.3.1 Overview of Proposed Road Development

The Proposed Road Development is dominated to the north by the open grasslands of Blackwater Park which are cut and managed for biodiversity. The River Blackwater flows across the Proposed Road Development from west to east. The Proposed Road Development crosses the saturated floodplain of the River Blackwater SAC and SPA in its southern part, which includes QI Priority Annex 1 alluvial forest, non-QI Annex 1 hydrophilous tall herb fringe and marsh habitat; and wet grassland. Scattered woodland plantations, treelines, grasslands and scrub occur throughout. Photographic records of the Proposed Road Development site are presented in Appendix A7-2.

7.3.2 Sites Designated for Nature Conservation

There are two European sites identified within the footprint of the Proposed Road Development and therefore considered to have a direct impact pathway. These are the River Boyne and River Blackwater SAC (site code 2299) and the River Boyne and River Blackwater SPA (site code 4232) (Volume 3, Figure 7.1).

The Boyne Estuary SPA (site code 4080), and Boyne Coast and Estuary SAC (site code 1957) are downstream (at least 25 km distant as the crow flies) of the Proposed Road Development. However, these sites are not in the CMU in which the Proposed Road Development is located[17], and are therefore scoped out.

There are no other impact pathways between the Proposed Road Development and more distant European sites.

Given the proposed works and potential for aquatic habitats and features to be affected, pNHA designated for surface water-dependent features were assessed. There are no connective features from pNHA or NHA in the wider area to the Proposed Road Development. There are aquatic pNHA located within the same CMU as, and downstream of the Proposed Road Development. These sites lie within the floodplain of the River Boyne. Applying the precautionary principle, whilst some are located at least 20 km downstream, all these pNHA sites are considered to be hydrologically connected to the Proposed Road Development where they are present within the same CMU.

The European and nationally designated sites, with which potential impact pathways have been identified, are presented in Table 7-6.

Table 7-6 Sites with statutory designations for nature conservation

Designated Site (and code)	Distance to Proposed Road Development (at closest point)	Conservation Significance
River Boyne and River Blackwater SPA (4232)	Within Proposed Road Development	Kingfisher *Alcedo atthis*
River Boyne and River Blackwater SAC (2299)	Within Proposed Road Development	Alkaline fens alluvial forests with alder *Alnus glutinosa* and ash *Fraxinus excelsior* river lamprey *Lampetra fluviatilis* atlantic salmon *Salmo salar* Otter *Lutra lutra*
Slane Riverbank pNHA (1591)	11 km east (and downstream)	No NPWS site synopsis is available for this pNHA. Refer to that given for River Boyne and River Blackwater SAC which this pNHA overlaps

[17] As per Appendix A.8.1, significant concentrations of contaminants are not predicted to cross the Boyne CMU boundary downstream, and enter the complex of European sites in the Boyne Estuary and coastline.

Designated Site (and code)	Distance to Proposed Road Development (at closest point)	Conservation Significance
Boyne Woods pNHA (1592)	11 km east (and downstream)	No NPWS site synopsis is available for this pNHA. Refer to that given for River Boyne and River Blackwater SAC which this pNHA overlaps
Crewbane Marsh pNHA (0553)	12.5 km west (and downstream)	No NPWS site synopsis is available for this pNHA. Refer to that given for River Boyne and River Blackwater SAC which this pNHA overlaps
Dowth Wetland pNHA (1861)	18.5 km west (and downstream)	No NPWS site synopsis is available for this pNHA. Refer to that given for River Boyne and River Blackwater SAC which this pNHA overlaps
Boyne River Islands pNHA (1862)	20 km west (and downstream)	No NPWS site synopsis is available for this pNHA. Refer to that given for River Boyne and River Blackwater SAC which this pNHA overlaps

A NIS (AECOM, 2019) has 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. The assessment of impacts are described in detail in the NIS and also reviewed in Section 7.4 of this Chapter.

7.3.3 Protected and Rare Species

Protected and rare fauna species identified in the desk study of NBDC and NPWS records (within a minimum 5 km radius from the Proposed Road Development) are detailed in Table 7-7.

Table 7-7 Protected and rare fauna species returned from NPWS and NBDC search within a minimum 5 km radius from the Proposed Road Development

Common Name	Scientific Name	Legally Protected Species ($_a$ Habitats Directive, $_b$ Wildlife Act)	Red-listed (Excluding Least Concern)	Habitat Preferences
Badger	*Meles meles*	✓ $_b$	-	Deciduous or mixed woodlands near farmland or open ground[18]
Brown long-eared bat	*Plecotus auritus*	✓ $_{a,\ b}$	–	Open deciduous and coniferous woodland, parkland, gardens and orchards[20]
Common frog	*Rana temporaria*	✓ $_{a,\ b}$	–	Lakes and ponds, grassland, marsh, wet heath, peatlands, woodland and scrub, dune slacks, machair and riparian[19]
Common pipistrelle	*Pipistrellus pipistrellus sensu lato*	✓ $_{a,\ b}$	–	Along hedgerows and treelines, woodlands, parklands[20]
Common whorl snail	*Vertigo pygmaea*	–	✓	Damp pastures and margins of wetlands at low altitude; in the west and north in coastal habitats such as dune grassland[20]
Daubenton's bat	*Myotis daubentonii*	✓ $_{a,\ b}$	–	Near calm, slow-moving water[20]
European eel	*Anguilla anguilla*	–	✓	Streams, rivers, lakes, coastal waters and estuaries, lagoons[18]
Hedgehog	*Erinaceus europaeus*	✓ $_b$	–	All lowland habitats where grassland is found next to mixed woodland and scrub[19]
Irish hare	*Lepus timidus* subsp. *Hibernicus*	✓ $_b$	–	Various habitats including upland and lowland bogs, farmland, and ranging from coastal to mountainous habitats[21]
Large red-tailed bumble bee	*Bombus lapidarius*	–	✓	Range of habitats such as gardens and parks[19]

[18] Available at: www.iucnredlist.org [Accessed on September 2019]
[19] Available at: www.biodiversityireland.ie [Accessed on September 2019]
[20] Available at: www.habitas.org.uk [Accessed on September 2019]
[21] Available at: www.mammals-in-ireland.ie [Accessed on September 2019]

Common Name	Scientific Name	Legally Protected Species (a Habitats Directive, b Wildlife Act)	Red-listed (Excluding Least Concern)	Habitat Preferences
Leisler's bat	*Nyctalus leisleri*	✓ a, b	–	Woodland, parkland, pasture, treelines, over lakes, beaches, dunes, riparian habitats, and in urban areas above streetlights[19]
Marsh whorl snail	*Vertigo antivertigo*	–	✓	Tall marginal vegetation or fen such as *Typha* or *Juncus* but also in wet unimproved pasture at the roots of *Iris* and grasses[20]
Natterer's bat	*Myotis nattereri*	✓ a, b	-	Woodland, pasture, hedgerows, treelines, and over water such as white-water rapids[19]
Otter	*Lutra lutra*	✓ a, b	-	Lakes and ponds, watercourses, swamps, riparian woodland, estuaries, sea inlets and bays, saltmarshes[19]
Pine marten	*Martes martes*	✓ a, b	–	Landscapes with forest or scrub cover[19]
Prickly snail	*Acanthinula aculeate*	–	✓	Woodland edge habitats and overgrown hedgerows[20]
Pygmy shrew	*Sorex minutus*	✓ b	–	Habitats with high ground cover, particularly woodlands, grasslands, hedgerows and peatlands[21]
Red deer	*Cervus elaphus*	✓ b		Semi-woodland with open lowland, upland and field habitats[21]
Red squirrel	*Sciurus vulgaris*	✓ b	-	Woodland[21]
Smooth grass snail	*Vallonia pulchella*	–	✓	Primarily pastures on river and lake floodplains[20]
Smooth newt	*Lissotriton vulgaris*	✓ b	–	Lakes, ponds, ditches, and in damp habitats with cover from desiccation[22]
Soprano pipistrelle	*Pipistrellus pygmaeus*	✓ a, b	–	Along hedgerows and treelines, woodlands, and riparian habitats[19]
Whirlpool ramshorn	*Anisus vortex*	–	✓	Streams, rivers and lakes with clear, unpolluted water[20]

There was no potential breeding habitat for smooth newt within the ZoI of the Proposed Road Development, in which no permanently wet drainage ditches or still wetland features were identified. There was potentially suitable habitat within the Proposed Road Development for all other species identified in Table 7-7.

Protected and rare flora species returned from the desk study of NBDC and NPWS records within a minimum 5 km radius of the Proposed Road Development are detailed in Table 7-8. None of the known sites for rare flora species in the Survey of rare/threatened and scarce vascular plants in County Meath (BEC Consultants, 2006) overlap the ZoI of the Proposed Road Development.

Table 7-8 Protected and rare flora species returned from NBDC and NPWS data search within 5 km of Proposed Road Development

Common Name	Scientific Name	Red-listed (excluding Least Concern)	Legally Protected under Flora Protection Order	Habitat preferences
Lance-leaved pottia	*Tortula lanceola*	✓	–	Well-drained, disturbed, calcareous soil[23]

There are no calcareous habitats present within the Proposed Road Development, and therefore no suitable habitat for lance-leaved pottia *Tortula lanceola*.

[22] Available at: https://freshwaterhabitats.org.uk [Accessed August 2019]
[23] Available at: www.rbg-web2.rbge.org.uk [Accessed August 2019]

7.3.4 Habitats

Habitats of high ecological value recorded within the ZoI of the Proposed Road Development are shown in Volume 3 Figures 7.2a and 7.2b, which include the relevant habitat codes from Fossitt (2000). A summary of each habitat is provided below. Lists of species recorded for each habitat are presented in Appendix A7-4. Surveys were carried out in July 2017 to May 2020.

7.3.4.1 Freshwater

FW2 Depositing / Lowland Rivers

The Proposed Road Development crosses the Blackwater River at Chainage 0+950 (Volume 3, Figure 7.4). The Blackwater River in the vicinity of the proposed crossing is a glide of deep water on gently sloping ground. The wetted width is approximately 20 m at the proposed crossing point. Macrophyte presence instream indicates reduced flow rates relative to other areas where instream vegetation is absent. Instream vegetation is dominated by yellow water-lily *Nuphar lutea*, reed sweet-grass *Glyceria maxima*, and floating sweet-grass *Glyceria fluitans*. Common duckweed *Lemna minor* is found in the shelter of marginal reed cover. Flowering rush *Butomus umbellatus* occurs occasionally.

FW4 Drainage Ditches

A single drainage ditch crosses the footprint of the Proposed Road Development. This ditch (referred to as the 'Windtown Stream' by the EPA[11] at a location more than 200 m downstream of the Proposed Road Development), was dry and overgrown at the time of survey in July 2018. The drainage ditch is located adjacent to a former woodland plantation south of Ratholdren Road. EPA mapping[11] incorrectly shows this drainage ditch apparently rising west of a (disused) railway bridge (approximately 200 m downstream of the Proposed Road Development). However topographical surveys show the drainage ditch extends further upstream from the railway line and across the Proposed Road Development. Based on information available on this ditch it is considered that it is piped across and fed by the cutting created by the existing railway line. The ditch outfalls to the Blackwater River approximately 1.1 km downstream from the Proposed Road Development.

FS1 Reed and Large Sedge Swamp

This habitat is scattered in narrow strips at the water's edge along the Blackwater River. It also extends 'inland' into the unmanaged floodplain on the northern bank of the Blackwater River, where the water table is above ground throughout the year. FS1 habitat grades into a) fragmented patches of Annex 1 hydrophilous tall herb fringe habitat (FS2 Tall-herb swamp/GM1 marsh) and b) remnant priority Annex 1 alluvial forest (WN6 Willow-alder ash woodland).

In the field, (non-Annex 1) FS1 is distinguished from (Annex 1) FS2/GM1 mosaic by the dominance of broad-leaved herbs in the latter. FS1 is conspicuously dominated by common reed *Phragmites australis* and creeping bent *Agrostis stolonifera* alongside abundant yellow iris *Iris pseudacorus*. Other frequent species include hedge bindweed *Calystegia sepium*, water horsetail *Equisetum fluviatile,* common nettle *Urtica dioica*, marsh-bedstraw *Galium palustre,* and blue water-speedwell *Veronica anagallis-aquatica.* Meadowsweet *Filipendula ulmaria* occurs rarely in drier areas. Conspicuous tussocks of (approximately 1.5 m high) greater tussock-sedge *Carex paniculata* are occasional. Branched bur-reed *Sparganium erectum*, hemlock water-dropwort *Oenanthe crocata* and lesser pond sedge *Carex acutiformis* occur along the water's edge.

In total, five positive indicator species for Annex 1 hydrophilous tall herb fringe habitat were recorded in FS1.

There is no bryophyte layer present.

FS2 Tall-herb swamp/GM1 Marsh

This habitat was recorded in two patches on the floodplain on the northern bank of the River Blackwater and is considered a feature of the Annex 1 hydrophilous tall herb fringe habitat but not a QI of this SAC.

FS2/GM1 habitat is combined where areas (closer to FS2) have standing water throughout the year, while in others (closer to GM1), the water table is at or below ground level.

The FS2/GM1 mosaic is distinguished from the FS1 habitat with which it forms a mosaic, by the greater abundance of broad-leaved herbs. Common reed is, whilst present in both habitats, significantly less abundant in FS2/GM1 compared to FS1.Similarly for FS1, there is no bryophyte layer present in FS2/GM1.

Six broad-leaved species occur in FS2/GM1: water mint *Mentha aquatica*, water forget-me-not *Myosotis scorpioides,* great willowherb *Epilobium hirsutum,* bittersweet *Solanum dulcamara,* water dock *Rumex* *hydropalanthum,* and marsh-woundwort *Stachys palustris*. These six species are all positive indicator species for Annex 1 hydrophilous tall herb fringe habitat (O'Neill et al 2013). Five additional indicator species (hedge bindweed, iris, water horsetail, common nettle, and marsh-bedstraw) occur in both FS1 and FS2/GM1.

In total, eleven positive indicator species for Annex 1 hydrophilous tall herb fringe habitat were recorded in FS2/GM1 habitat.

Following O'Neill and Barron (2013), FS2 / GM1 habitat was considered in unfavourable condition.

None of the hydrophilous tall herb fringe habitats monitored by the NPWS (O'Neill et al., 2013) occur within the potential ZoI of the Proposed Road Development.

7.3.4.2 Grassland

GA1 Improved Agricultural Grassland

GA1 habitat is present immediately west of the Proposed Road Development. This habitat is dominated by perennial rye-grass *Lolium perenne*, and other artificially seeded species of limited ecological value and at the time of survey appeared to be managed (cut) for agricultural purposes.

GS2 Dry Meadows and Grassy Verges

This habitat dominates managed meadow areas of Blackwater Park, and was also recorded on elevated (but relatively damper) ground on the margins of the River Blackwater floodplain. Whilst the GS2 habitat in Blackwater Park benefits from being subject to infrequent cutting, the arisings appear to be left after mowing by park managers. This results in the shading out of forbs and sedges in the sward, and nutrient enrichment which benefits common agricultural species. Scrub encroachment from eared willow *Salix aurita,* grey willow *Salix cinerea*[24]*,* and the hybrid of these two species *(S. x multinervis)* contributes to the overall assessment of this habitat as a rank, species-poor sward.

Within Blackwater Park, the GS2 sward is dominated by common bent *Agrostis capillaris, and* Yorkshire fog *Holcus lanatus*, broad-leaved dock *Rumex obtusifolius,* white clover *Trifolium repens* and creeping thistle *Cirsium arvense* the latter three being strongly indicative of enrichment. The rankest areas are dominated by false oat grass *Arrhenatherum elatius* and cock's-foot *Dactylis glomerata.*

Other species recorded within GS2 habitat include ragwort *Senecio jacobaea*, creeping buttercup *Ranunculus repens*, bush vetch *Vicia sepium* and tufted vetch *Vicia cracca*.

Species indicative of less improved (i.e. more ecologically favourable) conditions are occasional or rare. These include red bartsia *Odontities verna*, cut-leaved geranium *Geranium dissectum,* silverweed *Potentilla anserina,* smooth hawk's-beard *Crepis capillaris*, common bird's-foot-trefoil *Lotus corniculatus*, and meadowsweet *Filipendula ulmaria.*

At the transition into the floodplain on the lower slope of Blackwater Park, additional species include locally abundant hairy sedge *Carex hirta* and (rarely) lady's bedstraw *Galium verum*.

GS4 Wet Grassland

Relatively species-rich GS4 wet grassland is limited to the banks of the Blackwater River, above the floodplain. The habitat is dominated by creeping bent, Yorkshire fog, velvet bent *Agrostis canina*, and hairy sedge. Other species recorded include marsh-woundwort*,* willowherbs *Eplilobium* spp., and meadowsweet.

Species-poor GS4 wet grassland dominates an intensely grazed field at the northern end of the Proposed Road Development. The habitat is dominated by soft rush *Juncus effusus*, broad-leaved dock, and other common species of poorly drained intensely managed grassland.

7.3.4.3 Woodland and Scrub

WN6 Wet Willow-Alder-Ash Woodland

The nearest example of this habitat to the Proposed Road Development comprises a cluster (approximately 50 m long by approximately 30 m wide) of several (mature) crack willow *Salix fragilis*, located approximately 35 m to the west, on the northern bank of the Blackwater River. Crack willow dominates the canopy, which is categorised a dominant of Priority Annex 1 alluvial forest in Ireland (Perrin et al., 2008; O'Neill and Barron, 2013).

---

[24] *Salix cinerea* is referred to hereafter as 'grey willow' for convenience, albeit according to the BSBI's nomenclature adopted in this Chapter, grey willow in fact refers to *S.cinerea* subsp cinerea subspecies.

The understorey is dominated by crack willow regeneration, and the field layer comprises hedge bindweed, nettle, and bramble. Species present in the field layer include wild angelica *Angelica sylvestris*, Atlantic ivy *Hedera hibernica,* creeping buttercup and common nettle. The plot of woodland described here lacks conspicuous bryophytes in the ground layer.

Based on guidance from Perrin et al (2008) this community is considered to be an 89% fit to Priority Annex 1 alluvial forest. The absence of grey willow is a distinctive feature of this community type.

One other WN6 woodland type with potential fit to Priority Annex 1 alluvial forest occurs locally along the River Boyne floodplain, albeit outside the estimated ZoI of significant effects. Community type 3b '*Alnus glutinosa – Rubus fruticosus'* occurs as a remnant strip of alder *Alnus glutinosa* approximately 60 m west of the Proposed Road Development. This community has 56% fit to Priority Annex 1 alluvial forest according to Perrin et al 2008.

All instances of this habitat within the ZoI of the Proposed Road Development correspond to Priority Annex 1 alluvial forest.

None of the Priority Annex 1 alluvial forests monitored by the NPWS (O'Neill and Barron, 2013) occur within the ZoI of the Proposed Road Development.

WD1 Broadleaved Woodland

This habitat occurs within the footprint of the Proposed Road Development, adjacent to the convergence with Ratholdron Road, to the north of Blackwater Park. The majority of the canopy is dominated by (non-native) beech *Fagus sylvatica*, with occasional ash *Fraxinus excelsior*, birch *Betula* sp., and white poplar *Populus alba*. Understorey regeneration, consisting of hazel *Corylus avellana* and hawthorn *Crataegus monogyna* is present in at least some locations. A separate woodland strip nearby, adjoining the boundary of the Electricity Supply Board (ESB) lands is dominated by non-native plantation sycamore *Acer pseudoplatanus*. The field layer and ground layers appear sparse in these plantations likely due to shading from the dense canopy.

A belt of plantation WD1 woodland runs west to east across Blackwater Park, passing within approximately 10 m of the Proposed Road Development. This area is dominated by early mature ash, alongside wych elm *Ulmus glabra*, and rowan *Sorbus acuparia.* The understorey is dominated by hawthorn and brambles. The densely shaded field layer includes abundant wood dock *Rumex sanguineum,* shield ferns *Polystichum* spp., common nettle, Atlantic ivy, herb-Robert *Geranium robertianum*, and occasional hedge-woundwort *Stachys sylvatica*. Dog rose *Rosa canina* was also recorded as frequent.

WD2 Conifer Plantation

This occurs at a single location at the northern end of the Proposed Road Development. It is species-poor and dominated by non-native species cypress *Chamaecyparis* sp. and lodgepole pine *Pinus contorta*.

WD5 Parkland

This habitat occurs in amenity areas around the existing Blackwater Park carpark. A number of young ornamental trees occur and are of limited ecological value. Species include Japanese larch *Larix kaempferi*, small-leaved elm *Ulmus minor* and (copper) beech *Fagus sylvatica*.

WS1 Scrub

This habitat occurs as scattered bushes across the Blackwater Park meadow grasslands (GS2), where eared willow, grey willow, and their hybrid dominate. Elsewhere, hawthorn, bramble and/or gorse *Ulex europaeus* scrub is encroaching from hedgerows onto unmanaged areas of grassland. There is one area of dense blackthorn *Prunus spinosa* dominated scrub on the southern bank of the Blackwater River in an area of drier ground elevated above the surrounding floodplain.

WL1 Hedgerows

The hedgerows within and adjacent to the Proposed Road Development comprise a dense belt of mature hawthorn, with occasional semi-mature to mature ash. For the most part there is a poorly developed ground flora beneath the dense hawthorn. Some hedgerows have lush shield ferns, in addition to Atlantic ivy, herb-Robert and several other common hedgerow species such as hogweed *Heracleum sphondylium*. Dog rose is also recorded. Wild privet *Ligustrum vulgare* was scattered throughout hedges within and adjacent to the Proposed Road Development (see Section 7.3.4.4).

ED3 Recolonising Bare Ground

A localized area of sandy disturbed ground occurs near the centre of Blackwater Park in the vicinity of an approximately 4 m high vegetated mound originating from historical archaeological excavations. This area is disturbed by recreational mountain-bike users. Searches of this area revealed presence of a number of grassland species typical of dry habitats including wall speedwell *Veronica agrestis,* red bartsia, and red fescue *Festuca rubra* agg.

7.3.4.4 Protected Flora/Species of Conservation Concern

No protected plants or plants of conservation concern on the *Irish Red List for Vascular Plants* (Wyse Jackson et al 2016) were recorded during field surveys. Wild privet occurs throughout hedgerow habitats and is classed a "Waiting List" species on the Irish Red List for Vascular Plants (Wyse Jackson et al 2016), for which further research and surveys are needed before assessments can be made.

There are no Priority species which are plants identified in the Meath BAP.

There were no vascular plants of conservation concern returned from the desk study. No optimal disturbed chalk, limestone, or calcareous sandstone habitat which could contain the single non-vascular Red Data book plant recorded in the desk study (lance-leaved pottia). No notable of protected plants were recorded during the field study.

All other vascular plants recorded within and adjacent to the Proposed Road Development are of "Least Concern" on the Irish Red List (Wyse Jackson et al., 2016).

7.3.4.5 Invasive Flora

One 'scheduled' invasive species occurs near the Blackwater Park carpark on the Proposed Road Development. A stand of Japanese knotweed *Fallopia japonica* (approximately 5 m diameter) occurs next to a public footpath. No other scheduled species occur. No Himalayan balsam *Impatiens glandulifera* occurs in the floodplain of the Blackwater River in the ZoI of the Proposed Road Development.

7.3.5 Bats

7.3.5.1 Preliminary Roost Assessments (Ground Level)

A former farm shed of stone construction and corrugated pitched roofing (intact for the most part) was previously located within the Proposed Road Development along a local farm access, south of the convergence of the Proposed Road Development with Ratholdron Road (see photographs in Appendix A7-2). The structure has since been demolished (not related to the project) as of May 2020.

Daytime visual inspections in August 2017 found the former farm shed to contain potential crevices for bats in stonework, and the farm was assigned 'Low' suitability for roosting bats. 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)*".

The OPW buildings (see photographs in Appendix A7-2) were inspected in August 2018. The main building comprises a three-storey concrete building with a concrete shelter (approximately 10 m long) adjacent to the main building. The main building consists of two parts connected by internal walkways on the second floor, with an open courtyard within. The ground floor exterior has slatted wooden shutters, whilst the exteriors of the first and second floors, and walkways have metal-framed glass windows. Composite panels are used as cladding, and some deterioration was noted. The second-floor windows are covered with plastic sheeting, and the walkway exteriors are boarded up with wooden sheeting. Several gaps were noted in both the plastic and wooden sheeting. The junction between the building exterior and the flat roof is clad in metal (likely aluminium); again gaps were noted. A visual inspection of the interior confirmed that no loft spaces or suitable roosting areas are present. Fire damage is extensive on the ground floor and thus access to the ground floor western section was not possible.

Preliminary Roost Assessments were completed in August 2018 of all mature and semi-mature trees within the Proposed Road Development. One semi-mature ash tree in Blackwater Park (Chainage 0+650, Volume 3, Figure 7.3 and 7.4) located in the north-south aligned hedgerow was assigned low suitability for roosting bats. This tree which will be retained, is located approximately 10 m from the Proposed Road Development footprint. All other trees were assigned Negligible or low suitability for roosting bats.

7.3.5.2 Other Surveys

7.3.5.2.1 Bat Survey Results Summary

Six species of bats of (common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *Pipistrellus pygmaeus*, Leisler's bat *Nyctalus leisleri*, brown long-eared bat *Plecotus auritus*, Natterer's bat *Myotis nattereri*, and Daubenton's bat *Myotis daubentonii*) were identified using the Proposed Road Development for foraging and/or commuting across during all activity surveys.

Data from the SM2 static detector indicated that the Proposed Road Development:

- Has high levels of bat activity of soprano pipistrelle (66% of a total of 1,970 calls recorded); and,
- Significant bat activity of common pipistrelle (23% of total), and Leisler's bats (7% of total).

The area of the Proposed Road Development is also known to offer foraging or commuting activity to the following bat species of relatively 'High' sensitivity to lighting:

- Daubenton's bats (3% of total, but 13% of one riverside static detector recording station);
- Brown long-eared bat (<1% of calls recorded; total of 8 calls in the hedge running north-south along Blackwater Park)
- Natterer's bats (<1% of calls recorded; single calls along the Blackwater River, and in the hedge running north-south along Blackwater Park)

No bats were observed entering or exiting the former farm shed structure during the dusk emergence survey on 16 August 2017. No bats were observed entering or exiting OPW buildings during the dusk emergence survey on 28 August 2018.

The ash trees identified as of low suitability for roosting bats following Preliminary Roost Assessment was not subjected to a dusk or dawn emergence/re-entry survey.

Weather conditions for all surveys was considered suitable for bat activity under the BCT Guidelines (Collins, 2016)

Two significant hotspots of bat foraging activity were identified (Volume 3; Figure 7.3). These hotspots had four species confirmed as foraging or commuting and provided habitats to species of relatively high light sensitivity. These hotspots were located:

- On the floodplain along the Blackwater River, inside the Proposed Road Development (the only location where highly light sensitive Daubenton's were recorded); and
- In the hedgerow running north-south along the western boundary of the Proposed Road Development (the only location where highly light sensitive brown long-eared bat and Natterer's bats were recorded).

7.3.6 Badger

Three badger setts, not considered to be active, were located within 80 m of the Proposed Road Development (Table 7-9). No additional setts were identified within the ZoI of the Proposed Road Development (i.e. approximately 150 m of the Proposed Road Development boundary; the potential distance up to which piling, blasting, or rock-breaking could have significant effects). Badger setts have not been illustrated in Figure 7.3 of the published version of the EIAR to avoid persecution risk. A confidential version of Figure 7.3 is available upon request from MCC, subject to agreement with the NPWS.

Table 7-9 Status and tunnel orientation of holes in badger setts within ZoI of the Proposed Road Development

Sett reference	Distance to Proposed Road Development (Nearest Entrance)	Entrance reference	Status of entrance (Active/Disused/Collapsed /Other)	Tunnelling orientation
BS1	25 m	1	Disused	East
		2	Disused	East

Sett reference	Distance to Proposed Road Development (Nearest Entrance)	Entrance reference	Status of entrance (Active/Disused/Collapsed /Other)	Tunnelling orientation
BS2	75 m	1	Disused	North
		2	Disused	South-west
BS3	25 m	1	Disused	North
		2	Disused	North

The variety of wet and dry grassland, scrub, and wooded habitats within and adjacent to the Proposed Road Development 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 2017, 2018 and 2020, which reflects the disused condition of all setts recorded within the ZoI.

7.3.7 Otter

No evidence of otter was found within the Proposed Road Development or wider ZoI along the River Blackwater. No evidence of otter feeding, breeding or resting sites was found during the field surveys, despite surveys being carried out in November 2017 at the optimal time of year (i.e. following vegetation die-back) and other subsequent field visits. This widespread species is nevertheless presumed to forage and/or commute along the River Blackwater corridor, which contains favoured prey items including European eel, common frog and salmonid species.

7.3.8 Other Protected Mammals

There is abundant scrub and woodland habitat considered optimal for Irish stoat (Hayden and Harrington, 2001), on the margins of, and within the Proposed Road Development. Radio-tracking of stoat in Ireland (Sleeman, 1987) showed the 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).

Pygmy shrew were heard during kingfisher vantage point surveys. The 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 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).

There were no visual sightings or field signs of hedgehog *Erinaceus europaeus* 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 current disused status of all badger setts within the ZoI (and 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 assigned a conservation status of Least Concern according to the Irish Red List (Marnell *et al*., 2009).

There is potentially suitable habitat (e.g. meadow habitat) for Irish hare within the ZoI, and the species was recorded approximately 3 km to the north of the Proposed Road Development in 2012. However, in the current study, the species was not flushed by surveyors who repeatedly walked through grassland habitats over a total of eight days in different seasons. The suburban context for the Proposed Road Development, which includes regular disturbance by dog walkers, makes it suboptimal for Irish hare.

There is potentially suitable habitat for red squirrel *Sciurus vulgaris* in broad-leaved woodland within the ZoI of the Proposed Road Development. There are records of the species approximately 2 km from the Proposed Road Development from the NBDC dating to 2015. No red squirrel sightings were recorded. No squirrel dreys were recorded, 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). However red squirrel is elusive and the potential for the species to forage within the ZoI of the Proposed Road Development cannot be excluded.

7.3.9 Breeding Birds

7.3.9.1 Kingfisher

During the vantage point surveys, kingfishers were recorded on a total of four occasions during a total of eight survey hours from April to June 2018. Three sightings fell on a single survey date (12 June 2018; during the latter part of the kingfisher incubation period, and the peak chick-rearing period (BTO, 2005)). No feeding, perching, or food carrying was recorded. On three occasions, birds commuted along the river corridor without stopping. On one occasion, a bird was heard but not seen.

There was no optimal vertical soft-substrate nesting habitat for kingfisher within the ZoI of the Proposed Road Development.

Kingfisher was only recorded perching within the ZoI of the Proposed Road Development once (in July 2017, during habitat surveys). The perching post is located on the southern bank of the Blackwater River within the SPA, on a dead riparian shrub. This perching post is within the footprint of the proposed bridge abutment. Cummins et al. (2010) estimated there were 15-19 kingfisher territories in the River Boyne and Blackwater SAC[25]. This provides a density of 0.09-0.12 territories/linear km, which can be extrapolated to provide a mean territory length ranging from 8.3-11.11 km. Given a linear territory length of approximately 10 km, it is likely that the ZoI of the Proposed Road Development overlaps only a fraction of a single kingfisher territory, or potentially two territories, if the ZoI overlaps the junction of two territories.

There is no credible evidence that kingfisher nest, or regularly feed within the ZoI of the Proposed Road Development. The evidence gathered on field surveys suggests kingfisher use the ZoI occasionally to feed.

7.3.9.2 Other Breeding Bird Species

Meadow pipit *Anthus pratensis* is the only species of High Conservation Concern occurring within the ZoI in which a single territory is likely to occur in meadow (GS2) habitat. Robin *Erithacus rubecula* is the only species of Medium Conservation Concern occurring within the ZoI in which a single territory is also likely to occur (in scrub/woodland habitats).

Sparrowhawk (which is of Low Conservation Concern) is the only species occurring within the ZoI which is specially protected under Schedule 4 to the Wildlife Acts. A potential sparrowhawk nest (at that time inactive, lacking down lining or incubating birds) was observed in mixed woodland habitat east of the OPW buildings. No sparrowhawk alarm calling was recorded in this woodland, and no feeding signs, shed feathers, or other breeding evidence was recorded. However, sparrowhawk use multiple nests within a breeding territory, rotating annually, and a young or adult female bird was observed entering this woodland on a single occasion in June 2018. Based on this, a single territory of sparrowhawk is presumed to occur within the ZoI, and the nest site in the mixed woodland east of the OPW buildings could become active in future years.

Several species of Low Conservation Concern are considered to breed in the mosaic of wooded and grassland habitats across the ZoI of the Proposed Road Development. These species include wood pigeon *Columba palumbus*, dunnock *Prunella modularis*, goldfinch *Carduelis carduelis*, blackbird *Turdus merula*, song thrush *Turdus philomelos*, chiffchaff *Phylloscopus collybita*, wren *Troglodytes troglodytes*, willow warbler *Phylloscopus trochilus*,

[25] The River Boyne and Blackwater SPA was not designated at the time of the Cummins et al study in 2010.

sedge warbler *Acrocephalus schoenobaenus*, bullfinch *Pyrrhula pyrrhula*, reed bunting *Emberiza schoeniclus*, blue tit *Cyanistes caeruleus* coal tit *Periparus ater,* and great tit *Parus major.*

The buildings within the Proposed Road Development do not offer breeding sites to house martin *Delichon urbica*, barn swallow *Hirundo rustica* or swift *Apus apus*.

7.3.10 Wintering Birds

The SCI kingfisher populations of the River Boyne and Blackwater SPA are likely to be resident within the ZoI of the Proposed Road Development during the non-breeding season. At this time adult male kingfisher remain on their freshwater territories, while female and young kingfisher may commute downstream to coastal areas for enhanced feeding opportunities.

There is no optimal habitat for wintering birds designated under Annex 1 of the Birds Directive such as golden plover *Pluvialis apricaria,* or whooper swan *Cygnus cygnus*. These species favour open grassland and wetland areas for feeding, where human or other predators can be readily seen. The human disturbance in the Blackwater Park and the screening of the river corridor makes the ZoI of the Proposed Road Development sub optimal for these species. A review of the NPWS site synopsis (Version date: January 2014) for the River Boyne and River Blackwater SAC highlights a historic whooper swan population at several locations along the Boyne and Blackwater Rivers. It should be noted that whooper swan is not a qualifying interest of the SAC or a special conservation interest of the River Boyne and River Blackwater SPA. Historic populations have been recorded at Newgrange (approximately 20 individuals in recent winters), Slane (approximately 20 individuals in recent years), Wilkinstown (several records of greater than 100 individuals) and River Blackwater from Kells to Navan (104 individuals at Kells in winter 1996/97, 182 individuals at Headfort in winter 1997/98, 200-300 individuals in winter 1999/00). A review of typical connectivity distances documents whooper swan having a core foraging distance range from night roosts of up to 5km (SNH, 2016). Previous documented records of whooper swan at Newgrange (14.9 km east of the Proposed Road Development), Slane (11.2 km north-east of the Proposed Road Development), Wilkinstown (8 km north of the Proposed Road Development) and Headfort/Kells (13.8 km north-west of the Proposed Road Development) are significantly removed from the Proposed Road Development site and outside the core foraging range for whooper swan populations recorded in the wider surroundings (as described in the NPWS site synopsis). Given the location of the Proposed Road Development in proximity to the urban district environs of Navan town and habitats present onsite, the Proposed Road Development site is considered to be sub-optimal for the species.

The Proposed Road Development is also outside the core foraging range of other wintering bird populations such as greylag goose *Anser anser*, and pale-bellied Brent goose *Branta bernicla*.

Non-breeding populations of many of the species of Low Conservation Concern identified in Section 7.3.9 are likely to be present based on the habitats present. Some species only present in Ireland in the winter will additionally feed on berry bushes and wetland areas such as fieldfare *Turdus pilaris* and redwing *Turdus iliacus.*

7.3.11 Amphibians

Common frog *Rana temporaria* was incidentally observed during walkover surveys of the River Blackwater floodplain in July 2017. There was potential breeding habitat throughout marsh, swamp, wet grassland and wet woodland habitats within the ZoI of the Proposed Road Development.

Smooth newt requires (still or slow-flowing) ponds, small lakes, and drainage ditches rather than flowing waterbodies. The ZoI of the Proposed Road Development offers no potential breeding habitat for smooth newt due to the absence of standing waterbodies therein. Given the absence of breeding habitat, there is no potential for smooth newt to occupy ‘refugia’ in terrestrial habitats within the ZoI of the Proposed Road Development outside of the breeding season.

7.3.12 Fish

Atlantic salmon, brown trout *Salmo trutta*, and river lamprey are qualifying interests of the River Boyne and Blackwater SAC. There is suitable nursery and spawning habitat (such as gravels, deeper pools, and muds) for all three species and also brown trout[26] within the ZoI of the Proposed Road Development. The EPA has compiled a map of WFD Designated Salmonid Waters under the S.I. No. 293/1988 – European Communities (Quality of Salmonid Waters) Regulations 1988, as amended. Under this, Boyne and Blackwater Rivers are designated WFD

[26] Which is subject to various protections (along with all other fish species) under the Fisheries Acts 159-1990 as amended-

Designated Salmonid Waters. Inland Fisheries confirmed that River Blackwater currently has populations of atlantic salmon and brown trout, as well as several non-native species including pike *Esox lucius*.

Juvenile lamprey populations were surveyed by Ecofact (O'Connor, 2006), who found that significant populations of river lampreys and brook lampreys occur throughout the River Boyne catchment.

Extensive electrofishing operations were carried out in the Boyne catchment during the mid-1980s by the Central Fisheries Board (since renamed IFI; O'Grady 1995), which recorded ten non-native fish species. Of these, roach *Rutilus rutilus* is the only 'scheduled' species under the Regulations. These species are not discussed further in this EIAR, given there will be no instream works which could disperse this species.

7.3.13 Other Protected and Notable Species

7.3.13.1 Common Lizard

Common lizard was not observed during surveys. Sightings and field signs are rare outside of formal, targeted surveys, but optimal habitat (e.g. woods/scrub with basking sites on south-facing slopes) is present within the ZoI of the Proposed Road Development. In the absence of evidence to the contrary, a breeding population of the species is presumed to occur within the ZoI of the Proposed Road Development.

7.3.13.2 Butterflies

A number of common butterflies were recorded within the Proposed Road Development including green-veined white *Pieris napi*, meadow brown *Maniola jurtina*, speckled wood *Pararge aegeria*, common blue *Polyommatus icarus*, painted lady *Vanessa cardui,* and small tortoiseshell *Aglais urticae*. None of these species are of conservation concern as per the Irish Red List of butterflies (Regan *et al*., 2010).

No records of devil's bit scabious and kidney vetch (larval food plant of marsh fritillary and small blue respectively) were recorded within the Proposed Road Development.

7.3.13.3 Other Invertebrates

Six records of invertebrate species of conservation concern, as identified on Irish Red Lists were returned from the NBDC desk study; common whorl snail, large red-tailed bumble bee, marsh whorl snail, prickly snail, smooth grass snail and whirlpool ramshorn snail.

The woodland, reed bed, scrub, and grassland habitats present within the ZoI of the Proposed Road Development offer potentially suitable habitat for all of these species. In the absence of evidence to the contrary, and applying the precautionary principle, populations of all of these species are presumed present.

7.3.14 Summary Valuation of Significant Ecological Features

Table 7-10 summarises all significant ecological features identified within the ZoI of potentially significant effects. Significant features scoped into the EIAR are highlighted in grey in Table 7-10.

Table 7-10 Summary valuation of significant ecological features and identification of features scoped out from EIAR

Features		Highest Ecological Valuation within ZoI of Proposed Road Development	At Risk of Significant Effects	Scoped into assessment
Designated sites	European sites (River Blackwater and River Boyne SPA and SAC)	International	Yes	Yes (potentially at risk of significant effect). The potential for adverse effects are considered further within the NIS AND Section 7.4 of the EIAR.
	Other European sites	International	No	No (no risk of significant effect, no predicted pathways)

Features		Highest Ecological Valuation within ZoI of Proposed Road Development	At Risk of Significant Effects	Scoped into assessment
	National sites downstream of and within same CMU as Proposed Road Development (Slane Riverbank pNHA, Boyne Woods pNHA, Crewbane Marsh pNHA, Dowth Wetland pNHA, Boyne River Islands pNHA)	National	Yes	Yes (potentially at risk of significant effect)
	Other National sites (NHA/pNHA)	National	No	No (no risk of significant effect, no predicted pathways)
Habitats and flora	WN6 Wet willow-alder-ash woodland (Priority Annex 1 alluvial forest	International (QI of River Boyne and Blackwater SAC)	Yes	Yes (potentially at risk of significant effect)
	FW2 Depositing / lowland rivers (Coincident with River Boyne and Blackwater SAC/SPA)	International (Within River Boyne and Blackwater SAC)	Yes	Yes (potentially at risk of significant effect)
	FS2 Tall-herb swamp/ GM1 Marsh (Annex 1 hydrophilous tall herb fringe)	County-National	Yes	Yes (potentially at risk of significant effect)
	FS1 Reed and large sedge swamp	Local (Higher value)	Yes	Yes (potentially at risk of significant effect)
	FW4 Drainage ditches (the 'Windtown Stream')	Local (Higher value)	Yes	Yes (potentially at risk of significant effect)
	GS2 Dry meadows and grassy verges	Local (Higher value).	Yes	Yes (potentially at risk of significant effect). Habitat occurs within SAC boundary and potentially serves as secondary supporting habitat to QI otter.
	GS4 Wet grassland	Local (Higher value)	Yes	Yes (potentially at risk of significant effect). Habitat occurs within SAC boundary and potentially serves as secondary supporting habitat to QI otter.
	WD1 Broadleaved woodland	Local (Higher value)	Yes	Yes (potentially at risk of significant effect)
	WD2 Conifer plantation	Local (Lower value)	No	No (no risk of significant impact)
	WD5 Parkland	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	WS1 Scrub	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	WL1 Hedgerows	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	WL2 Treelines	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	GA1 Improved agricultural grassland	Local (lower value)	No	No (no risk of significant impact)
	ED3 Recolonising bare ground	Local (Lower value)	No	No (insufficient value)
	Rare flora – Lance-leaved pottia	Local (Higher value)	No	No (no risk of significant impact)
Fauna	Fish (atlantic salmon, and river lamprey) in the River Blackwater	International (QIs of River Boyne and Blackwater SAC)	Yes	Yes (potentially at risk of significant impact)

Features		Highest Ecological Valuation within ZoI of Proposed Road Development	At Risk of Significant Effects	Scoped into assessment
	Kingfisher (resident; foraging only)	International (SCI of River Boyne and Blackwater SPA)	Yes	Yes (potentially at risk of significant impact)
	Otter (presumed to forage in River Blackwater) *	International (QI of River Boyne and Blackwater SAC)	Yes	Yes (potentially at risk of significant impact)
	European eel and brook lamprey in the River Blackwater	County-National	Yes	Yes (potentially at risk of significant impact)
	Invertebrates of conservation concern presumed present in wetland and grassland surveys (Potentially including common whorl snail, large red-tailed bumble bee, marsh whorl snail, prickly snail, smooth grass snail, and whirlpool ramshorn)	County	Yes	Yes (potentially at risk of significant impact)
	Bats (foraging populations of at least six bat species)	Local-County	Yes	Yes (potentially at risk of significant impact)
	Ash tree in Blackwater Park with ‘Low’ suitability)	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	Birds other than kingfisher including one species of High Conservation Concern (meadow pipit only) one specially protected species under national legislation (Sparrowhawk), and several other species	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	Common frog	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	Common lizard, hedgehog, and stoat (all presumed present) *	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	Pygmy shrew	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	Badger setts	Local (Higher value)	Yes	Yes (potentially at risk of significant impact)
	Wintering birds excluding resident kingfisher	Local (Lower value)	No	No (no risk of significant impact)
	Other species (rabbits, foxes and other unprotected species)	Local (Lower value)	No	No (no risk of significant impact)

Table Footnotes

*Populations of species including lizard, hedgehog, and stoat, have been presumed present due to the broad habitat preferences of these species, and the difficulty in confirming presence in the course of typically acceptable EIAR survey effort.

7.4 Assessment of Impacts

This section should be read in conjunction with the impact assessment methodology in Section 7.2.6 which defines the categories adopted in this Chapter to characterise duration and significance of impacts. Impact assessment is carried out after considering embedded control measures. Mitigation measures may need to be applied on consideration of the results of the impact assessment. All mitigation measures (embedded controls measures and otherwise) are detailed in Section 7.5.

7.4.1 Do Nothing Scenario

The potential value of the Proposed Road Development to species of conservation value such as badgers and birds would continue, provided the existing public park 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 (and dogs) disturbance would continue. Japanese knotweed could, in the absence of remediation works, spread to riparian habitats, posing a threat to water quality.

Pollution risks from current agricultural and unsewered inputs will continue to pose a threat to atlantic salmon, river lamprey and other aquatic species. There is perhaps the greatest potential for climate change to have significant effects in the Do-Nothing Scenario. For instance:

- Increasing sea temperature which may negatively affect a) QI atlantic salmon of the Rover Boyne and Blackwater SAC during their growth from juveniles to adults at sea prior to their return to spawning grounds in the Blackwater River; and European eel during their marine breeding phase prior to their return to feeding grounds in the Blackwater River;
- Increasing frequency or intensity of extremely cold winters may significantly affect kingfisher winter survival, given populations of ‘first-winter’ birds may already be subject to mortality as high as 75%, and extreme weather is one of the greatest threats to the species’ survival (BirdLife, 2018).

7.4.2 Introduction to Types of Impacts

The Proposed Road Development could have a range of potential impacts (direct and/or indirect) upon significant ecological features during the construction and/or operation 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 usually arise as a knock-on effect of a development and would include aspects such as disturbance to bat activity as a result of habitat loss.

7.4.2.1 Introduction to Potential Construction-Phase Impacts

In the absence of mitigation, the Proposed Road Development could have a range of potential impacts on the QI /SCI of European sites within the ZoI during the construction phase. Significant potential impacts during construction include habitat loss, habitat deterioration, disturbance (i.e. visual, vibration and noise, temporary barriers to connectivity, etc.) 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 potential significance of impacts including vulnerability of individual receptors (e.g. condition of vegetation, or fitness of faunal populations), time of year and lifecycle stage of a species impacted, and the potential for unforeseen events such as extreme weather (including flooding of working areas), or introduction of invasive species to exacerbate predicted impacts.

In the absence of mitigation measures, construction phase impacts have the potential to disturb a range of habitats and protected species throughout the estimated 15 – 18 months duration of construction.

7.4.2.2 Introduction to Potential Operation-Phase Impacts

In the absence of mitigation and appropriate control measures, the Proposed Road Development could have a range of potential impacts on the QI /SCI of European sites within the ZoI during the operation phase. Significant potential impacts during the operational phase include pollution, habitat loss, habitat deterioration (altered flood regime), barriers to connectivity, disturbance, bird strike, mortalities due to collisions (road casualties) and artificial lighting.

7.4.3 Construction Phase

This section, which presents potential construction phase impacts for the Proposed Road Development alone, should be read in conjunction with the summary tables of potential impacts for the Proposed Road Development in Section 7.2.6).

7.4.3.1 European Sites (River Boyne and Blackwater SAC and SPA)

A NIS has been prepared to provide the competent authority with the information necessary to complete an Appropriate Assessment for the Proposed Road Development in compliance with Article 6(3) of the Habitats Directive.

7.4.3.1.1 Pollution

Surface Water

Potential pollution effect pathways (arising during construction works) have been identified with the Proposed Road Development and both the River Blackwater SAC and the River Boyne and River Blackwater SPA.

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 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 and site stripping and earthworks); and extreme weather events with potential for flooding Pollution as a result of accidental spillage and sediment release could potentially affect the QI and SCI species of the River Boyne and River Blackwater SAC and SPA that 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 salmonid and lamprey spawning habitat downstream (if present). This could have knock on negative impacts on the QI species (river lamprey, atlantic salmon, otter of the River Blackwater and River Boyne SAC and SCI kingfisher of the SPA). Pollutants have the potential to enter the flood plain and the River Blackwater during the construction phase (i.e. in the absence of a temporary cut off wall), pollutants may be carried to the flood plain and the QI habitats within, as well as the River Blackwater, with surface water run-off aided by the downward nature of the river bank. It should be noted that the Proposed Road Development adopts a clear span bridge structure and eliminates the requirement for instream works.

There is separately, a risk of pollutants entering the 'Windtown Stream' (drainage ditch) and being carried downstream into the River Blackwater. The potential effects to the River Boyne and Blackwater SAC/SPA, from the pollution pathway via this drainage feature and could be significant in the short to medium term.

No significant pollution effects are predicted from the construction works within the floodplain of the River Blackwater. As part of the project design, a cut-off wall will be put in place. The proposed wall will be designed to act as a cofferdam from potential ingress of flood waters.

There is a risk of pollutants entering the Windtown Stream and being carried downstream into the River Blackwater. These pollutants could have potentially significant effects on water quality or the physical structure of the river. Pollution is predicted to significantly affect spawning habitats for QI atlantic salmon and river lamprey of the River Boyne and Blackwater SAC, reduce available invertebrate prey for QI atlantic salmon, and/or reduce available fish prey of river lamprey. Any significant effects on fish or water quality in the Blackwater River could also significantly affect commuting and foraging QI otter of the River Boyne and Blackwater SAC, and SCI kingfisher of the River Boyne and Blackwater SPA. Taken together and subject to the types and volumes of contaminants concerned, potential effects to the River Boyne and Blackwater SAC/SPA, from the pollution pathway via the Windtown Stream could be significant in the short to medium-term.

Groundwater

In the absence of appropriate mitigation, the "Land and Soil" Chapter (Chapter 8) of this EIAR has identified potential pollution effects to groundwater and soils. 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 may 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. Applying the Precautionary Principle, such pollution could occur during the early stages of construction in each phase resulting in soil and/or groundwater contamination migrating into nearby receiving waters within the River Blackwater SAC and/or River Boyne and Blackwater SPA.

7.4.3.1.2 Habitat Loss

Land-take with respect of the River Boyne and River Blackwater SAC and SPA boundaries during the construction phase will be restricted to non-QI habitats of local importance (i.e. Dry meadows and grassy verges (GS2), Wet grassland (GS4), Broadleaved Woodland (WD1), Mixed broadleaved/conifer woodland (WD2), Scrub (WS1), Reed and large sedge swamp (FS1), Hedgerows (WL1) and Treelines (WL2)). The habitats onsite are common and widespread, however; the habitats are deemed to offer supporting secondary habitat to QI otter where the habitats overlap with the River Boyne and River Blackwater SAC and SPA boundary. There will be no loss of any QI habitat of the River Boyne and River Blackwater SAC. The Proposed Road Development has been designed to avoid QI Priority alluvial forest habitats of the River Boyne and Blackwater SAC.

The River Boyne and Blackwater SPA is not formally designated for any bird habitat SCI, however a perching post used by kingfisher for feeding will be permanently removed under current designs. It appears reasonable to state that abundant alternative riparian perching features currently exist within the territory of kingfisher affected which is likely to cover an area of ten linear km. Storm damage also presumably creates and destroys perching post features on a regular basis. The loss of the perching post could be significant in the short-term.

7.4.3.1.3 Habitat damage or deterioration

The main negative impacts recorded in QI alluvial forest habitat nationally are the spread of invasive species and "*over-vigorous native species*" (O'Neill and Barron, 2013).

In the absence of mitigation, there is potential for the introduction and dispersal of scheduled invasive species to the river corridor of the River Boyne and Blackwater SAC and SPA. Japanese knotweed, which is present within 30 m of the Proposed Road Development at Blackwater Park, could if spread within the SAC (e.g. via vehicle tyre treads, machinery, construction personnel, etc.), lead to erosion of bankside habitats (via shading out of the field and ground layers), and/or shading out of positive indicator species of QI Priority alluvial forest habitat, with potential impacts to the River Boyne and Blackwater SAC. Potential also exists for habitat deterioration in the form of littering/dumping of waste generated onsite and site access.

There is also the risk of introducing or increasing the spread of problematic native species in the course of carrying out earthworks in the vicinity of the River Boyne and Blackwater SAC. For instance, the field layer of QI alluvial forest could become dominated by common nettle due to localized nutrient enrichment associated with run-off during construction.

In the absence of mitigation, potential effects could be significant at the international scale of effect significance in the long-term.

7.4.3.1.4 Disturbance

QI river lamprey and atlantic salmon (River Boyne and River Blackwater SAC)
Sound from piling of abutments located on the river banks (set back distances of 10 m and 7.5 m from the river bank) will be emitted both through the water column as a sound pressure wave and through the ground as vibration.

atlantic salmon possess a swim bladder which enhances hearing sensitivity, as the bladder acts to convert sound pressure to vibrations (Tavolga et al., 1981). Strong avoidance behaviour to noise has been shown by some salmonid species (Nedwell et al., 2003). Lamprey species lack a swim bladder and some species have been shown to be tolerant of relatively low pressures without ill affect (Colotelo et al., 2012). However, there is lack of evidence regarding the potential sensitivity of lamprey to noise disturbance. The potential for significant injury and/or disturbance impacts to atlantic salmon and river lamprey from drilling is assumed to be significant within the locality of proposed drilling activities.

QI Otter (River Boyne and River Blackwater SAC)
Piling of bridge abutments, and noise and visible presence from construction staff and vehicles could displace foraging or commuting QI otter of the River Boyne and Blackwater SAC if present during construction. Potential displacement impacts to commuting and foraging otter would be limited to local level for the duration of construction (i.e. short-term). No evidence of otter feeding, breeding or resting sites was found during the field surveys.

No otter breeding or resting sites were identified within the ZoI during surveys informing the EIAR. However, otter could establish new above-ground 'couches' or below-ground holts between the completion of mammal surveys informing the EIAR on 23 November 2017 and 18 May 2018, 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 effect significance at International scale.

There will be no requirement for instream works associated with the Proposed Road Development and will therefore not serve as a temporary barrier to connectivity to the species using the River Blackwater. In the absence of mitigation, there is potential for significant short-term disturbance related effects during the construction phase.

7.4.3.1.5 SCI kingfisher (River Boyne and River Blackwater SPA)

Piling of bridge abutments, noise and visible presence from construction staff and vehicle activity could displace foraging or commuting SCI kingfisher of the River Boyne and River Blackwater SPA, if present during construction. Potential displacement impacts to commuting and foraging kingfisher would be limited to local level for the duration of construction (i.e. short-term). There will be no requirement for instream works associated with the Proposed Road Development.

No kingfisher nest sites were identified within the ZoI during surveys informing the EIAR. However, kingfisher could create new nesting holes between the completion of bird surveys in June 2018, and the start date of construction. If nests became established within the ZoI prior to construction, piling and associated disturbance could result in injury of kingfisher and/or young, potentially resulting in population-level effects significant at International scale.

The Proposed Road Development may also serve as a temporary barrier to connectivity should the species utilise the terrestrial habitats of the Proposed Road Development site for foraging and commuting. In the absence of mitigation, there is potential for significant short-term disturbance related effects during the construction phase.

7.4.3.2 Nationally Designated Sites

Having regard for the surface water treatment controls in the CEMP proposed to be submitted as part of the design, it is considered that there will be no impact pathway between the Proposed Road Development and the Slane Riverbank pNHA, Boyne Woods pNHA, Crewbane Marsh pNHA, Dowth Wetland pNHA or Boyne River Islands pNHA (or any other nationally designated sites) which could facilitate potentially significant pollution impacts.

7.4.3.3 Habitats and Flora

7.4.3.3.1 Annex 1 Habitat Loss/Damage

Non-QI Annex 1 hydrophilous tall herb occurs approximately 2 m from the proposed cut-off wall, and approximately 12 m from the proposed bridge abutment (on the northern bank) at its nearest point. Before the cut-off wall is built, the potential for machinery to encroach beyond the cut-off wall footprint and result in loss of non-QI Annex 1 hydrophilous tall herb fringe habitat cannot be excluded. Given the County-National value of this habitat, potential effects would be significant at County-National level, in the absence of mitigation.

7.4.3.3.2 Loss of Other Habitats

Permanent localised loss of reed and large sedge swamp (FS1), dry meadows (GS2), wet grassland (GS4), scrub (WS1), Broadleaved Woodland (WD1), Mixed broadleaved/conifer woodland (WD2), etc. within the Proposed Road Development footprint. Table 7-11 presents the respective habitat loss associated with the Proposed Road Development.

Table 7-11 Predicted Habitat Loss Associated with the Proposed Road Development

Habitat	Indicative Area (ha) Affected by the Proposed Road Development	Potential Scale of Impact Significance
GS2 Dry meadows and grassy verges	1.4 ha	Long-term slight negative effect
GA1 Improved agricultural grassland	0.93 ha	Long-term imperceptible negative effect
WD1 Broad-leaved woodland	0.34 ha	Long-term slight negative effect
FS1 Reed and large sedge swamp	0.16 ha	Long-term slight negative effect
GS4 Wet grassland	0.15 ha	Long-term slight negative effect
WS1 Scrub	0.1 ha	Long-term slight negative effect

Habitat	Indicative Area (ha) Affected by the Proposed Road Development	Potential Scale of Impact Significance
WD4 Conifer plantation	<0.1ha	Long-term slight negative effect
WD2 Mixed broadleaved/conifer woodland	<0.1ha	Long-term slight negative effect
GA2 Amenity grassland	<0.1ha	Long-term imperceptible negative effect
WL1 Hedgerows	<0.1ha	Long-term slight negative effect

The degree of effect in relation to habitat loss, in the absence of best practice, is assessed as ranging from Long Term Imperceptible Negative Effect to Long Term Slight Negative Effect. The extent of habitat loss outlined in Table 7.11 will not represent any significant loss of biodiversity. In addition, a large proportion of the habitats are highly modified and subject to high levels of management and are common and widespread in the local area.

7.4.3.3.3 Rare or Notable Flora

There will be no loss of, nor significant effects to any protected plants, or plants of conservation concern on Irish Red Lists. Wild privet, named on the waiting list of the Irish Red List (Wyse Jackson et al., 2016) is a common species planted along hedgerows in lowland habitats, and is valued at Local Importance (Higher value). Any potential impacts from loss of individual plants in hedgerows are limited to Local level.

7.4.3.3.4 Invasive Species

In the absence of mitigation measures and appropriate biosecurity control measures, the stand of Japanese knotweed next to the public foot path in Blackwater Park could potentially be disturbed during construction works and result in the spread and dispersal of this species to other areas of the Proposed Road Development site or beyond. Disturbance of soil containing rhizome fragments (Fennell et al., 2018) could result in the spread of the species, particularly where tyre treads or other machinery act as a vector during construction works. Subject to the habitats concerned, spread of the species could result in effects significant at Local - County levels.

7.4.3.4 Fauna

7.4.3.4.1 Bats (Loss/Disturbance Features with Suitability for Roosting)

There will be a permanent loss (through demolition) of one structure identified as being of low suitability to roosting bats. Following visual inspections and dusk emergence surveys, no bats were confirmed roosting. The loss of the structure is assessed as significant at the Local geographic scale.

A single ash tree located approximately 10 m from the Proposed Road Development footprint (Chainage 0+650) (Volume 3, Figure 7.3 and 7.4) was identified as having low suitability to roosting bats. This tree will be retained however, in the absence of mitigation, indirect light spill could impact on bat populations that may be present. Potential effects are assessed as significant at the Local geographic scale.

7.4.3.4.2 Bats (Other Potential Impacts to Foraging Populations)

Construction will permanently sever, and temporarily light (artificial lighting required):

- One bat activity hotspot along the north-south aligned hedgerow in Blackwater Park which is the only location where highly light-sensitive brown long-eared and Natterer's bats forage
- Plantation woodlands approaching the Ratholdren Road junction in which at least three bat species forage (including Leisler's bats; all are species are of low to moderate light sensitivity)

In the absence of appropriate control measures, the construction will temporarily light the corridor of the River Blackwater.

The geographic scale of effect significance to bat foraging habitats is assessed at Local level for the duration of construction (i.e. short-term).

7.4.3.4.3 Badger (Setts)

No direct impacts are predicted to known setts. No significant indirect effects from piling of proposed bridge abutments (between chainages 0+900 and 1+000) (Volume 3, Figure 7.4) are predicted to the three known setts, all of which are at least 150 m from the location of proposed piling.

Applying the precautionary principle, and given the recommended set-back distances of the NRA (NRA, 2006a) from badger setts (i.e. a minimum of 50 m from active setts during the badger breeding season), there is potential for tracking of heavy machinery or temporary storage to indirectly disturb two setts located approximately 25 m from the Proposed Road Development (BS1 and BS2; e.g. resulting in collapse of entrances, and/or injury or displacement of any badgers present). It is possible that one or both of these setts (disused as of April 2018) could become active prior to construction.

Badgers could also establish new setts in suitable habitat comprising scrub and rank grassland within the ZoI of the Proposed Road Development. The species could establish setts during the window of time between the completion of mammal surveys informing the EIAR on 23 November 2017, 18 May 2018 and 25 May 2020, and the start date of construction.

Potential effects to badger in the absence of mitigation could be significant at a Local geographic scale for the duration of construction and a period of time thereafter (i.e. < 7 years and therefore short-term).

7.4.3.4.4 Badger (Other Potential Impacts)

In the absence of mitigation measures, open excavation associated with the construction phase could trap badgers if they stray into such excavations overnight and no means of escape is provided.

7.4.3.4.5 Other Protected Mammals

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 impacts would be greatest when juveniles remain present in nests (i.e. generally from April-October in the case of all three species).

Taken together, site potential effects significant at Local geographic scale, for the duration of construction and a period of time thereafter (i.e. < 7 years and therefore short-term).

7.4.3.4.6 Birds Specially Protected under Schedule 4 to the Wildlife Acts (Sparrowhawk)

At least one pair of sparrowhawk is assumed to breed within the mixed woodland east of the OPW buildings. The size of the national population estimated for the species (12,340; Crowe et al., 2014), and abundance of wooded nesting habitat for the species across Co. Meath, suggests that several pairs of sparrowhawk would not comprise 1% of the population of County Meath. On this basis, potential loss of one pair of sparrowhawk nesting site within the Proposed Road Development, is predicted to be limited to significance at the Local geographic scale. Subject to population-level impacts which are difficult to predict, duration of these potential impacts could last from the short into the medium-term, given the relatively low reproductive rate of this raptor species compared to other birds such as passerines.

7.4.3.4.7 Other Breeding Birds

In the absence of mitigation, construction works could disturb at least one territory of High Conservation Concern meadow pipit, at least one territory of Medium Conservation Concern robin and one to several territories each of a number of Low Conservation Concern passerines. Potential impacts include disturbance and injury to eggs, young and nests, and permanent loss of potential nesting sites and foraging habitat.

Taken together, potential effects to other breeding birds are not predicted to be significant above Local geographic scale. Subject to population-level impacts which are difficult to predict, duration of these potential impacts may be limited to the short, given the relatively high reproductive rate of passerines compared to some other birds such as raptors.

7.4.3.4.8 Amphibians

Common frog is assumed to spawn in wetland habitats including marsh and wet grassland habitats. Works in, or removal of these habitats at the time of year when spawn, tadpoles or froglets are most likely to be present (i.e.

February to July inclusive[27]), could result in mortality of spawn, tadpoles, or froglets, and/or permanent loss of spawning habitat significant at a Local geographic scale. Although population-level impacts are difficult to predict, duration of these potential impacts is predicted to be limited to the short-term due to the abundance of common frog and their ability to rapidly re-populate a wide range of wetland habitats.

7.4.3.4.9 Butterflies

Site clearance is likely to result in the mortality of adult butterflies and/or caterpillars of several common species of Least Conservation Concern. Potential effects would be significant at Local geographic scale in short-term.

7.4.3.4.10 Other Invertebrates

In the absence of evidence to the contrary, and applying the precautionary principle, other invertebrate communities present within the Proposed Road Development have been assumed to include a range of species of conservation concern recorded in the desk study collectively assessed as of Local-County Value. Potential effects form the permanent removal of reed swamp, and wet and dry grassland habitats are predicted to be significant at Local-County geographic scales at worst.

7.4.3.4.11 Common Lizard

Potential disturbance impacts to common lizard populations presumed present in scrub and grassland habitats are predicted to be significant at Local geographic scale, for the duration of construction (i.e. < 7 years and therefore short-term).

7.4.3.4.12 Fish and Aquatic Features (Excluding atlantic salmon and river lamprey)

Having regard for the surface water treatment controls in the CEMP, no potentially significant effects from pollution are predicted to impact European eel, brown trout or brook lamprey.

In the absence of mitigation, and applying the precautionary principle, significant injury and/or displacement impacts from drilling are predicted to impact brown trout, brook lamprey European eel populations in the River Blackwater. Potential impacts are predicted to be significant at Local geographic scales in the short-term.

7.4.4 Operational Phase

This section presents potential operation phase impacts for the Proposed Road Development in isolation and should be read in conjunction with summary tables of potential impacts (Section 7.2.6).

7.4.4.1 European Sites (River Boyne and River Blackwater SAC only)

A Natura Impact Statement has been prepared to 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. In the absence of mitigation and appropriate control measures, the Proposed Road Development could have a range of potential impacts on the QI/SCI of European sites within the ZoI during the operational phase. Significant potential impacts during the operational phase include pollution, habitat loss, habitat deterioration (altered flood regime), barriers to connectivity, disturbance, bird strike risk, mortalities due to collisions (road casualties) and artificial lighting. Potential impacts during the operational phase, in the absence of adequate management and mitigation measures are described in the following sections.

7.4.4.1.1 Pollution

QI river lamprey, QI Otter and QI atlantic salmon (River Boyne and River Blackwater SAC); and SCI kingfisher (River Boyne and River Blackwater SPA)

No permanent drainage infrastructure for the Proposed Road Development will be at risk of flooding, even considering the 1:1000 year Annual Exceedance Probability (AEP) flood level (i.e. the 0.1% AEP; alternatively described as the “low probability” flood extent in the CFRAM dataset), in the high-end future scenario (i.e. accounting for a 30% increase in rainfall associated with climate change). As such there is no risk of the operational drainage system being flooded.

[27] Source: Website of the Irish Peatland Conservation Council http://www.ipcc.ie/a-to-z-peatlands/frogs/ . Accessed

The support abutment of bridge is located within the flood plain. Hydraulic modelling demonstrated there is limited potential to impact on the flood regime of the River Blackwater thus flood storage and the morphology of the river channel will not be impacted.

There is potential for impacts on water quality during the operational phase associated with siltation of storm water drainage system and attenuation pond/tanks; and 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 receiving watercourses including the River Blackwater that could potentially impact on QI river lamprey, QI Otter and QI atlantic salmon and SCI kingfisher due to the presence of a range of contaminants, typically including hydrocarbons, suspended solids and de-icing agents. In the absence of mitigation, there is the potential for significant effects associated with accidental spills and leaks to occur from vehicles using the Proposed Road Development during its operation.

The impacts and effects as a result of changes in air pollutant concentrations has been assessed for the Proposed Road Development in Chapter 10 (Air Quality). The assessment has concluded that there would be no instance under any of the scenarios considered where a receptor is predicted to be exposed to annual mean concentrations higher than the National Air Quality Standard value for Nitrogen Dioxide (NO2) and Particulate Matter (PM_{10} and PM2.5). No impacts are foreseen with regard to air pollutants on ecological receptors.

7.4.4.1.2 Habitat Loss

QI alluvial forest (River Boyne and River Blackwater SAC)

The Proposed Road Development will not pose any risk of (indirect) shading of QI Priority Annex 1 alluvial forest habitat in the River Boyne and River Blackwater SAC, due to the separation distance between the nearest proposed infrastructure (i.e. proposed cut-off wall) and the nearest area of this habitat type (which is c.a 25 m west of the Proposed Road Development on the northern bank of the Blackwater River).

QI river lamprey and QI atlantic salmon (River Boyne and River Blackwater SAC)

The proposed bridge structure is 16 m wide and will cast a permanent shadow on the underlying river bed. Bridges can cause shading of the river bank and bed thereby potentially altering the aquatic flora present in the river bed (Environment Agency, 2002). Cocchislia et al., (2012) reports that tree and shrub canopies provide shade and regulate watercourse temperatures that benefit fish populations. The shading effect of bridges can benefit fish by providing better cover and feeding opportunities (United States Federal Highway Administration, 1985). Shading associated with the proposed bridge crossing at the River Blackwater will not result in habitat loss or displacement of QI atlantic salmon and QI lamprey species during the operation phase and significant effects are not predicted.

The Proposed Road Development will not pose any risk of (indirect) shading of QI Priority Annex 1 alluvial forest habitat in the River Boyne and River Blackwater SAC, due to the separation distance between the nearest proposed infrastructure (i.e. proposed cut-off wall) and the nearest area of this habitat type (which is approximately 23 m west of the Proposed Road Development on the northern bank of the Blackwater River).

The River Boyne and River Blackwater SPA is not designated for any bird habitat SCI. No significant effects are predicted.

7.4.4.1.3 Habitat Deterioration (Altered Flood Regime)

River Boyne and River Blackwater SAC & SPA

The results of the bespoke hydraulic modelling (which takes account of local topography and is more accurate than CFRAM mapping) displayed a maximum increase of 0.008 m in the water level immediately upstream for all bridge options and no change was indicated in the water level immediately downstream of the proposed bridge for a 1% AEP event (accounting for climate change). It was concluded from the results of the hydraulic modelling that the development of the bridge would have limited impact on the flow and water levels.

Under the bespoke hydraulic modelling developed for the project (accounting for climate change), the following abutment areas will be within the 1% AEP extent:

- C. 250 m^2 of the abutment on the northern bank of the Blackwater River; and,
- C. 20 m^2 of the abutment on the southern bank of the Blackwater River.

The project design team has verified that potential flood regime changes will not result in significant changes to the frequency or intensity of flooding at Priority QI Alluvial Forest habitat locations (the nearest of which is approximately 25 m from the Proposed Road Development at its nearest point).

7.4.4.1.4 Severance Impacts to QI otter

Based on current bridge design and nature of the proposed works (project avoids instream works), there is no predicted severance to QI otter passage (commuting and foraging individuals).

7.4.4.1.5 Disturbance to SCI kingfisher and QI otter from Human Presence and Lighting

The presence of cyclists and pedestrians (both of which are unpredictable forms of disturbance), artificial lighting and to a lesser extent the presence of cars (a predictable disturbance) associated with the proposed bridge crossing poses a potential risk of displacing foraging and commuting QI otter, commuting QI river lamprey and salmon; and/or foraging SCI kingfisher. The effects of disturbance displacement are expected to decrease over time as birds, fish and mammals adjust to the new habitat configuration. This habituation may lead to some alterations in bird foraging behaviour (Welty, 1987). Artificial light can increase luminance levels in natural areas which could affect ecological functions. The location of inappropriate lighting could result in displacement disturbance impacts. In the absence of mitigation and appropriate control measures, potential impacts could result in significant long-term effects.

7.4.4.1.6 Barrier to Connectivity

SCI kingfisher (River Boyne and River Blackwater SPA)

There is adequate freeboard (approximately 2.5 m) above the 1% AEP flood level (1:100 year) for passage of SCI kingfisher beneath the proposed bridge crossing. No SCI kingfisher nest sites were identified within or in the immediate surroundings of the Proposed Road Development.

There is potential for artificial light to spill onto the River Blackwater associated with the Proposed Road Development during hours of darkness. The location of inappropriate lighting during the operational phase could cause disturbance or a barrier to connectivity on foraging and commuting SCI kingfisher. In the absence of mitigation and appropriate control measures, potential impacts could result in significant long-term effects.

QI river lamprey, Salmon and otter (River Boyne and River Blackwater SAC)

The proposed bridge abutments are located at setback distances of 10 m and 7.5 m from the river corridor. This area will be maintained in a natural state (except for the requirement of a temporary cut off wall during the construction phase). A mammal ledge above the 1% AEP (1:100 year) has been incorporated into the design of the proposed bridge crossing, to avoid any potential for severance impacts to commuting otter to cater for flood events at the 1% AEP (1:100 year). No otter breeding sites or resting places were identified within or in the immediate surroundings of the Proposed Road Development. No potential significant effects associated with barrier to connectivity or severance risks are predicted on QI otter.

There is potential for artificial light to spill onto the River Blackwater associated with the Proposed Road Development during hours of darkness. The location of inappropriate lighting during the operational phase could cause disturbance or a barrier to connectivity on QI atlantic salmon, QI river lamprey and QI otter.

In the absence of mitigation and appropriate control measures, potential impacts could result in significant long-term effects.

7.4.4.1.7 Bridge Strike Risk to SCI kingfisher

Kingfisher foraging behaviour (involving visual identification of fish prey in water) requires them to avoid flying 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. Kingfisher typically establish vertical nest banks at 1-2 m in height (Cummins et al., 2010). It is assumed that the species typical flight heights fall within this range when foraging and commuting along river corridors. The proposed bridge will be >2.5 m above the water level and will provide sufficient free board for the passage of SCI kingfisher. The evidence base indicates there is unlikely to be significant risk of collision impacts to kingfisher from the proposed bridge crossing and operating traffic of the River Boyne and Blackwater SPA.

7.4.4.1.8 Mortalities Due to Collisions (Road Casualties)

QI otter (River Boyne and River Blackwater SAC)

There is potential for accidental otter fatalities with vehicles as individuals attempt to cross the new road development from watercourses and adjoining terrestrial habitats. New roads and bridges are not a significant threat (due in part to modern construction requirements), however existing roads will continue to threaten otter populations (NPWS, 2017a). Furthermore, the project avoids any requirement for instream works and interference of the River Blackwater and will not impede commuting and foraging otter using this river corridor during both the construction and operational phase of the Proposed Road Development.

7.4.4.2 Nationally Designated Sites

Having regard for the proposed drainage system, including an attenuation pond/tanks, there are no hydrological impact pathways between the Proposed Road Development and the Slane Riverbank pNHA, Boyne Woods pNHA, Crewbane Marsh pNHA, Dowth Wetland pNHA or Boyne River Islands pNHA (or any other nationally designated sites) which could trigger potentially significant pollution effects.

7.4.4.3 Habitat Loss

Non-QI Annex 1 hydrophilous tall herb fringe habitat occurs approximately 2 m from the proposed cut-off wall, and approximately 12 m from the proposed bridge abutment (on the northern bank) at its nearest point.

Applying the precautionary principle, the potential for shading of the non-QI Annex 1 hydrophilous tall herb fringe habitat cannot be excluded located to the west of the Proposed Road Development. The proposed cut-off wall will be a temporary structure and dismantled following construction phase, unless a partial demolition of the proposed cut-off wall (with incorporation the remaining bottom part into the bridge foundation) is agreed between MCC and the appointed Ecologist to avoid more detrimental effects to the SAC associated with the full demolition.

In the absence of mitigation, potential effects on non-QI Annex 1 hydrophilous tall herb fringe habitat are predicted to be significant at the County Level (i.e., the same geographic scale of significance applied to the habitat as a whole).

7.4.4.4 Fauna

7.4.4.4.1 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 Blackwater River corridor.

7.4.4.4.2 Bats (Lighting)

A UK research report into the impact of lighting on bats (Stone, 2013) has categorized 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. If the effectiveness of the types and locations of lighting cowls is not verified by a suitably experienced bat ecologist using a handheld lux meter, light spill onto watercourses and vegetated areas could disturb or displace of up to six species (of a total of nine in Ireland) during the operational phase of the Proposed Road Development. Potential effects on bats could be significant at Local to County geographic scales for the duration of operation (i.e. in the long-term).

7.4.4.4.3 Badger and Small Mammals (other than Bats)

Increased activity and human presence, noise, fencing and additional lighting may displace badger, hedgehog, pygmy shrew, and stoat from favoured foraging habitats during the operational phases. Potential effects could be significant at Local geographic scale for the duration of operation (i.e. in the long-term).

In the absence of mitigation and appropriate control measures, potential impacts could result in significant long-term effects.

7.4.4.4.4 Breeding Birds

Habitat loss impacts have been addressed under construction. One species protected under the Wildlife Acts (sparrowhawk), one species of Medium Conservation Concern, and numerous species of Low Conservation Concern may be displaced from nesting or foraging habitats within the Proposed Road Development due to visible human presence in previously undisturbed areas. Potential effects could be significant at Local Scale for the duration of operation (i.e. in the long-term).

7.5 Mitigation Measures

In the absence of mitigation, Section 7.4 of this EIAR identified effects likely to arise from the Proposed Road Development on the attributes associated with the QI of the River Boyne and River Blackwater SAC and the SCI of the River Boyne and River Blackwater SPA. 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 measures that avoid the potential for any adverse impacts on the QI of the River Boyne and River Blackwater SAC, SCI of the River Boyne and River Blackwater SPA, nationally designated and/or protected habitats and species and Annex I habitats. The following control 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 River Blackwater.
- Installation of an attenuation pond/tanks, including treatment and attenuation of all surface water to appropriate standards prior to discharge to the River Blackwater.
- Alignment of the Proposed Road Development which has avoided direct impacts on QI alluvial forest (priority Annex I habitat) of the River Boyne and River Blackwater SAC.
- Installation of a temporary cut off wall (i.e. proposed construction sequence for the bridge is to construct a large 1 m wide and up to 5 m deep cut off wall) which will minimise seepage and overtopping from the construction zone adjacent to the River Boyne and River Blackwater SAC and SPA. The temporary cut off wall coupled with dewatering measures will create a safe and dry works area and will be constructed using an excavator on bog mats and a trench box. The cut off wall will be detailed to ensure it caters for the flood level to avoid the risk of flood to the construction zone. The proposed cut-off area serves as a coffer dam to protect the working area from potential ingress of flood waters. As such, no significant pollution effects will occur from the construction works within the flood plain of the River Blackwater. Mitigation measures such as silt fencing will be used to reduce the risk to the River Blackwater and the River Boyne and River Blackwater SAC and SPA. The elevated section of the cut-off wall (i.e. above ground elements) will be dismantled and removed offsite and reinstated with soil and grass seed/vegetated turves in keeping with the natural landscape.
- Adequate freeboard above the River Blackwater (2.5 m) allowing for safe passage of QI otter of the River Boyne and River Blackwater SAC and SCI kingfisher of the River Boyne and River Blackwater SPA.
- Inclusion of a mammal ledge within the 1% AEP flood event (1:100 year) in the design of the proposed bridge crossing; to NRA standard (NRA, 2006b), to allow for continued passage of otter and other mammals in the event of a 1% AEP flood event (1:100 year).
- Mammal fencing will be installed along the proposed road alignment, and a dry mammal underpass has been designed into the proposed alignment (in a proposed road embankment in Blackwater Park with no risk of flooding (Chainage 0+450; Volume 3, Figure 4.3). Mammal fencing and the proposed underpass will be designed (e.g. including 'lead-in planting'), installed and maintained in accordance with the NRA specification (NRA, 2006). Appropriate setback distances from the River Blackwater corridor will be maintained to avoid any restrictions on the movement of Otter from utilising riparian zones along the river margins.
- 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. With particular regard to the discharge on the north side of the River Blackwater, it is noted that the interceptor ditch on the west side will be piped under the proposed embankment (at approx. Chainage 0+875; Volume 3, Figure 7.3) to join the interceptor ditch on the east side. This solution will provide one single outfall location into the River Blackwater to the east of the proposed bridge which will be located to a greater distance from the QI alluvial

forest (QI of River Boyne and River Blackwater SAC) and Annex I hydrophilous tall herb fringe communities (non-QI), thereby minimising the potential for indirect effects associated with drainage on QI alluvial forest. Adoption of a solid bridge parapet (1.4 m high) and low-rise lighting system (e.g. lighting integrated within the bridge parapet or alternative systems where the level of light source is not higher than the bridge parapet) in order to avoid light spill (natural zone) onto the River Boyne and River Blackwater SAC and SPA.

- Control measures such as silt fencing will be used throughout the construction phase to reduce the risk to the River Boyne and River Blackwater and the SAC and SPA. Regular monitoring and recording of the effectiveness of the control measures will be used implemented with additional control measures employed if and when required.
- The proposed bridge abutments comprise a setback distance of 10 m and 7.5 m respectively from the River Blackwater, thereby maintaining a natural corridor on either side of the river bank.
- The location and layout of the construction compounds[28] will incorporate the protection and control measures and conform to the requirements outlined in the CESCP.
- Various construction methods that safeguard the water quality of the River Boyne and River Blackwater SAC and SPA (i.e. River Blackwater).
- Adoption of a sealed system where the proposed road crosses the River Blackwater SAC. Road runoff associated with the project 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.
- A vegetated interceptor ditch will be constructed at the tank outlet. This will be located upstream of the River Boyne and River Blackwater SAC and SPA and will provide additional treatment. The headwall will be constructed using precast concrete or Stone Gabions to minimise the potential for pollution to enter the River Blackwater during construction.
- The project design caters for shut-down facilities at outfalls (as a precautionary measure) due to the presence of the River Boyne and River Blackwater SAC and SPA.
- Control measures such as silt fencing will be used throughout the construction phase to reduce the risk to the River Blackwater and the SAC. Regular monitoring and recording of the effectiveness of the control measures will be used with control measures employed if and when required.
- Planting of native, species-rich woodland and grassland areas within the Proposed Road Development as specified in Chapter 12 (Landscape and Visual); and,
- Minimal hedge removal through ‘stepping-in’ of proposed fence lines near these habitats;

Sections 7.5.1 and 7.5.2 present the mitigation measures to be employed by the appointed Contractor during construction and MCC during the operational phase respectively.

Mitigation has been proposed to avoid or further reduce potential impacts to acceptable levels. These measures include the following key themes:

- Precedence of mitigation protecting European sites over mitigation protecting other features where conflict arises (e.g. seasonal avoidance of piling during the spawning season of QI atlantic salmon, which results in inevitable disturbance to nationally protected nesting birds);
- Commission a suitably experienced Ecologist during construction and handover phases to oversee and advise the appointed Contractor(s) on implementation of mitigation;
- Pre-construction surveys for invasive species, badger, otter, and kingfisher to ensure mitigation addresses any changes in site conditions since completion of surveys to inform this EIAR in 2017, 2018 and 2020;
- Timing of works:
- Limit earthworks within the floodplain of the River Boyne and River Blackwater SAC/SPA to the driest months of the year when rainfall poses the least risk of siltation to fish including atlantic salmon and lamprey species;
- Time works differently by location within the Proposed Road Development footprint to minimise disturbance of nesting birds, badgers and their setts; and

[28] It was proposed that the primary construction compound would be located on the land located to the south-west of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. An alternative and secondary compound is proposed to the north of the existing N51/R147 roundabout on the land currently occupied by the commercial building to be demolished.

- Use of monitoring by a suitably experienced ecologist to determine the effectiveness of mitigation in agreement with NPWS.

7.5.1 Construction-Phase Mitigation

7.5.1.1 Role of The Ecologist

Prior to commencement of construction, a suitably experienced Ecologist (the Ecologist), will be engaged as part of the Employer's Representative (ER) Team. The Ecologist will be a full member of a relevant professional institute such as the 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 Ecologist 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 Method Statements and programme.

The Contractor will accommodate the Ecologist, whose role will be to:

- Oversee carrying out of pre-construction surveys to the appropriate NRA specifications (NRA, 2005-2011) (Section 7.5.1.2);
- Communicate relevant matters to MCC, and other stakeholders as relevant;
- Review Contractor Method Statements for compliance with the mitigation outlined in this Chapter and NIS;
- Attend site meetings and input to Contractor toolbox talks prior to commencement of the Proposed Road Development; and
- Supervise and direct construction of the Proposed Road Development as part of the Employer's Site Representative (ESR) Team (Ecological Clerk of Works).

At the time of writing, there were no protected species licences required in relation to QI/SCI, or invasive species. The Ecologist will determine the potential requirement for licences outside the scope of this EIAR Chapter.

7.5.1.2 Pre-Construction Surveys

At least two months in advance of commencing any construction works (including enabling or advance works), the Ecologist will oversee the design and implementation of pre-construction surveys having regard for best available scientific knowledge including the specifications in the NRA 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 2017,2018, 2019 and 2020.

The Ecologist shall ensure suitably experienced ecologists complete the surveys (as determined by the Ecologist).

The Ecologist 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);
- 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), to include updates of the status of all badger setts identified during EIAR surveys[29];
- Red squirrel dreys (within 50 m of all works); and,
- Invasive species (within 50 m of all other works).

The Ecologist will take necessary steps to mitigate survey limitations including for instance:

- Overseeing localized 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);

[29] Badger setts have not been illustrated in this EIAR due to persecution risk, but have been provided to MCC separately. MCC can provide sett locations to the appointed Ecologist.

- Using hair tubes to determine presence of red squirrel having regard for relevant guidance including Cornally and Lawton (2016).
- Accessing the Blackwater River by boat to search for kingfisher nest sites where the pre-construction survey window does not overlap the kingfisher nesting season, or where areas with potential to contain otter breeding or resting sites cannot be accessed from the banks.

7.5.1.3 Pollution Control Mitigation

Water Quality

The measures described in this section shall 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 MCC, and the appointed Ecologist. 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 shall be implemented as a minimum by the appointed Contractor:

- Installation of a temporary cut off wall (i.e. proposed construction sequence for the bridge is to construct a large 1 m wide and up to 5 m deep cut off wall) which will minimise seepage and overtopping from the construction zone adjacent to the River Boyne and River Blackwater SAC and SPA. The cut off wall will be detailed to ensure it caters for the flood level to avoid the risk of flood to the construction zone.
- Construction Phase earthworks to avoid periods of relatively high rainfall, in conjunction with flood forecasting.
- Phasing and other silt control measures to be refined by the Contractor into an CESCP, which will be agreed between MCC and the appointed Ecologist.
- A construction compound will be required along or in the vicinity of the Proposed Road Development. It was proposed that the primary construction compound would be located in the land located to the south-west of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. An alternative and secondary compound is proposed to the north of the existing N51/R147 roundabout on the land currently occupied by a commercial building to be demolished. Use of high-performance silt fencing, whose efficacy has been proven by credible evidence (Liddon, 2013).
- Use of a single layer of high-performance silt fence around all other works adjacent or in close proximity to the SAC; and specifically, and exclusively following installation methods outlined in published literature (Caraco, 2000) to maximize the effectiveness of particle filtration by geotextiles.
- Use of a triple layer of high-performance silt fence, in conjunction with sandbags, within 50 m of the boundary of the River Boyne and River Blackwater SAC/SPA.
- Supervision of installation and performance throughout construction of silt fencing and other pollution control measures by the Ecologist and ER Team who will advise the Contractor on repairs required to maximize performance (including repair of sandbags).
- Use of silt dewatering bags or tubes in conjunction with filter drains and other means necessary to capture, attenuate, and treat surface water generated during construction prior to any discharge to watercourses (subject to the relevant licenses);
- Use of geo-textile or timber mats within the 0.1% AEP flood level (1:1000 year) to minimise erosion of soils during tracking of machinery over other vegetated ground.
- Fuel handling and bunding procedures during the works, in unsurfaced areas of the site and in areas near rivers, streams and watercourses.
- Contractor to adopt, and provide evidence to MCC and the Ecologist of staff training in Spill Response & Control Plan to minimize the risk of adverse impacts upon surface waters and groundwater in the unlikely event of accidental spillages, flooding or other emergencies;
- Procedures for dewatering the working area to include adequate treatment of any resulting silt-laden surface water prior to discharge.
- 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; and
- Material and machinery storage to be outside the 1% AEP flood level (1:100 year).

Mitigation measures relating to safeguarding water quality during the construction phase are outlined in Chapter 9 (Water) of this EIAR

Earthworks

Mitigation measures relating to safeguarding water quality of natural watercourses and earthworks during the construction phase of the project are outlined in Chapter 8 (Land and Soils) of this EIAR.

7.5.1.4 Invasive Species (Measure for All Features)

An Invasive Species Management Plan (ISMP) will be produced by the appointed Contractor to determine the appropriate methods for treatment, control, and/or removal of Japanese knotweed. The ISMP will be informed by a pre-construction survey. The pre-construction survey will be carried out during the growing season (i.e. from May to September) to assess if new populations of invasive species have become established since the original surveys were completed in 2017, 2018 and 2020 to inform this EIAR. The Ecologist will review the draft ISMP to ensure it has due regard for emerging best scientific knowledge.

Developing codes of practice aims to reduce the risk from, and impacts of, invasive species and safeguarding the QI and SCI of the River Boyne and River Blackwater SAC/SPA.

In addition to the preparation of an ISMP, the proposed works will adopt best practice control measures to avoid the potential for cross-contamination with infested areas. The project and ISMP will have due regard to the relevant biosecurity measures throughout all phases of the project:

- Clearly identify and mark out the infested areas of Japanese knotweed to inform construction personnel and operating machinery. Infested areas of Japanese knotweed will be fenced off (where possible) and signage will be installed to highlight the location of invasive species.
- Create dedicated exclusion zone entry and exit points for operators on foot and for mobile equipment in the vicinity of infested areas comprising stands of Japanese knotweed.
- All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their use elsewhere.
- Wheel washing facilities will be provided at the site entrance. All washing must be carried out in areas with no potential to result in the spread of invasive species.
- Care will be taken not to disturb or cause the movement of fragments of invasive species, either intentionally or accidentally.
- All plant machinery and construction personnel will be restricted to the footprint of the proposed works area and will avoid unnecessary crossings in adjoining areas known to support stands of Japanese knotweed.
- 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 seven metres will be applied to avoid disturbance of lateral rhizomes.
- Machinery must be thoroughly pressure-washed in a designated area at least 25 metres 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 Japanese knotweed before commencement of works.
- For any material entering the site, the supplier must provide an assurance that it is free of invasive species (i.e. Japanese knotweed).
- Good construction site hygiene will be employed to prevent the spread of these 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 on site 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 (PCA) (2018) – *Practical Management of Invasive Non-Native Weeds in Britain and Ireland*. And

with reference to the National Roads Authority *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (NRA, 2010) where appropriate.

7.5.1.5 Emergency Response and Environmental Training

The Contractor shall 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 Ecologist. 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 shall be carried by the Contractor; and,
- Information on spill control procedures as specified in Section 7.5.2.3 and Chapter 9 (Water) of EIAR.

7.5.1.6 Construction Environmental Management Plan (CEMP)

The Contractor will be required to implement the measures outlined in the CEMP), also referred as Environmental Operating Plan (EOP), in accordance with the NRA/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;
- 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.

7.5.1.6.1 Construction and Demolition Waste Management Plan

Included within the CEMP will be the 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; 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.

7.5.1.6.2 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 scheme. These mitigation measures will be implemented in full and will ensure that sediment laden runoff from the construction site does not enter watercourses or water bodies with an emphasis on the River Boyne and River Blackwater SAC/ SPA.

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.

7.5.1.7 Mitigation for European Sites (River Boyne and River Blackwater SAC and SPA

7.5.1.7.1 Pre-Construction Surveys

The requirements to complete surveys for invasive species, kingfisher nest sites, and otter breeding or resting sites have been described above under Section 7.5.1.2. The role of the Ecologist will include communicating and reporting these findings and associated actions arising to MCC, the Contractor, the NPWS and/or the IFI as appropriate.

7.5.1.7.2 Habitat Damage/Deterioration

The Ecologist shall supervise setting out of the works to avoid the potential for QI alluvial forest of the River Boyne and Blackwater SAC (which are located c. 25 m west of the Proposed Road Development) to be disturbed during works .A number of measures are proposed to avoid disturbance and habitat deterioration of QI alluvial forest (Volume 3, Figure 7.3) during the construction phase of the project. The following measures have been considered in respect of QI alluvial forest:

- An exclusion zone will be established to safeguard areas of QI alluvial forest within the Proposed Road Development to avoid any unnecessary disturbance or intrusion during site works. The Ecologist will supervise setting out of all works within European sites and instruct the contractor on areas of alluvial forest and other sensitive habitats to avoid.
- Temporary signage will be installed to highlight the location of QI alluvial forest to construction personnel accessing the site.
- Any requirement for stockpiling, re-fuelling of machinery, site access, etc. during the construction phase will be sited away from QI alluvial forest.
- 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 Ecologist.
- Any waste/litter generated onsite will be removed offsite to a waste licensed facility. There will be no interference with areas of QI alluvial forest during site works. The Ecologist will verify that the Contractor has left the site of the proposed works as found, and where relevant direct the Contractor to remove any litter, or materials off-site.

7.5.1.7.3 Phasing of Earthworks

Earthworks for the proposed cut-off wall within the 1% AEP flood level (1:100 year) will be carried out from July to September inclusive (following published guidelines by IFI (2016)). This period is deemed to have the least ecological impact on aquatic fisheries and QIs of the River Boyne and River Blackwater SAC. The proposed bridge abutments and associated piling operations are located at a setback distance of 7.5 m and 10 m respectively from the River Blackwater and avoids any requirement for instream works. Therefore, construction of the bridge abutments and associated operations will not be subject to the same timeframe restrictions that will apply for the proposed cut-off wall. It is envisaged that such cut-off wall works will be scheduled to coincide with periods of dry weather. As a further precaution, to minimise the risk of an unforeseen flood event during construction of the proposed bridge abutments and allow for protective measures to be installed prior to flooding management, the Contractor will monitor weather conditions in advance throughout the construction phase. There will be some requirement for vegetation clearance during the bird nesting season (1st of March to 31st of August inclusive). A derogation licence under Section 55 of European Communities Regs 2011 may be sought to carry out the works to comply with the requirements of the provisions of Regulation 53. However, construction works will adhere to avoid vegetation removal where possible. There will be no requirement for vegetation removal of riparian habitats associated with the River Blackwater 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

MCC, the Employer's Representative (ER) Team, and the Ecologist who will agree the appropriate response to protect the working area.

Due to the ecological sensitivities associated with the River Boyne and River Blackwater SAC and SPA, vegetation clearance and earthworks for the following elements of the Proposed Road Development will be phased for the months July to September inclusive:

- The locations of the proposed cut-off wall in proximity to the River Blackwater.

Elsewhere, vegetation clearance will be restricted where possible, particularly within the River Boyne and River Blackwater SAC and SPA.

7.5.1.7.4 Phasing of the Proposed Cut-off Wall/Piling (Disturbance to Fisheries)

A range of best practice control measures in relation to noise and vibration have been compiled in Chapter 11 (Noise and Vibration Chapter) of this EIAR. The proposed measures will have due regard to the QI of the River Boyne and River Blackwater SAC and SPA during the construction phase. The proposed measures will be carried out with a view to maintaining noise 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, river lamprey and otter) of the River Boyne and River Blackwater 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 and river lamprey, it is recommended that works associated with the proposed cut-off wall in proximity to the River Blackwater will be undertaken within the timeframe of 1 July to 30 September (inclusive). 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. The construction of the proposed cut-off wall within the River Boyne and Blackwater (SAC and SPA) will be programmed outside the spawning, nursery, and migration season for QI river lamprey and will be scheduled from July to September inclusive, unless otherwise agreed with IFI. The proposed bridge abutments and associated piling operations are located at a setback distance of 7.5 m and 10 m respectively from the River Blackwater and avoids any requirement for instream works. Therefore, construction of the bridge abutments and associated operations will not be subject to the same timeframe restrictions that apply for the proposed cut-off wall. It is envisaged that such cut-off wall works will be scheduled to coincide with periods of dry weather primarily during summer months and outside the core migration period for Atlantic salmon and river lamprey. To mitigate impacts to QI river 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 MCC 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 MCC.

To mitigate impacts to QI species, soft-start drilling activities will be employed to allow salmon and other fish to move away before the full intensity of drilling 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 MCC 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 MCC.

7.5.1.7.5 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 QI species (i.e. river lamprey, salmon and otter). Turning off lights during periods of darkness throughout the construction phase will eliminate any risk of impacts sensitive ecological receptors outside of work hours. The risk of impacts associated with artificial lighting on the River Blackwater 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 River Boyne and River Blackwater SAC. Light spill from construction onto the River Blackwater will 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 Ecologist will ensure that these measures are adhered to during the construction phase.

7.5.1.8 Mitigation for Bats

7.5.1.8.1 Roosting Bats

No mitigation is proposed for roosting bats. All buildings have been identified as being of “low suitability”.

7.5.1.8.2 Foraging Bats

During construction, an experienced bat ecologist will visit the 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.

7.5.1.9 Mitigation for Badger

Following completion of, and informed by pre-construction badger surveys, the Ecologist will determine the potential requirements for licensed works to badger setts. As a minimum, unless otherwise agreed with the NPWS, the two nearest setts to the Proposed Road Development (BS1 and BS3) will be temporarily excluded under licence from the NPWS, following NRA guidance (NRA, 2006a).

The Contractor shall check spoil piles and evidence of excavations on a regular basis to monitor badger activity.

7.5.1.10 Mitigation for Other Protected Mammals

There is no mitigation proposed for red squirrel, as there are currently no dreys known to occur within the ZoI of the Proposed Road Development. In the event where red squirrel dreys are confirmed as active (e.g. through direct sighting of a red squirrel, or through use of hair tubes), the Ecologist will advise the Contractor on relevant mitigation requirements potentially including licensing from the NPWS.

Implementation of mitigation for breeding birds (Section 7.5.2.11) will avoid vegetation removal during March-August inclusive where possible with the exception of earthworks required from the period July to September inclusive at the location of the proposed cut-off wall (to minimise any potential impacts on fisheries in proximity to the River Blackwater and seasonal constraints in line with IFI Guidelines (IFI, 2016)). A derogation licence under Section 55 of European Communities Regs 2011 may be sought to carry out the works (vegetation clearance) to comply with the requirements of the provisions of Regulation 53. However, construction works will adhere to avoid vegetation removal where possible. The construction works will primarily be carried out during dry weather periods largely restricted to summer months. This mitigation will simultaneously avoid the majority of the main breeding season for pygmy shrew and hedgehog which run from April-October, and stoat, which breeds in May-June (Hayden and Harrington, 2001).

Four artificial hedgehog nesting boxes will be provided by the Contractor, for installation by the Ecologist in sheltered areas of retained scrub and woodland away from obvious sources of human disturbance, and with entrances pointing away from prevailing winds. The Ecologist will insert straw, while wearing gloves to prevent transference of pheromones, in each box during installation to encourage usage.

7.5.1.11 Mitigation for Nesting Birds

The Ecologist or other suitably experienced ecologist 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 during summer months where possible.

Vegetation clearance for most areas will be restricted during summer months where possible. 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 works requires removal of vegetation during the breeding season, such works will be approved by the Ecologist, or other suitably experienced ecologist, 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. The Ecologist 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 containing nests 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, may be carried out to greatly reduce the risk of birds nesting within the Proposed Road Development for much of that breeding season (excluding for earth works where necessary).

Subject to the seasonal avoidance described above, there are no special measures required for the potential sparrowhawk nest site in the mixed woodland (WD2) habitat by the OPW buildings.

7.5.1.12 Mitigation for Amphibians

Initial cut-off wall, initial ground works, and preparation and mitigation works within the floodplain of the Blackwater River, and the Windtown Stream (a dry drainage ditch) will be scheduled outside the peak breeding season for common frog (breeding season from February/early March to June (Reid et al., 2013)) unless otherwise agreed with the Ecologist and the Ecologist has determined there are no spawn, or tadpoles present.

Where the programme does not accommodate this seasonal restriction, relevant wetlands will be surveyed to identify locations of any spawn and where necessary a licence will be obtained from the NPWS to permit the translocation the spawn outside of the working area in advance of construction.

Where translocation is required, the NPWS will also be consulted to determine if translocation of adult frogs, froglets and/or tadpoles is also required (e.g. through capture by netting in conjunction with amphibian fencing as set out in NRA (2009b)), in addition to spawn. The Ecologist will agree suitable receptor sites with the Contractor for any translocations prior to any derogation licence application.

7.5.1.13 Mitigation for Invertebrates Including Butterflies

No mitigation is proposed in addition to that inherent in the landscape planting plan, which includes native, species-rich wildflower meadow, wetland habitats reinstatement and reuse of spoil/vegetated turves and hedgerow communities.

No mitigation is proposed in relation to the potential (and assumed) presence of invertebrate species of conservation concern presumed present in wetland, 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.

7.5.2 Operation-Phase Mitigation Measures

7.5.2.1 European Sites (River Boyne and River Blackwater SAC and SPA)

7.5.2.1.1 Artificial Lighting

During the operational phase, the risk of impacts associated with artificial lighting on the River Blackwater will be minimised by the adoption of the following design requirements:

- A low level lighting column (avoidance of over hanging lanterns, etc.) will be provided along the proposed bridge crossing at the River Blackwater.
- The location of lighting columns along the rest of the scheme will be designed to maximise the set back distance from the proposed bridge taking into account the ecological sensitivities associated with the River Boyne and River Blackwater SAC and SPA.
- Artificial lighting along the proposed river bridge will be provided by means of low-rise lighting system (e.g. lighting integrated within the bridge parapet or alternative systems where the level of light source is not higher than the bridge parapet) in order to avoid light spill onto the River Blackwater. The proposed bridge will comprise a solid bridge parapet to avoid light spill onto the River Boyne and River Blackwater SAC and SPA.
- An ecologist will be present to oversee and ensure that the proposed lighting will not result in additive light spill on the adjoining river.

7.5.2.1.2 Pollution Prevention

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 that have been incorporated. There will be no direct discharges to surface waters during the operational phase. Control measures having due regard to pollution prevention control during the operational phase are outlined in Chapter 9 (Water) of this EIAR.

7.5.2.1.3 Noise

In order to minimise noise levels during the operational phase of the Proposed Road Development, a range of mitigation measures have been proposed:

A Low Noise Road Surface (LNRS) is proposed along all sections of the link road, as well as on the following sections of the existing road network:

- Windtown Road between its intersection with the link road and the northern tie-in to the existing road network in the vicinity of Nangle Court;
- Windtown Road between its intersection with the link road and its eastern tie-in to the existing road network in the vicinity of Abbeylands; and,
- Kells Road between its intersection with the link road and its western tie-in to the existing road network in the vicinity of Blackwater Park

A 1.5 m high noise barrier is also proposed along the new link road, extended 39.5 m along the northbound carriageway in the vicinity of Blackwater Park.

7.5.2.1.4 Otter Passage

No mitigation is required, unless current bridge designs are altered to constrain otter and other mammal passage along the river.

7.5.2.2 Bats

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 including the two hotspots identified by adopting the following measures:

- Incorporate cowled lighting throughout the Proposed Road Development to direct light spill away from both retained and created habitats;
- Assess the adequacy of cowling in the vicinity of the (retained) ash tree located at Chainage 0+650 (Volume 3, Figure 7.3 and 7.4), and propose amendments, as informed by site-specific lux level readings (see text following this bullet list);
- Use of specialist bollard or low-level downward directional luminaires and red Light Emitting Diode (LED) fittings on the proposed bridge crossing having regard for research indicating light-sensitive bat species are equally active in such light, as in darkness (Spoelstra et al., 2017);
- In all other areas, install luminaires 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,
- Maximise the separation distance between light mast locations and vegetated features wherever possible, and as a minimum by locating luminaires from Chainages 0+400 to 0+850 (Volume 3, Figure 7.4) on the eastern side of the Proposed Road Development.

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 site during operation to measure, using a suitably calibrated light meter, light spill onto vegetated features within 100 m of the Blackwater 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.

7.5.2.3 Badgers

As stated in Section 7.5, mammal fencing will be installed along the entire Proposed Road Development, and a dry mammal underpass has been designed into the proposed alignment. No other mitigation is proposed.

7.6 Monitoring

7.6.1 Construction-Phase Monitoring

7.6.1.1 Role of the Contractor

The contractor will carry out a programme of water quality monitoring, whose parameters will be agreed with the IFI and the Ecologist.

7.6.1.2 Role of the Ecologist

The Ecologist will be appointed to oversee, advise, and facilitate the proper implementation of all ecological mitigation measures by the Contractor, to include consultation input from the NPWS and IFI.

7.6.1.2.1 Ecological Monitoring Strategy

The Ecologist 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 function the Ecological Monitoring Strategy (EcMS) will be to:

- Inform adaptive management measures to be agreed with MCC 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;

The specific aims of the EcMS will be to monitor and oversee the correct implementation of mitigation, and instruct the Contractor on how to adapt mitigation as required, with particular regard to:

- Results of pre-construction surveys which may identify new ecological constraints within the ZoI of the Proposed Road Development.
- Implementation of the ISMP.
- Phasing of works including piling, earthworks, and vegetation clearance in response to potentially unforeseen weather conditions or programme changes.
- Condition and performance of silt fencing silt de-watering sacs and other aspects of the CESCP, as informed by site observations by the Ecologist, and the results of the Contractor's WQMP.
- Working methods within the flood plain of the River Blackwater;
- Cowling of construction lighting to protect the QI of the River Boyne and River Blackwater SAC and SCI of the River Boyne and River Blackwater SPA.
- Ensure directional lighting used to minimise light spillage on the QI of the River Boyne and River Blackwater SAC and SCI of the River Boyne and River Blackwater SPA
- Construction and installation of the mammal ledge for otter and mammal fencing (including lead-in planting, and access ramps).
- A habitat enhancement plan will be drafted to maintain and enhance the Annex 1 hydrophilous tall herb fringe habitat.

The appointed Ecologist will report the actions taken under the EcMS to the NPWS and IFI in agreement with MCC.

7.6.2 Operation-Phase Monitoring

MCC will be responsible, during operation, for the commission of a suitably experienced ecologist to monitor effectiveness of; and make recommendations to adapt the measures set out in relation to the design of lighting in the 'natural zone' at the River Blackwater and associated SPA and SAC.

7.7 Residual Impacts

This section should be read in conjunction with summary tables of potential impacts in Section 7.2.6.

7.7.1 Construction-Phase

7.7.1.1 Designated Sites

Following implementation of mitigation, including the adaptive management approach incorporated through monitoring, there will be no significant residual effects to designated sites.

7.7.1.2 Other Species and Habitats

Following habitat enhancement, there will be a positive residual effectto Annex 1 hydrophilous tall herb fringe habitat.

There will be potential localized mortality of populations of several (unprotected) invertebrate species identified on Irish Red Lists, which have been presumed present in the absence of evidence to the contrary. The significance of this residual impact is assessed as a negative effect at the local-county geographic scale.

All other residual effects will be limited to significance at Local level, namely:

- Permanent net removal of habitats which are not QI of European sites, and not Annex 1 habitats, including scrub, reed and large sedge swamp, plantation woodlands (various types), wet grassland and dry grassy verge habitat during construction;
- Permanent net removal of nesting habitats for nationally protected birds, and nationally protected species including hedgehog, pygmy shrew, stoat, and common frog;
- Disturbance to badger during construction, including from the temporary exclusion under license of two badger setts;
- Disturbance and/or mortality during construction to localized populations of nationally protected species including hedgehog, pygmy shrew, stoat, and common frog; and,
- Temporary indirect effects on bat foraging habitats due to construction lighting (despite cowling to minimise effects).

7.7.2 Operation-Phase

7.7.2.1 Designated Sites

There will be no significant residual effects to designated sites during operation.

7.7.2.2 Other Species and Habitats

Significant residual effects during operation to other species and habitats are predicted to be limited to Local level in all cases, namely in relation to:

- Disturbance during operation to localized populations of nationally protected species including nesting birds, hedgehog, pygmy shrew, stoat, and common frog;
- Disturbance, severance and/or displacement impacts to foraging badgers and bats from operation of Proposed Road Development including lighting.

7.8 Cumulative Impacts

This assessment has particular regard for developments potentially affecting the River Boyne and River Blackwater SAC and the River Boyne and Blackwater SPA, as the Proposed Road Development interacts with both European sites.

7.8.1 Developments Types Relevant to European Site Threats

The Natura Standard Data Form for the River Boyne and River Blackwater SAC (NPWS, 2017a) ranks five activities as posing a threat of high importance to the SAC. These are:

- Industrial or commercial areas;

- Other human changes to hydraulic conditions;
- Invasive non-native species;
- Other discharges; and,
- Pollution to surface waters.

In addition, fifteen activities posing a threat of medium importance to the SAC have been identified. They are:

- Siltation, rate changes, dumping, depositing of dredged materials;
- Sand and gravel extraction;
- Removal of hedges and copses or scrub;
- Stock feeding;
- Storage of materials;
- Roads and motorways;
- Other sports and leisure activities;
- Cultivation;
- Human induced changes in hydraulic conditions;
- Artificial planting on open ground (non-native trees);
- Disposal of industrial waste;
- Use of biocides, hormones and chemicals;
- Other patterns of habitation;
- Management of aquatic and bank vegetation for drainage purposes; and,
- Fertilisation.

Modifying structures of inland water courses and mowing of grassland are linked with positive impacts of medium importance to the SAC.

The Natura Standard Data Form for the River Boyne and River Blackwater SPA (NPWS, 2017b) ranks three activities as posing a threat of high importance to the SPA. These are:

- Urbanised areas, human habitation;
- Roads, motorways; and,
- Dispersed habitation.

'Human-induced changes in hydraulic conditions' have been identified as posing a threat of medium importance to the SPA.

7.8.2 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. The National Planning Application Map Viewer[30] was used to conduct the search. The search was limited to the 5-year period preceding the date of issue of this report (due to the typical five-year lifetime of permission). Retention applications (i.e. typically local-scale residential or commercial developments where an impact has already occurred) and withdrawn and refused applications (including refusals on appeal), were excluded.

It should be noted that importantly:

- No live or consented applications were identified within the River Boyne and Blackwater SAC/SPA;
- No live or consented applications were identified within the 1% AEP flood level (1:100) of the Blackwater River; and,

[30] www.myplan.ie [accessed October 2019].

- No live or consented applications were identified within Blackwater Park.

The projects bulleted below were identified, focused in the existing urban fringe of Navan Town. These projects are within the same CMU as the Proposed Road Development, and therefore offer a potential source of in-combination pollution effects (during construction and/or operation). The projects are also within the same potential territory of several populations of protected species locate within the ZoI Proposed Road Development with potential risk of in-combination effects:

- Blackwater Park, Windtown Road, Navan, Co. Meath (P8/19005) (approx. 120 m east of proposed development site). The development will consist of the construction of single storey changing room facilities comprising of office area, 2 no. changing rooms, separate male, female & disabled toilets and 2 no. store rooms. One part of the building is plastered externally while the other part has facing brick finish. Roof is finish in tapered zip-lock aluminium standing seam roofing sheets.
- The Navan Greater Dublin Area (GDA) Cycle Network (P8/18014) (approx. 0.9km west): Construction works along various routes in Navan which will involve the following elements; - Construction of new kerb lines for new footpath and/or cycle tracks; - Earthworks - excavations of portions of existing verges, of existing roadway/footpaths, for service ducts and road crossings; - Removal of trees, setting back of boundaries, landscaping; - Construction of footpaths and cycle tracks, road markings and drainage works.
- Shared pedestrian and cycle greenway facility along the disused Navan to Kingscourt rail line (P8/13007 and P8/13008) (approx. 188 m north-east). The proposed greenway facility commences at Blackwater Park, Ratholdron Road, Navan and terminates at Kingscourt, Co. Cavan. The existing rail line commences in the administrative area of Meath County Council at Simonstown, Navan and continues as far as the townland of Boynagh, south of Kingscourt. The rail line then meanders across the county boundary into Co. Cavan before re-entering Co. Meath at 2 further locations in the townlands of Boynaghbought and finally at Derumgill, adjacent to the former Kingscourt railway station.
- Planning reference NA171232 – The (conditional) development of the resumption of underground mining in the Nevinstown orebody. Previously planning permission was granted by An Bord Pleanála, ref PL17.204034. Mining will follow a cyclic pattern resulting in the removal of underground ore, hoisting to surface for processing followed by the filling of the extraction voids using cemented backfill. The surface characteristics and features of the Nevinstown townland will not be altered by mining activity. There will be no additional above ground structure/infrastructure associated with the development. Grant date October 2018;
- Planning reference NA181137 (c. 510 m) – To remove temporary accommodation blocks to rear of site, provide internal alterations to existing educational and administrative building, alterations to elevations and new entrance porch, additional carpark spaces to rear of site, new site access and entrance arrangement, landscaping and all associated site works. Grant date 14/01/2019;
- Planning reference NA180732 – decommission and remove existing below ground District Regulating Installation (DRI) adjacent to Watergate St. and install a new above ground 0.8 7m x 0.5 0m x1.36 m (LxWxH) DRI enclosure including a 3m high 'lamp post' style relief vent stack with all ancillary services and associated site works Grant date 04/10/2018;
- Planning reference NA180163 – The upgrading, reconfiguration and change of use of existing car showroom and retail units to provide for 2 no. car showrooms (781 sq.m), workshop (563 sq.m.), parts store (150 sq.m.) and ancillary staff facilities and public toilet (109 sq.m.) The proposed development will also include: 2 no. free-standing double-sided signs, upgrades to the existing signage and shopfronts including new glazing and cladding, reconfiguration of the existing car park and yard to provide for 92 no. car parking spaces, concrete paved forecourt area and reconfiguration of internal road. The proposed development includes all engineering works, landscaping works, boundary treatments and site development work on the approx. 0.70-hectare site. Significant further information/revised plans submitted on this application. 27/07/2018.
- Planning reference NA181543 – The proposed development will consist of the demolition of an existing vacant single storey dwelling and associated shed (total c. 165.7 sqm) and the construction of 74 no. apartment units in 2 no. 5 storey blocks over partial basement with combined gross floor area of c. 7308.3 sqm (excluding c. 405 sqm basement) and a maximum overall height of c. 17 m OD. The proposed apartments will include 13 no. 1 bed units, 60 no. 2 bed units, and 1 no. 3 bed unit; associated plant; landscaped public open space; 95 no. car parking spaces; 86 no. bicycle spaces; 2 no. bin stores; ESB Substation; drainage arrangements; 3 no pedestrian access/egress onto footpaths along the N51 and R147; and associated boundary treatments and site development works, vehicular access to the proposed development will be through the residential scheme permitted on lands to the south of the subject site (Reg Ref: NA151301). Granted 09/07/2019;

- Planning reference NA150427 – Development located at Blackwater Retail Park, Navan, Co. Meath. The (consented) construction of a coffee shop and restaurant granted August 2015 (0.2 km from the proposed development). The proposed development will consist of the construction of a single storey Coffee Shop and a single storey Drive Thru Restaurant including associated Drive Thru Lane, external yard and bin store. The proposed development also includes signage on the elevations of the building, external seating areas, minor alterations to the existing carpark, alterations to the eastern boundary and all ancillary site development site services and hard and soft landscaping works. Grant Date 11/08/2015.
- Planning reference NA151301 – Development located at Moathill, Navan, Co. Meath. The proposed development will consist of 99 no. residential units comprising 32 no. duplex/apartments and 67 no. 2 storey detached and semi-detached houses. The development will also include, a 2 storey crèche with play area, bin shelters, bicycle parking and car parking spaces, 2 no. landscaped public open spaces, a footpath and cycleway along the N51 National Road, a new vehicular access from the N51 National Road and associated revised junction layout, and all associated site and drainage works (ca. 150 m from the proposed development). Grant date 03/06/2016;
- Planning Reference NA171138 – the development will consist of: 1.Upgrades to the existing site access roads, security (fencing upgrades) and replacement of the site entrance gates. 2.Landscaping and reinstatement. 3.Intake works modifications. 4.Provision of 2 no. aluminium sulphate storage tanks. 5.Provision of 1 no. flocculation tank. 6.Provision of 1 no. backwash water storage tank.7.Provision of 4 No.UWWEST's(used wash water equalisation and settling tanks 8.Provision of 1 no. sludge balancing tank 9.Provision of 2 no. sludge thickening tanks 10.Provision of 1 no. sludge holding tank 11.Provision of sludge dewatering building (7.5m x17m) 12.Demolition of the 2 no. existing aluminimum sulphate storage tanks 13.Demolition of the raw water pumping station super structure 14.Building repair and refurbishment. The (consented) upgrade to the existing Water Treatment Plant at Liscarton, Navan (wholly contained within the boundary of the existing WTP): consented 11/01/2018 (approximately 2.5 km from the proposed development); also part of the Navan and Mid Meath Water Supply Scheme (Scheme code 2300PUB1016)[31];
- Planning Reference NA180163 – Located at Balmoral Estate, Kells Road, Navan, Co. Meath. The upgrading, reconfiguration and change of use of existing car showroom and retail units to provide for 2 no. car showrooms (781 sq.m), workshop (563 sq.m.), parts store (150 sq.m.) and ancillary staff facilities and public toilet (109 sq.m.) The proposed development will also include: 2 no. free standing double sided signs, upgrades to the existing signage and shopfronts including new glazing and cladding, reconfiguration of the existing car park and yard to provide for 92 no. car parking spaces, concrete paved forecourt area and reconfiguration of internal road. The proposed development includes all engineering works, landscaping works, boundary treatments and site development works on the approx. 0.70 hectare site. Significant further information/revised plans submitted on this application. Decision date 27/07/2018
- Planning Reference NA171476 – Construction of warehouses, offices and a food store with parking, currently subject to determination by ABP following appeal (c.. 255 m from the proposed development site) at Balmoral Estate, Kells Road , Navan, Co. Meath. The proposed development will consist of: Demolition of existing single and two storey warehouse buildings within the western portion of the site; Construction of a 6 no. storey mixed use building over basement (with rooftop plant at fifth floor level) to include setbacks and accessible terraces (eastern elevation) at first and fifth floor levels: Provision of a discount food store (to include off-licence use) with a gross floor area of c. 1,695 sq.m (net retail area 1,140 sq. m) at ground floor level to include all ancillary areas; provision of a 135 sq.m retail unit at first floor level (south) and c. 5,412 sq.m of office/medical floor space from first to fifth floors; provision of external plant enclosures (western elevation) at ground floor level; landscaped surface car park (90 no. car parking spaces) to serve the proposed discount food store (including 1 no. set down space), 70 no. bicycle parking spaces, goods delivery/reception area; provision of a basement car park to serve the medical/office uses (incluing plant room/ancillary areas and 120 no. car parking spaces); reconfiguration of internal road and provision of ramp to basement of proposed development; Upgrades to the existing footpath along Kells Road and provision of a landscape plaza area at the junction of the Kells Road and the existing access road to Balmoral Industrial Estate; provision of 7 sq. m of illuminated signage located on the northern and eastern elevation including a 42 sq.m totem sign located at the main entrance of the site; all associated and ancillary site development and landscaping works. Significant further information/revised plans submitted on application. Decision date 27/07/2018.
- Planning Reference NA160607 – Development located at Blackcastle Demesne, Navan, Co. Meath. The (consented) construction of 218 new residential units and associated works, granted June 2016 (1.7 km from the proposed development); Construction of a total 218 no. units comprising of 135 no. single (6 no. houses designed for the elderly) and two storey (129 no.) houses and 83 no. apartments, including 13 no. apartments

[31] www.epa.ie [accessed 6 September 2019].

within the restored Blackcastle House and Stables. The breakdown of houses consists of 32 no. four bedroom houses, 61 no. three bedroom houses, 36 no. two bedroom houses and 6 no. one bedroom houses. The breakdown of apartments contained within 5 no. two (Block E) and three storey (Blocks A, B, C & D) buildings (not including Blackcastle House and Stables) are 14 no. three bedroom apartments, 42 no. two bedroom apartments and 14 no. one bedroom apartments. The 13 no. apartments within the restored Black House and Stables consists of 2 no. three bedroom apartments, 4 no. two bedroom apartments and 7 no. one bedroom apartments. The development includes the demolition of a number of existing outbuildings (Blackcastle House, a protected structure and associated stables and walled garden will be retained). The development includes all associated and ancillary works, including site infrastructure works; the provision of a 403 sq.m creche to facilitate c. 74 children; refurbishment and amendments including, two new openings to the walled garden; amendments to the entrance to Blackcastle House from the N51 including widening of the protected entrance pillars to allow limited vehicular access to the proposed development; provision of ESB substation; car parking; public open spaces; landscaping; boundary treatment; new internal roads; and footpaths. An Environmental Imapct Statement and Natura Impact Statement have been prepared in respect of this planning application, the site includes Blackcastle House, entrance pillars (Both Protect Structures) and associated walled garden and outbuildings. Further Information/Revised plans submitted on this application. Decision Date 20/12/2016;

- Planning Reference NA160363 – Development located at Windtown, Navan, Co. Meath. The development will consist of a new single storey support services building with car parking, connect to existing entrance to public road and connect to existing mains water, mains sewerage and surface water with ancillary site works (c.. 70 m from the Proposed Development site). Grant date 14/07/2016.
- Planning Reference NA140993 – Development located at St. Patrick's Classical School, Moatlands (Kells Road), Navan, Co. Meath. The development will consist of the demolition of part of existing structure and construction of a fully serviced 2 storey extension to the existing school containing 1 no. music/drama room and 1 no. science laboratory and preparation room together with ancillary stairs, stores, circulation spaces and associated works (c. 210 m from the Proposed Development site). Grant date 12/02/2015.
- Planning Reference NA140992 – Development located at St. Patrick's Classical School, Moatlands (Kells Road), Navan, Co. Meath. The development will consist of the demolition of part of existing structure and construction of a fully serviced single storey extension to the existing school containing 1 no. woodwork room together with ancillary stores, plant, circulation space and associated works. (c. 210 m from the Proposed Development site). Grant date 12/02/2015.
- Planning Reference NA161020 – Development at Ratholdron Old, Abbeyland, Navan Co. Meath. Construction of 6 no. dwelling houses consisting of 3 no. semi-detached blocks, connection to public water main, public sewer and associated site development and ancillary works including development of a vehicular entrance and service road, open space provision, all landscaping works, site boundary treatment and associated drainage works. Significant further information/revised plans submitted on this application (c.. 178 m from the proposed development site). Grant Date 05/04/2017.

7.8.3 Plans

7.8.3.1 Project Ireland 2040

The Project Ireland 2040 NPF (NPF, 2018) does not list specific plans for the ZoI of the Proposed Road Development, and no in-combination effects are predicted

7.8.3.2 Meath County Development Plan

The MCDP 2013 -2019 (MCC, 2013) identifies Navan as the primary growth centre in Meath. Several policies and objectives of the CDP are directly related to the protection of European sites, and have been drafted to include protective policy wording, which negates the potential for in-combination effects:

- ”NH POL 5; To permit development on or adjacent to designated Special Areas of Conservation, Special Protection Areas, or those proposed to be designated over the period of the plan, only where an assessment carried out to the satisfaction of the Meath County Council, in consultation with National Parks and Wildlife Service, indicates that it will have no significant adverse effect on the integrity of the site.”
- ”NH POL 6; To have regard to the views and guidance of the National Parks and Wildlife Service in respect of proposed development where there is a possibility that such development may have an impact on a designated European or National site or a site proposed for such designation.”

- ”NH POL 7 To undertake appropriate surveys and collect data to provide an evidence-base to assist Meath County Council in meeting its obligations under Article 6 of the Habitats Directives, subject to available resources.”
- “TRAN POL 32; To ensure that all road plans and project proposals in the County which could, either individually or in combination with other plans and projects, have a significant effect on a Natura 2000 site, undergo an Appropriate Assessment in accordance with Article 6 (3) of the EC Habitats Directive.”
- ”WS OBJ 13; To design flood relief measures to protect the conservation objectives of Natura 2000 sites and to avoid indirect impacts of conflict with other qualifying interests or Natura 2000 sites.”
- ”WS OBJ 14; To promote positive flood relief measures that can enhance habitats in the Boyne floodplain such as swales, constructed wetland basins etc.”
- ”WS OBJ 15; To seek to ensure that construction works are designed so as not to result in surface water runoff into SACs or SPAs either directly or indirectly via a watercourse.”
- ”NH OBJ 2; To ensure an Appropriate Assessment in accordance with Article 6(3) and Article 6(4) of the Habitats Directive, and in accordance with the Department of Environment, Heritage and Local Government Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities, 2009 and relevant EPA and European Commission guidance documents, is carried out in respect of any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect on a Natura 2000 site(s), either individually or in-combination with other plans or projects, in view of the site’s conservation objectives.”
- ”NH OBJ 3: To protect and conserve the conservation value of Special Areas of Conservation, Special Protection Areas, NHA and pNHA as identified by the Minister for the Department of Arts, Heritage and the Gaeltacht and any other sites that may be proposed for designation during the lifetime of this Plan.”

7.8.3.3 Economic Development Strategy for County Meath

The Economic Development Strategy for County Meath 2014 – 2022 (MCC, 2015b) identifies Navan as an area of high importance for County Meath. However, as this plan does not identify any specific objectives for the area, no significant in-combination effects are predicted.

7.8.3.4 Navan Development Plan 2009-2015

The Proposed Road Development is zoned under the NDP 2009-2015 (which has been extended until 2019, despite the name of the plan). The plan was most recently varied in 2019. There is no potential for significant habitat loss in-combination habitat loss impacts, because the Blackwater Park is zoned as an open space for recreational amenities. There is no potential for significant habitat loss impacts in the River Boyne and Blackwater SAC/SPA from other development within the ZoI of the Proposed Road Development, because the SAC/SPA is zoned ‘To protect the setting, character and environmental quality of areas of high natural beauty’.

The fields to the west of the Blackwater Park are zoned to provide new residential housing; There is potential for habitat loss of these species-poor grasslands, currently cut for silage. These impacts are non-significant due to the negligible value of the habitat. However, any loss of relatively higher value scrub and hedgerow habitats on the margins of the existing grasslands could act in-combination with the Proposed Road Development to cumulatively raise the geographic scale of impact significance.

7.8.3.5 Navan 2030

The draft Navan 2030 Plan (MCC, 2017) under consultation at the time of writing, relates only to the urban core of Navan Town and a new Park and Ride facility located on the R147. The NIS for the draft Navan 2030 Plan (Brady Shipman Martin, 2017) stated that the lands within the Navan 2030 Plan provided no habitats of significance to European site features, the NIS concluded that earthworks during removal of agricultural lands and operational drainage posed a potential risk to the River Boyne and Blackwater SAC/SPA. Following pollution mitigation, the NIS concluded there was no potential for the plan to significantly affect any European sites.

7.8.3.6 Transport Strategy for the Greater Dublin Area

Both the River Boyne and River Blackwater SAC and the River Boyne and River Blackwater SPA are within the study area of the draft Transport Strategy for the Greater Dublin Area (2016-2035) (NTA, 2015). The N2/M2 national route inclusive of a bypass of Slane intersects the SAC and SPA is identified as potentially having a negative impact on the SAC and SPA. An AA screening (and if necessary and AA, informed by a NIS) will, as required by law, be completed for this project, to identify and mitigate any significant effects (including those arising in combination with the Proposed Road Development).

7.8.3.7 Flood Risk Assessment and Arterial Drainage Plans/Projects

In the OPW's Eastern Catchment Flood Risk Assessment and Management Study[32] (Eastern CFRAM) the Proposed Road Development is located within Hydrometric Area '07 (Boyne)'. Under CFRAM projects, Areas for Further Assessment (AFAs) are areas where, based on the Preliminary Flood Risk Assessment, the risks associated with flooding are considered to be potentially significant. For these areas further, more detailed assessment is required to determine the degree of flood risk, and develop measures to manage and reduce the flood risk. The AFAs are the focus of the CFRAM Studies. The Eastern CFRAM identified Navan as an AFA, due to historical fluvial flooding in the town.

The Flood Risk Management Plan (FRMP) for the Boyne Catchment[33] ('the Boyne FRMP') includes specific measures for the Boyne River Basin as a whole and the Navan AFA in particular. The Boyne FRMP proposes installing a flood forecasting and early warning system through upgrading existing water level gauging stations and installing new stations as appropriate. The FRMP also considered the installation of hard defences (flood embankments and walls), road raising and clearance of a 750 m reach of the Abbeylands Tributary to prevent flooding in the Navan AFA.

The NIS[34] for the Boyne FRMP identified several potential impacts from flood relief works. The Boyne FRMP has proposed modifications to the banks of the Blackwater River within the SAC and SPA leading to potential disturbance of QIs, increase in sedimentation, water quality impacts noise and vibration and changes in channel morphology. However, the NIS concluded that the impacts could be suitably mitigated to avoid adverse effects to site integrity, taking account of in-combination effects.

The Eastern CFRAM identified the OPW's Boyne Arterial Drainage Scheme[35] as having a negative impact on the River Boyne and Blackwater SAC/SPA. This scheme, implemented between 1969 and 1986 aimed to increase drainage of agricultural land through the creation of drainage ditches and dredging of rivers which has led to an increase in water levels and flow in the Boyne and Blackwater Rivers. The modifications made to the natural environment as part of the Boyne arterial drainage scheme require regular maintenance. Arterial Drainage Maintenance (ADM) projects primarily consist of removing the build-up of foreign or natural material that impedes the free flow of water including through the removal of vegetation. In some cases, re-grading of river banks following landslides or erosion is required. The ADM are subjected to AA every five years; most recently in 2016, at which time an NIS was produced (JBA Consulting, 2016). Following implementation of mitigation measures to protect European sites during ADM activities, the NIS concluded the ADM would not adversely affect the integrity of any European sites, taking account of in-combination effects.

7.8.3.8 Environmental River Enhancement Programme

The Environmental River Enhancement Programme[36] (EREP), operated by IFI aims to reduce negative impacts caused by past OPW drainage projects. The EREP is likely to positively influence the condition and quality of aquatic habitats and species in the River Boyne and Blackwater SAC/SPA. Indeed, such modification has been identified as having a potential positive impact on the River Boyne and River Blackwater SAC (NPWS, 2017a).

7.8.4 Ground Water

According to the Geological Survey Ireland (GSI)[37], the vulnerability of the (Locally Important) aquifer underlying the Proposed Road Development is Moderate to Extreme. The Proposed Road Development is located above two different groundwater bodies, both of which have been identified as At Risk[38]. However, no ecological features with

[32] Available online at http://eastcfram.irish-surge-forecast.ie. Accessed August 2019.
[33] Available online at - https://www.floodinfo.ie/publications/ Accessed August 2019.
[34] Available online at - https://s3-eu-west-1.amazonaws.com/docs.floodinfo.opw/floodinfo_docs/Eastern_CFRAM/_UOM07/07_NaturaImpactStatement/NIS_Final2018_RiverBasin_07.pdf Accessed August 2019.
[35] Available online at: https://www.opw.ie/en/floodriskmanagement/operations/environmentalactivities. Accessed August 2019
[36] Annual reports available online at https://www.fisheriesireland.ie/Projects/erep.html. Accessed on various dates in 2019.
[37] Whilst the Trim GWB (code IE_EA_G_002) and Wilkinstown GWB (code IE_EA_G_010) both had 'Good' status as of the most recent available monitoring period (2010 – 2015), but are both "At Risk". Available online at www.gsi.ie. Accessed 16 August 2019.
[38] Available online at www.catchments.ie. Accessed August 2019.

significant groundwater dependence were identified in this Chapter, so in-combination effects considering groundwater quality are not assessed further.

7.8.5 Pollution (Surface Waters)

Surface water pollution and flood plain development interacting with river hydromorphology are respectively pressures of medium and high importance, as identified in the NPWS Standard Data Form for the River Boyne and River Blackwater SAC (NPWS, 2017a).

The existing water quality of watercourses upstream, adjacent and downstream of the Proposed Road Development within the Boyne CMU offers a useful proxy metric for the pressure of existing projects and plans on the aquatic features within the Boyne and Blackwater SAC. As was detailed in 7.3, the EPA does not monitor surface water quality in the Windtown Stream, however, the water quality status in the River Blackwater is Moderate (Q3-4) at the nearest EPA monitoring station (Blackwater Kells; located approximately 900 m downstream; most recent results from 2012) to the proposed works. This indicates the Blackwater 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 QI atlantic salmon and river lamprey via changes in water quality in the River Boyne and River Blackwater SAC. This would indirectly affect SCI kingfisher of the River Boyne and River Blackwater SPA through prey reductions.

However, there are binding obligations on all Irish local authorities including MCC to achieve good status of surface waters, under the terms of the EU Water Framework Directive 2000/60/EC (WFD), 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 River Basin Management Plan for Ireland (2018-2021) (RBMP)[39] 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).

7.9 Summary Tables of Potential Impacts

Table 7-12 summarises the geographic scale of potential impact significance at construction and operational phase for the Proposed Road Development.

[39] Available online at – http://www.housing.gov.ie/water/water-quality/river-basin-management-plans/river-basin-management-plan-2018-2021

Table 7-12 Summary of potential impacts on designated sites, habitats and flora

Ecological feature (Sorted from International to Local)	Valuation	Potential Construction Phase Impacts	Significance of Potential Construction-Phase Impact	Potential Operation Phase Impacts	Significance of Potential Operational Phase Impact (i.e. after Landscaping establishment)	Mitigation Proposed (non-embedded mitigation outside project Design)?	Residual Impact Significance	Cumulative Residual Impact Significance
European sites (River Boyne and River Blackwater SAC and River Boyne and River Blackwater SPA)	International	Habitat loss and deterioration Invasive species Pollution Disturbance	International	None	N/A	No	Not significant	Not significant
National sites (Slane Riverbank, Boyne Woods, Crewbane Marsh, Dowth Wetland and Boyne River Island pNHAs)	National	None	N/A	None	N/A	No	Not significant	Not significant
FW2 Depositing / lowland rivers (Coincident with River Boyne and Blackwater SAC/SPA)	County-National	Habitat loss and deterioration Pollution Invasive species	County-National	None	N/A	No	Local	Local
FS2 Tall-herb swamp/ GM1 Marsh Non-Annex 1 hydrophilous tall herb fringe	County-National	Habitat loss and deterioration Invasive species	County-National	None	N/A	No	Local-County (positive)	Local
FS2 Tall-herb swamp (Annex 1 hydrophilous tall herb fringe)	County-National	Habitat loss and deterioration Invasive species	International	None	N/A	No	Local-County (positive)	Not significant
FS1 Reed and large sedge swamp	Local (Higher value)	Habitat loss	Local	None	N/A	No	Local	Local
FW4 Drainage ditches (the ‘Windtown Stream’)	Local (Higher value)	Habitat loss	Local	None	N/A	No	Local	Local
GS2 Dry meadows and grassy verges	Local (Higher value)	Habitat gain	Local	None	N/A	No	Local	Local
GS4 Wet grassland	Local (Higher value)	Habitat loss	Local	None	N/A	No	Local	Local

Ecological feature (Sorted from International to Local)	Valuation	Potential Construction Phase Impacts	Significance of Potential Construction-Phase Impact	Potential Operation Phase Impacts	Significance of Potential Operational Phase Impact (i.e. after Landscaping establishment)	Mitigation Proposed (non-embedded mitigation outside project Design)?	Residual Impact Significance	Cumulative Residual Impact Significance
WD1 Broadleaved woodland	Local (Higher value)	Habitat gain	Local	None	N/A	No	Local	Local
WD2 Conifer plantation	Local (Lower value)	Habitat loss	Local	None	N/A	No	Local	Local
WD5 Parkland	Local (Higher value)	Habitat loss	Local	None	N/A	No	Local	Local
WS1 Scrub	Local (Higher value)	Habitat loss	Local	None	N/A	No	Local	Local
WL1 Hedgerows	Local (Higher value)	Habitat gain	Local	None	N/A	No	Local	Local-County
WL2 Treelines	Local (Higher value)	Habitat gain	Local	None	N/A	No	Local	Local
GA1 Improved agricultural grassland	Local (Higher value)	Habitat loss	Local	None	N/A	No	Local	Local
ED3 Recolonising bare ground	Local (Lower value)	Habitat loss	Local	None	N/A	No	Local	Local
Rare flora – Lance-leaved pottia	Local (Higher value)	Habitat loss	Local	None	N/A	No	Local	Local

Table 7-13 Summary of Potential Impacts on Fauna

Ecological Feature (Sorted from International to Local)	Valuation	Potential Construction Phase Impacts	Significance of Potential Construction-Phase Impact	Potential Operation Phase Impacts	Significance of Potential Operation-Phase Impact	Mitigation Proposed (non-embedded mitigation outside project Design)?	Residual Impact Significance	Cumulative Residual Impact Significance
Fish (atlantic salmon, and river lamprey) in the River Blackwater	International (QIs of River Boyne and Blackwater SAC)	Noise Pollution Habitat loss and degradation (spawning and foraging habitat)	International	None	N/A	Yes	Local	Local-County
Kingfisher (resident; foraging only)	International (SCI of River Boyne and Blackwater SPA)	Noise Pollution (indirect impact via prey (fish) population decline)	Local	Disturbance Bridge strike	Local	Yes	Local	Local-County
Otter (presumed to forage in River Blackwater) *	International (QI of River Boyne and Blackwater SAC)	Noise Disturbance Pollution (indirect impact via prey (fish) population decline) Habitat loss and degradation	Local	Disturbance	Local	No	Local	Local-County
European eel and brook lamprey in the River Blackwater	County-National	Noise Pollution Habitat degradation (spawning and foraging habitat)	Local	None	N/A	Yes	Local	Local-County
Invertebrates of conservation concern presumed present in wetland and grassland surveys (Potentially including common whorl snail, large red-tailed bumble bee, marsh whorl snail, prickly snail, smooth grass snail,	County	Habitat loss and degradation	Local	None	N/A	No	Local-County	Local-County

Ecological Feature (Sorted from International to Local)	Valuation	Potential Construction Phase Impacts	Significance of Potential Construction-Phase Impact	Potential Operation Phase Impacts	Significance of Potential Operation-Phase Impact	Mitigation Proposed (non-embedded mitigation outside project Design)?	Residual Impact Significance	Cumulative Residual Impact Significance
and whirlpool ramshorn)								
Foraging bats (at least six bat species)	Local	Habitat loss Light spill	Local	Habitat loss Light spill	Local-County	No	Local	Local-County
Ash tree in Blackwater Park with 'Low' suitability for roosting bats	Local (Higher value)	None – no roosting bats identified	Not significant (Local if removed)	None	None	No	Local	Local-County
Birds other than kingfisher including one species of High Conservation Concern (meadow pipit) one specially protected species under national legislation (Sparrowhawk), and several other species	Local (Higher value)	Habitat loss Disturbance during breeding season	Local	Habitat loss	Local	Yes	Local	Local-County
Common frog	Local (Higher value)	Habitat loss and degradation Disturbance during breeding season	Local	None	N/A	Yes	Local	Local-County
Common lizard, pygmy shrew, hedgehog, and stoat (all presumed present)*	Local (Higher value)	Noise Habitat loss and degradation	Local	Disturbance Noise Fencing Lighting	Local	No	Local	Local-County
Badger	Local (Higher value)	Entrapment in open excavations	Local	Disturbance Noise Fencing Lighting	Local	No	Local	Local-County

Ecological Feature (Sorted from International to Local)	Valuation	Potential Construction Phase Impacts	Significance of Potential Construction-Phase Impact	Potential Operation Phase Impacts	Significance of Potential Operation-Phase Impact	Mitigation Proposed (non-embedded mitigation outside project Design)?	Residual Impact Significance	Cumulative Residual Impact Significance
Badger setts	Local (Higher value)	None	N/A	None	N/A	No	Local	Local-County
Wintering birds excluding resident kingfisher	Local (Lower value)	Habitat loss	Local	Habitat loss	Local	No	Local	Local-County
Other species (rabbits, foxes and other unprotected species)	Local (Lower value)	Habitat loss	Significant	Human presence Noise Fencing Additional lighting	Significant	No	Local	Local-County

7.10 Concluding Statements on In-Combination Effects

7.10.1 Designated Sites

Having regard for river enhancement works under the EREP, the legal protection for the Blackwater River as a European site (through legislation at national level, and policy initiatives at national, county and local levels), no significant in-combination effects are predicted to affect the River Boyne and Blackwater SAC/SPA.

7.10.2 Annex 1 Hydrophilous Tall Herb fringe Habitat

The areas of this habitat within the River Boyne and Blackwater SAC within the ZoI of the Proposed Road Development are subject to no formal legal protection and require specialist botanical expertise to distinguish from non-Annex 1 reed swamp habitats. The latest available data on the national conservation status of this habitat dated to 2019 (NPWS, 2019b) at the time of writing. At that time, the national conservation status for the habitat was unfavourable (“bad”).

However, no other projects within the ZoI of the Proposed Road Development were identified in potential areas containing this habitat (i.e. within or below the 1% AEP flood level (1:100 year). The NPWS (2019a) have not identified any threats of high importance to this habitat. Grazing and invasive species are threats of medium importance, but, are not known threats within the ZoI of the Proposed Road Development. In the absence of evidence to the contrary, there are no significant in-combination effects predicted to Annex 1 hydrophilous tall herb fringe habitat taking into consideration the avoidance of direct habitat loss and the habitat management plan that will be prepared to maintain and enhance this habitat type.

7.10.3 Other Species and Habitats

The existing and proposed projects and plans identified within the ZoI of the Proposed Road Development are likely to result in in-combination effects to species and habitats excluding those features of designated sites. The plans and projects described in this Chapter will potentially lead to:

- Loss of wooded/hedged habitats;
- Loss of marginal rough grassland and scrub habitats and farmed habitats;
- Spread of invasive species;
- Disturbance, injury or mortality during construction affecting protected species including badger, common frog, common lizard, hedgehog, nesting birds and stoat;
- Increased traffic volumes (and associated noise and lighting) elevating the risk of pollution or light spill impacts to habitats and mobile species;
- Downstream pollution during construction, and operation.

Potential impacts from the Proposed Road Development alone have been predicted to be significant at Local level for habitats (including reed swamp, scrub, hedgerow, dry meadow, and wet grassland, and plantation woodlands). There are no national, county level or local scale indices for conservation status or loss rates of non-Annex I habitats. Applying the precautionary principle, potential cumulative impacts are predicted to be elevated from Local scale for the Proposed Road Development alone, to ‘Local to County levels’ for hedgerows which are under particular pressure from development. A section of the hedgerow will be removed by the Proposed Road Development and this will create a gap in otherwise continuous green corridor across the site, and in the habitat connectivity in the wider landscape. Such corridors are particularly important to wildlife as they are used to commute across the urban landscape.

Potential impacts to nationally protected fauna species are not predicted to be raised above the geographic scale of significance for the Proposed Road Development alone, because planning authorities and ecological stakeholders such as the NPWS would typically request that significant habitats for protected species are adequately surveyed and mitigated. In contrast, planning authorities and the NPWS rarely insist upon specialist surveys of (unprotected) invertebrates of conservation concern. Furthermore, many invertebrates of conservation concern (e.g., micro and macro-moth species) can feed and breed in common grassland, scrub and other marginal habitats of otherwise limited conservation interest. As such and on a precautionary basis, in the absence of evidence to the contrary, potential impacts to invertebrates of conservation concern are determined to be elevated from Local-County geographic scale for the Proposed Road Development alone, to County geographic scale taking account of in-combination impacts.

7.11 Limitations and Assumptions

Sources of information are not exhaustive, and every effort was made to obtain 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 during the appropriate season having regard for NRA guidance (NRA, 2009b). The suite of walkover surveys was adequate to address (and in all cases excluded) the potential for protected invertebrate species to occur (i.e. marsh fritillary and small blue butterflies). Whilst specialist surveys for (unprotected) invertebrates identified on Irish Red Lists were not carried out, a precautionary approach has been adopted which presumes their presence.

7.12 References

- Abbott IM, Harrison S, Butler F. (2012b). Clutter-adaptation of bat species predicts their use of under-motorway passageways of contrasting sizes—a natural experiment. J Zool (Lond) 287:124–132
- AECOM. (2019). Local Distributor Road 4, Abbeyland, Navan. Screening Assessment and Natura Impact Statement. Unpublished Report to Client.
- Atherton, I., Bosanquet, S., Lawley, M. (eds). (2010). Mosses and Liverworts of Britain and Ireland. A field Guide, British Bryological Society. Latimer Trend & Co. Ltd: Plymouth.
- 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.
- Bach, L. Burkhardt, P. & Limpens, H.J.G.A. (2004). Tunnels as a possibility to connect bat habitats. Mammalia 68: 411-420.
- Balmer, D., Gillings, S., Caffrey, B., Swann, B., Downie, I., Fuller, R. (2013). Bird Atlas 2007-2011.British Trust for Ornithology.
- BCT & ILP (2018). Bats and artificial lighting in the UK. Bats and the Built Environment series. Guidance Note 08/18. Available online at file:///C:/Users/Robert.Fennelly/Downloads/ilp-guidance-note-8-bats-and-artificial-lighting-compressed.pdf Accessed August 2019.
- BEC Consultants (2006). Survey of rare/threatened and scarce vascular plants in County Meath. Botanical, Environmental & Conservation (BEC) Consultants Ltd. Available online at http://oldsitehc.info/fileadmin/user_upload/Publications/County_Heritage_Services/Misc_Meath_Docs/Meath_06_Rare_Plant_Survey.pdf Accessed September 2018.
- BirdLife International. (2018). Species factsheet: Alcedo atthis. Available online at from http://www.birdlife.org Accessed August 2019.
- Blaxter, J. H.S., (1981). The Swimbladder and Hearing In: Hearing and Sound Communication in Fishes.
- Boonman, B. (2011). Factors determining the use of culverts underneath highways and railway tracks by bats in lowland Areas. Lutra 43, 3-16.
- Brady Shipman Martin (2017). Navan Town Centre. Integrated Public Realm and Movement Plan. Provision of Information for an Appropriate Assessment. Available online at http://www.meath.ie/CountyCouncil/MajorProjects/Navan2030Plan/File,65796,en.pdf. Accessed August 2019.
- Bruintjes, R., Simpson, S. D., Harding, H., Bunce, T., Benson, T., Rossington, K. and Jones, D. (2016) The impact of experimental impact pile driving on oxygen uptake in black seabream and plaice. Proceedings of Meetings on Acoustics, 27:1, 010042.
- BTO (2005). Nest Record Scheme Data. Kingfisher Alcedo atthis. Available online at https://app.bto.org/birdfacts/results/bob8310.htm. Accessed August 2019.
- Caraco, D. (2000). Strengthening Silt Fences: The Practice of Watershed Protection. Watershed Protection Techniques 2; 434-428.
- CIEEM (2018; updated September 2019). Guidelines for Ecological Impact Assessment In The UK and Ireland. Terrestrial, Freshwater, Coastal and Marine. September 2018.
- Cleary, G. P., Corner, L. A., O'Keeffe, J., & Marples, N. M. (2009). The diet of the badger Meles meles in the Republic of Ireland. Mammalian Biology 74(6), 438-447.
- Colhoun. K. and Cummins, S. (2013). Birds of Conservation Concern in Ireland 2014–2019, Irish Birds 9 523-544.
- Collins, J. (ed.). (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edn). The Bat Conservation Trust, London.
- Colotelo, A. H., Pflugrath, B. D., Brown, R. S., Brauner, C. J., Mueller, R. P., Carlson, T. J., ... & Trumbo, B. A. (2012). The effect of rapid and sustained decompression on barotrauma in juvenile brook lamprey and Pacific lamprey: Implications for passage at hydroelectric facilities. Fisheries Research, 129, 17-20.

- Cornally, A. and Lawton, C. (2016). A guide to the identification of Irish mammal hair. Irish Wildlife Manuals, No. 92. National Parks and Wildlife Service, Department of the Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Ireland.
- Crowe, O., Musgrove, A.J., & O'Halloran, J. (2014). Generating population estimates for common and widespread breeding birds in Ireland, Bird Study, 61:1, 82-90.
- Cummins, S., Fisher, J., Gaj McKeever, R., McNaghtan, L., Crowe, O. (2010). Assessment of the distribution and abundance of Kingfisher Alcedo atthis and other riparian birds on six SAC river systems in Ireland. A report commissioned by the National Parks and Wildlife Service and prepared by BirdWatch Ireland.
- De Jong, K., Amorim, M. C. P., Fonseca, P. J. and Fox, C. J. and Heubel, K. U. Noise can affect acoustic communication and subsequent spawning in fish. Environmental Pollution, 237, 814-823.
- Desbusschere, E., Hostens, K., Adriaens, D., Ampe, B., Botteldooren, D., de Boeck, G., de Muynck, A., Sinha, A.K., Vandendriessche, S., van Hoorebeke, L., Vincx, M., Degraer, S. (2016) Acoustic stress responses in juvenile sea bass Dicentrarchus labrax induced by offshore pile driving. Environmental Pollution, 208: B, 747-757.
- Díaz, M., Møller, A. P., Flensted-Jensen, E., Grim, T., Ibáñez-Álamo, J. D., Jokimäki, J., and Tryjanowski, P. (2013). The geography of fear: a latitudinal gradient in anti-predator escape distances of birds across Europe. PloS one, 8(5), e64634.
- DoHGLP (2018). River Basin Management Plan for Ireland. Prepared by the Department of Housing, Planning, and Local Government.
- EPA. (2017). *EPA Guidelines on the information to be contained in Environmental Assessment Reports*, Draft, August 2017, Environmental Protection Agency, Co. Wexford, Ireland.
- Fennell, M., Wade, M., & Bacon, K. L. (2018). Japanese knotweed (Fallopia japonica): an analysis of capacity to cause structural damage (compared to other plants) and typical rhizome extension. PeerJ, 6, e5246.
- Ferguson-Lees, J., Castell, R., and Leech, D. (2011). A field guide to monitoring nests. British Trust for Ornithology, The Nunnery, Thetford.
- Fossitt, J. (2000). Guide to Habitats in Ireland. The Heritage Council.
- Gilbert, G., Gibbons, D.W., & Evans, J. (2012). Bird Monitoring Methods: A manual of techniques for key species. RSPB/BTO/JNCC/WWT/ITE/The Seabird Group RSPB/BTO, Sandy.
- Graham, G. G., and Primavesi, A. L. (1993). Roses of Great Britain and Ireland. BSBI handbook (7).
- Haigh, A. J. (2011). The ecology of the European hedgehog (Erinaceus europaeus) in rural Ireland. PhD Thesis, University College Cork. Available online at https://cora.ucc.ie/bitstream/handle/10468/558/HaighAJ_PhDThesis2012_Redacted.pdf?sequence=8&sa=U&ei=CxtUU8TGKOfg8gH71oG4Bw&ved=0CD0QFjAH&usg=AFQjCNFLtZnc24PjJo_4NArN8-YXmQOZMQ
- Hardey, J. Crick, H., Wernham, C., Riley, H., Etheridge, B., Thompson, D. (2013). Raptors: A field guide for surveys and monitoring. Third edition.
- Harris, S., Cresswell, P., and Jefferies, D. (1989). Surveying Badgers. The Mammal Society, London.
- Hawkins, A. (2005) Assessing the impact of pile driving upon fish. Available at: https://escholarship.org/uc/item/28n858z1.
- Hayden, T. and Harrington, R. (2001) Exploring Irish Mammals. Town House, Dublin.
- IFI. (2016). Guidelines on Protection of Fisheries During Construction Works Adjacent to Watercourses. Inland Fisheries Ireland
- JBA Consulting (2016). Natura Impact Statement Draft Arterial Drainage Maintenance 2016-2021. Available online at https://www.opw.ie/en/media/2016-2021arterial-drainage-maintenance-sea-scoping-report-activities.pdf. Accessed August 2018
- King, J.L., Marnell, F., Kingston, N., Rosell, R., Boylan, P., Caffrey, J.M., FitzPatrick, Ú., Gargan, P.G., Kelly, F.L., O'Grady, M.F., Poole, R., Roche, W.K. and Cassidy, D. (2011). Ireland Red List No. 5: Amphibians, Reptiles and Freshwater Fish. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

- Kilroy, G., Dunne, F., Ryan, J., O'Connor, A., Daly, D., Craig, M., Coxon, C., Johnston, P. and Moe, H., 2008. A framework for the assessment of groundwater dependent terrestrial ecosystems under the water framework directive (2005-W-FS-5). Associated datasets and digital information objects connected to this resource are available at Secure Archive For Environmental Research Data (SAFER) managed by the Environmental Protection Agency Ireland.
- Liddon, K. (2013). Prevention of Diffuse Pollution from Active Forestry Harvesting Sites: A preliminary study into the source of sediment and the practical use of material for sediment retention. Undergraduate Honours Dissertation.
- Lockhart, N., Hodgetts, N., Holyoak, D. (2012). Ireland Red List No. 8 Bryophytes. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Marnell, F., Kingston, N., and Looney, D. (2009). Ireland Red List No. 3: Terrestrial Mammals, National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- MCC (2010). County Meath and Coastal Habitats Survey. Available online at http://www.meath.ie/CountyCouncil/Publications/HeritagePublications/File,43109,en.pdf Accessed August 2019.
- MCC. (2012). Meath County Development Plan 2013-2019. Available at: http://www.meath.ie/CountyCouncil/Publications/PlanningPublications/MeathCountyDevelopmentPlan2013-2019/ Accessed August 2019.
- MCC (2015a). Draft County Meath Biodiversity Action Plan 2015-2020. Available online at http://www.meath.ie/CountyCouncil/Publications/HeritagePublications/File,60028,en.pdf Accessed August 2019.
- MCC (2015b). Meath Economic Development Strategy 2014-2022. Available at: https://www.meath.ie/sites/default/files/migrated_files/Business/MeathEconomicDevelopmentStrategy/LargerthanFourMBDownload%2C63735%2Cen.pdf Accessed August 2019.
- MCC (2017). Draft Navan 2030 Plan. Available online at Available online at http://www.meath.ie/CountyCouncil/MajorProjects/Navan2030Plan/#docs Accessed August 2019.
- Møller, A. P. (2009). Basal metabolic rate and risk-taking behaviour in birds. Journal of evolutionary biology 22.12: 2420-2429.
- National Planning Framework (2018). The Project Ireland 2040. Available online at: http://npf.ie/ Accessed August 2019.
- NTA. (2016). Transport Strategy for the Greater Dublin Area 2016-2035. National Transport Authority. Available at: https://www.nationaltransport.ie/ wp-content/uploads/2016/08/Transport_Strategy_for_the_Greater_Dublin_Area_2016-2035.pdf Accessed August 2019.
- Nedwell, J. R., Turnpenny, A. W. H., Langworthy, J. and Edwards, B. (2003). Measurements of underwater noise during piling at the Red Funnel Terminal, Southampton, and observations of its effect on caged fish. Subacoustech report reference 558R0207, October 2003. Available online at https://tethys.pnnl.gov/sites/default/files/publications/Nedwell%20et%20al%202003.pdf Accessed September 2018.
- Nedwell, J. R., Turnpenny, A. W. H., Lovell, J. M. and Edwards, B. (2006) An investigation into the effects of underwater piling noise on salmonids. The Journal of the Acoustical Society of America, 120, 2550.
- NPWS (Undated) The status and trends of Ireland's bird species – Article 12 Reporting 2008-2012. Available online at https://www.npws.ie/status-and-trends-ireland%E2%80%99s-bird-species-%E2%80%93-article-12-reporting Accessed August 2019.
- NPWS. (2006). Bat Mitigation Guidelines for IrelanD, National Parks and Wildlife Service. Department of the Environment, Heritage and Local Government.
- NPWS. (2019a). The Status of EU Protected Habitats and Species in Ireland. Species Assessments Volume 1. Version 1.1. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.

- NPWS. (2019b). The Status of EU Protected Habitats and Species in Ireland. Habitat Assessments Volume 2. Version 1.1. Unpublished Report, National Parks & Wildlife Services. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- NPWS. (2017a). Natura Standard Data Form. River Boyne and River Blackwater SAC (002299). First compilation 2003-06, update date 2017-09. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
- NPWS. (2017b). Natura Standard Data Form. River Boyne and River Blackwater SPA (004232). First compilation 2010-11, update date 2017-09. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht.
- NPWS. (2017c). National Biodiversity Action Plan 2017-2021. National Parks and Wildlife Service, Department of Culture, Heritage and the Gaeltacht
- NRA. (2005-2011) Environmental Planning and Construction Guidelines Series 2005 – 2011.
- NRA. (2006a). Guidelines for the treatment of badgers prior to the construction of national road schemes. National Roads Authority: Ireland.
- NRA. (2006b). Guidelines for the treatment of otters prior to the construction of national road schemes. Dublin: National Roads Authority.
- NRA. (2009a). Guidelines for assessment of ecological impacts of national roads schemes, revision 2.Page, C.N. (1997). The Ferns of Britain and Ireland (3rd Edition). Cambridge University Press, Cambridge, UK.
- NRA. (2009b). Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes. National Roads Authority: Ireland.
- O'Grady, M. (1995). The Enhancement of Salmonid Rivers in the Republic of Ireland 1. Water and Environment Journal, 9(2), 164-172.
- O’Connor W. (2006). A survey of juvenile lamprey populations in the Boyne Catchment. Irish Wildlife Manuals, No. 24 National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin,
- O'Neill, F. H., Martin, J. R., Devaney, F. M., & Perrin, P. M. (2013). The Irish semi-natural grasslands survey 2007-2012. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht. Dublin, Ireland
- O’Neill, F.H. and Barron, S.J. (2013). Results of monitoring survey of old sessile oak woods and alluvial forests. Irish Wildlife Manuals, No. 71. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland
- Perrin, P.M, Martin, J.R., Barron, S.J., O’Neill, F.H., McNutt, K.E. & Delaney, A.M. (2008). National Survey of Native Woodlands 2003-2008: Volume II: Woodland classification. Report submitted to National Parks & Wildlife Service, Dublin.
- Rees, E. C., Bruce, J. H., and White, G. T. (2005). Factors affecting the behavioural responses of whooper swans (Cygnus c. cygnus) to various human activities. Biological conservation, 121(3), 369-382.
- Regan, E.C., Nelson, B., Aldwell, B., Bertrand, C., Bond, K., Harding, J., Nash, D., Nixon, D., and Wilson, C.J. (2010). Ireland Red List No. 4 – Butterflies. National Parks and Wildlife Service, Department of the Environment, Heritage and Local Government, Ireland.
- Reid, N., Dingerkus, S.K., Stone, R.E., Pietravalle, S., Kelly, R., Buckley, J., Beebee, T.J.C. & Wilkinson, J.W. (2013) National Frog Survey of Ireland 2010/11. Irish Wildlife Manuals, No. 58. National Parks and Wildlife Service, Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Shiels, C.B, Shiel, R.E, and Fairley, J.S. (2006). Seasonal changes in the foraging behaviour of Leisler’s bats (Nyctalus leisleri) in Ireland as revealed by radio telemetry. Journal of Zoology 249, 347-358.
- Sleeman, D. P. (1987). The ecology of the Irish stoat. PhD Thesis, University College Cork. Available online at https://cora.ucc.ie/bitstream/handle/10468/1824/SleemanDP_PhD1987.pdf?sequence=1 Accessed February 2018.
- Smit, C. J. and Visser, G. J. (1993). Effects of disturbance on shorebirds: a summary of existing knowledge from the Dutch Wadden Sea and Delta. Wader Study Group Bulletin. 68: 6-19.

- Smith, G.F., O'Donoghue, P., O'Hora, K., and Delaney, E. (2011). Best Practice Guidance for Habitat Survey and Mapping, The Heritage Council, Ireland.
- Smith, G.F., Delaney, E., O'Hora, K., and O'Donoghue, P. (2011). County Meath Tree, Woodland and Hedgerow Survey. Report prepared for Meath County Council.
- SNH (2016). Assessing Connectivity with Special Protection Areas (SPAs). Scottish Natural Heritage.
- Stace, C.A. (2010). New Flora of the British Isles. Third Edition, Cambridge University Press.
- Spoelstra, K., van Grunsven, R. H., Ramakers, J. J., Ferguson, K. B., Raap, T., Donners, M., ... & Visser, M. E. (2017). Response of bats to light with different spectra: light-shy and agile bat presence is affected by white and green, but not red light. Proceedings of the Royal Society B 284(1855), 20170075.
- Stone, E.L. (2013). Bats and lighting: Overview of current evidence and mitigation guidance. Report published by University of Bristol in conjunction with Natural England and the Bat Conservation Trust. Available online at: https://cdn.bats.org.uk/pdf/Bats_and_Lighting_-_Overview_of_evidence_and_mitigation_-_2014_UPDATE.pdf?mtime=20181101151311 Accessed September 2019.
- Walsh, S. (2012). A summary of climate averages for Ireland. Climatological Note No. 14. Met Eireann, Dublin. Available online at https://www.met.ie/climate-ireland/SummaryClimAvgs.pdf. Accessed September 2019.
- Whitfield, D. P., Ruddock, M., and Bullman, R. (2008). Expert opinion as a tool for quantifying bird tolerance to human disturbance. Biological Conservation, 141(11), 2708-2717.
- Wyse Jackson, M., FitzPatrick, Ú., Cole, E., Jebb, M., McFerran, D., Sheehy Skeffington, M. and Wright, M. (2016). Ireland Red List No. 10: Vascular Plants. National Parks and Wildlife Service, Department of Arts, Heritage, Regional, Rural and Gaeltacht Affairs, Dublin, Ireland.

Chapter 08: Land and Soils

08

8. Land and Soil

8.1 Introduction

This chapter of the EIAR assesses and evaluates the potentially significant effects on the land, soil, geology and hydrogeology of the site and surrounding area from the Proposed Road Development.

In order to assess baseline conditions, an environmental investigation of the Proposed Road Development site was carried out. In assessing potential significant effects associated with construction and operational phases of the Proposed Road Development on land, soils, geology and hydrogeology, both the importance of the attributes and the predicted scale and duration of likely effects have been considered.

8.2 Methodology

This assessment meets the requirements for an EIAR as outlined in the relevant National and EU legislation. This chapter has been prepared in accordance with the EPA Draft guidance document EPA's '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*' (2017), EPA's guidance documents '*Guidelines on the Information to be Contained in Environmental Impact Statements'* (2002), EPA's '*Advice Notes on Current Practice in the Preparation of Environmental Impact Statements*' (2003)., and the Institute of Geologists of Ireland (IGI) guidance document '*Guidelines for Preparation of Soils, Geology, Hydrogeology Chapters of Environmental Impact Statements'* (2013).

8.2.1 Sources of Information

This assessment has been prepared from a desktop review of existing information and a site walkover survey on 16 August 2018. The following is a list of sources of information consulted for use in this chapter:

- Ordnance Survey Ireland (OSI) website[40] 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);
- GSI website[41] Public Viewer;
- GSI website Groundwater Vulnerability Map / Groundwater Data Viewer;
- EPA website[42] Envision for ground and groundwater information;
- OPW CFRAM website[43] for flood data;
- Local Authority Web Portals;
- Topography map[44];
- Google Street view[45];
- IGSL 2019 Ground Investigation Report (Appendix A8-1; Volume 4); and
- FRA Report (Appendix A8-2; Volume 4).

8.2.2 Appraisals Methodology

The appraisal methodology considered a description of the impact i.e. the "quality" of the effects (i.e. whether it is adverse or beneficial), the "significance" of the effects (i.e. the magnitude of the effect in terms of the environment), the "probability" of the event occurring, and the "duration" of the effects (i.e. whether it is short or long term) and also considers the significance/sensitivity of the existing environment. Terminology for describing the quality, significance, extent, probability and duration of effects is set out in Section 3.7.3 of the 2017 EPA EIAR guidance.

[40] http://www.osi.ie
[41] http://www.gsi.ie
[42] http://gis.epa.ie/Envision/
[43] www.opw.ie
[44] http://en-ie.topographic-map.com
[45] https://www.google.ie/

A qualitative approach was used in this evaluation and Figure 8-1 taken from the EPA EIAR guidance shows how comparison of the character of the predicted impact to the sensitivity of the receiving environment can determine the significance of the effect.

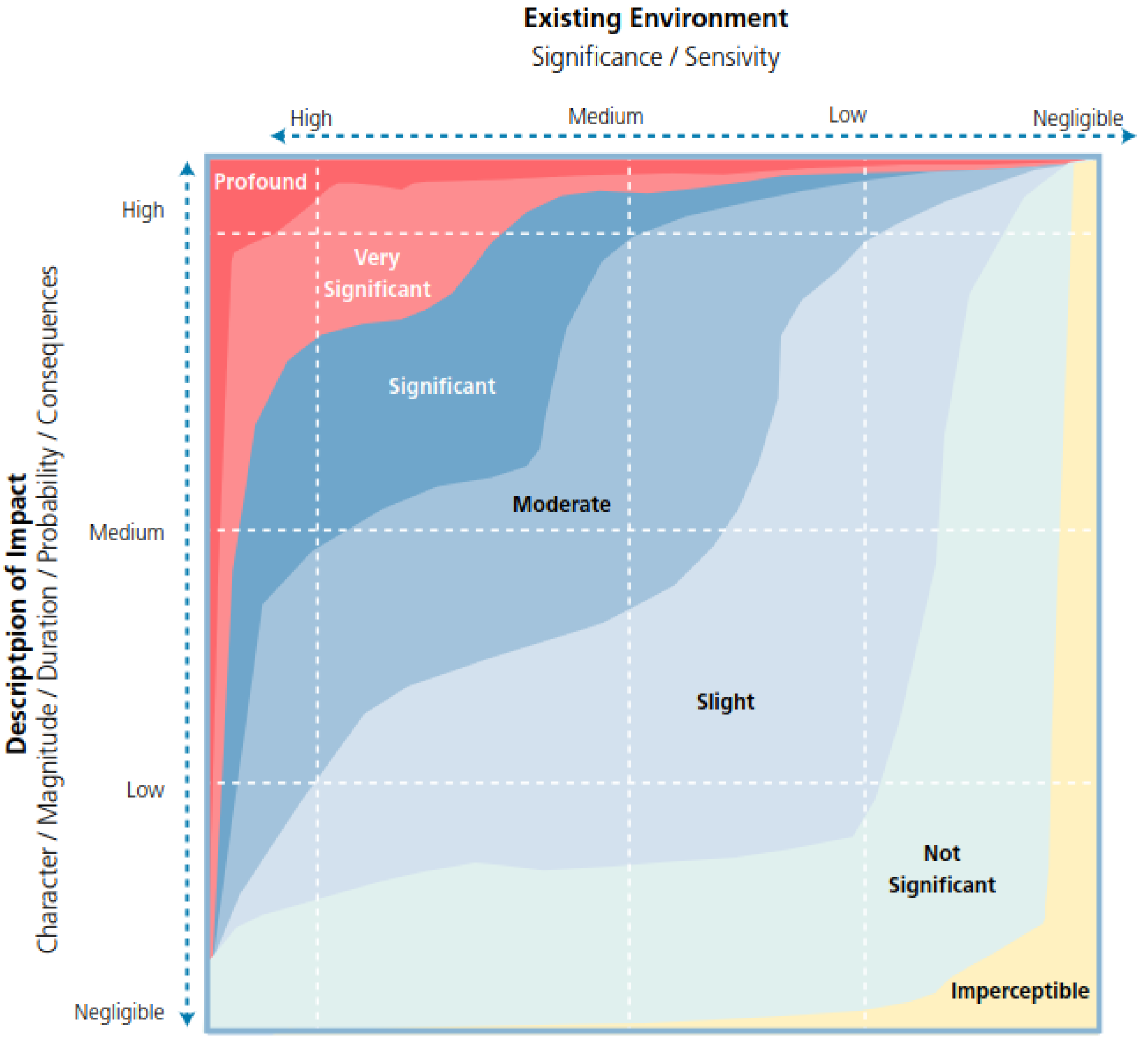


Figure 8-1 Determination of the Significance of the Effect (EPA, 2017)

Table 8-1 Describing the Significance of Effects

Significance Level	Description
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.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends.
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound Effects	An effect which obliterates sensitive characteristics.

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

8.2.2.1 Limitations in the Methodology and Gaps in Information

There were no significant gaps in the desk top data available at the time. There were no limitations to access during the site walkover survey and all areas where access was required was possible.

8.3 Characteristics of the Proposed Road Development

The Proposed Road Development comprises a c. 1.15 km local distributor road consisting of an urban Arterial Street, incorporating both footpath and cycle path provisions. A new bridge crossing over the River Blackwater in the south is also proposed.

The Proposed Road Development includes an embankment road section either side of a new bridge crossing over the River Blackwater in order to address road gradient and levels. To achieve the required engineering design, the Proposed Road Development will consist of approximately 20% at grade, 20% cut and 60% formed along raised embankments either side of the bridge river crossing. A culvert over an existing stream/field ditch will also be required in the northern portion of the scheme. There will be a new interchange/connection at both the northern and southern extents of the Proposed Road Development with the existing road network.

The Proposed Road Development will provide road surface water runoff collection and treatment facilities so that rainfall from all paved areas is effectively removed from the road surface and treated before discharge to the existing water environment. This includes the provision for cut-off and storage in the event of a road accident causing spillage of deleterious materials.

An illustration of the Proposed Road Development Plan and Profile is presented in Figure 4.5 to 4.7 inclusive contained in Volume 3 of this EIAR. A detailed description of the Proposed Road Development can be found in Chapter 4 (Description of the Proposed Road Development).

8.3.1 Construction Activities

The overall construction duration of the Proposed Road Development will be approximately 15 – 18 months. The earthworks construction will involve the excavation and placement of materials for the construction of embankments as well as the hauling and importation of materials to complete the sub-formation and road formation. The construction of the structures will involve the delivery of fill materials. The civil works of relevance to land, soil, geology and hydrogeology include the following activities:

- Preliminary works, including clearance, levelling, site roads/pedestrian access and establishment of lay-down and fabrication area;
- Construction of bridge and abutment structures;

- Drainage works - the installation of pipes, culverts, surface water channels, filter drains, ditches and attenuation systems;
- Demolition of an existing commercial property; and
- Landscaping and reinstatement.

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

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

8.3.2 Operational Activities

There will be surface water runoff discharge, via a sealed system of gullies and kerb drains, feeding into downstream attenuation systems. The proposed road drainage system will be divided into three separate networks, A, B and C. Network A (chainage 0+000 – 0+225) will service the northern portion of the Proposed Road Development. This section will connect into an existing Surface Water Outfall via a petrol interceptor and storage tank.

Network B (chainage 0+225 – 0+900) will service the central portion of the Proposed Road Development. This section will discharge first via a petrol interceptor into a lined attenuation pond on the western side of the mainline at approximately Ch.0+800. The attenuation pond will discharge to the northern bank of the River Blackwater via a vegetated interceptor ditch.

Network C (chainage 0+900 – 1+150) will service the southern portion of the Proposed Road Development. Runoff from this section will flow via a petrol interceptor into an attenuation tank. A vegetated interceptor ditch will be constructed at the tank outlet, upstream of the River Blackwater.

All tanks and the attenuation pond will be fitted with a flow control device and shut off valve. Flows will be attenuated prior to discharge to the receiving watercourse so that the post development peak flow rate is not greater than the original greenfield runoff rate (2.3 l/sec/ha). The attenuation systems will be designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse.

During the operation of the Proposed Road Development the tanks, attenuation pond and interceptors will be maintained by the Local Authority.

There will be no significant storage or use of hazardous / water polluting materials during the operational phase of the Proposed Road Development.

During operation the road will have an expected traffic volume of 3,138 vehicle movements northbound and 2,841 vehicle movements south bound in 2022 (AADT, see Chapter 5 (Traffic Analysis)). Any fuel loss from accidental spills should they occur on the Proposed Road Development will be diverted to the closed drainage system detailed above. A shut-down valve at the outlet to each outfall will allow any potential spillage to be accommodated within the attenuation system.

8.4 Description of the Existing Environment

8.4.1 Site Area Description

The Proposed Road Development will connect the N51/R147 Kells Road to the L3409 Ratholdron Road through Abbeyland. The location is characterised by the presence of agricultural land with some wooded areas in the section north of the River Blackwater, which runs to the west of Blackwater Park. The southern section of the Proposed Road Development site contains the River Blackwater and continuing to the south then meets the N51/R147 Kells Road, replacing a disused OPW building. Kells Road is lined by both residential and commercial properties.

The proposed route encompasses an area of maintained woodland in the northern portion. The route then crosses one ditch (orientated northwest to southeast) which runs along a field boundary to the west of a playground at Blackwater Park. During the site walkover completed as part of this assessment, the ditch was observed to be approximately 3 to 4 m to the water surface and approximately 3 m wide at the point where the proposed route would cross it. Water with no discernible flow was observed in the base of the ditch. It was not possible to determine the depth of water within the ditch during the site walkover due to heavy vegetation and unsafe access at the time. Dry ditches were observed along the western boundary of Blackwater Park, along with raised embankments along the southern half of the boundary. Discrete areas of fill (concrete and rubble) were observed within the ground surface on the periphery of the park the extent and depth of this material could not be determined as the site walkover was a visual inspection only.

A small copse with steep slopes is located immediately north of the River Blackwater which corresponds with the location of a small quarry which can be seen on historical maps. From this point, lands slope notably downwards to the River Blackwater. To the south of the river, lands rise again to the south. The Proposed Road Development runs across OPW lands, which comprise a small area of rough vegetated ground, raised by approximately 1 m above surrounding lands, to the north of a tarmac car park and a disused building with an access lane to the west. A row of residential properties are located immediately west of the OPW site with gardens to the rear (north) and an area of undeveloped low lying ground north of the gardens towards the River Blackwater. This low-lying ground is relatively flat and at a lower elevation than surrounding lands, the vegetation present in this area is characteristic of flood plain flora.

8.4.2 Topography

The land upon which the northern portion of the Proposed Road Development site is situated on slopes gently downwards to the south, the southern half of the Proposed Road Development site is characterised by more notable downward slopes towards the River Blackwater from the south and the north. According to the large-scale topographical map, ground elevation at River Blackwater is approximately 35 m above Ordnance Datum (m OD). Moving north and south away from the river, the ground slopes upwards to an elevation of approximately 45 m OD at the southern site boundary and 48 m OD at the northern Proposed Road Development site boundary.

Lands to the west and east of the site are at a similar elevation to the site. Higher elevations (above 54 m OD) are noted to the north / northeast and to the southwest as distance increase away from the River Blackwater.

8.4.3 Surrounding Land Use

The Proposed Road Development Site is set within an agricultural / parkland setting with residential land uses to the north and east and a mixture of residential, commercial and industrial land uses to the south. Lands to the west are agricultural in use. A disused railway line runs in a north to south orientation c. 170 m west of the Proposed Road Development site. The Proposed Road Development site is approximately 0.5 km to the northwest of Navan town centre.

Immediately east of the Proposed Road Development site is recreational parkland (Blackwater Park). An ESB compound and a MCC depot are situated adjacent to the entrance to Blackwater Park.

The southern portion of the Proposed Road Development Site will replace the current disused OPW building and is bounded to the east by a Teagasc building and Balmoral Industrial Estate beyond. A row of residential properties are located to the west, with Blackwater Retail Park beyond.

A review of the EPA's website indicated that there are two active Industrial Pollution Control (IPC) / Industrial Emission Licensed (IEL) facilities within 500 m of the Proposed Road Development site:

- Navan Carpets Limited c. 200 m west of the Proposed Road Development site. Available mapping suggests this licence is recorded at a property now in use as a retail park and that the licensed site may no longer be in existence; and
- Boliden Tara Mines Limited c. 320 m southwest of the Proposed Road Development site.

Available maps indicate that the eastern boundary of the Tara Mines licence extends along the line of the rail line to the west of the Proposed Road Development site. It is possible that mine shafts may extend beneath the Proposed Road Development site and this will be considered during the detailed design phase.

8.4.4 Quaternary Deposits

The Teagasc soil map (available on the GSI website) indicates that there is some variation in the soils across the Proposed Road Development Site and surrounding area. Surrounding the River Blackwater, alluvial material (AlluvMIN) is located. Moving south, made ground underlies the Proposed Road Development site and dominates for the majority of the area to the south. The intersection of the N51/R147 Kells Road is underlain by mainly basic, shallow, rocky, peaty/non peaty material (BminSRPT). North of the River Blackwater and the associated alluvial material, a narrow band of BminSRPT extends across the Proposed Road Development Site beyond which the soil is characterised by mainly acidic, peaty, poorly drained mineral (AminPDPT) at the most northern portion. This soil, AminPDPT, characterises the parkland and agricultural areas of the Proposed Road Development site. To the east of the Proposed Road Development site, made ground underlies the nearby residential areas.

Publicly available geotechnical reports on the GSI website include one geotechnical report (#7183) for a location within a 500 m radius of the Proposed Road Development Site at Athboy Road, Navan, Co. Meath. According to this report, 16 boreholes were drilled on the property to a maximum depth of 7.7 meters below ground level (m bgl) and six trial pits were excavated to a maximum of 3.0 m bgl. Made ground was reported to vary in depth extensively with recorded depths of between 0.2 m below ground level (bgl) and 1.2 m bgl. The general stratigraphic trend was reported as follows: top soil above made ground, underlain by superficial deposits comprising sandy clay and gravel. The gravel unit was encountered at depths between 4.2 m bgl and 5.3 m bgl. In some of the deeper boreholes it was noted that beneath this gravel layer, a layer of stiff clay extends. Trial pits typically encountered a stratigraphy of made ground or topsoil above sandy gravelly clay with an interbedded layer of gravel.

8.4.5 Bedrock

According to information published on the GSI website, two faults strike northeast – southwest across the Proposed Road Development site. The southern portion of the Proposed Road Development site is underlain by bedrock of the Lucan formation, described as dark limestone and shale. Multiple bedrock outcrops of this unit are noted, predominately located in close proximity to the River Blackwater.

The middle section of the Proposed Road Development site is underlain by the Brittstown Formation comprising well bedded, basic to intermediate, volcaniclastic rocks, lavas, siltstone and shale.

The northern portion of the Proposed Road Development site is underlain by the Navan Syenite Formation, an igneous intrusion which is separated from the Brittstown Formation by a fault. Faulting also occurs to the north of the syenite, where bedrock of the White Island Bridge Formation, comprising tuff, tuffaceous siltstone and mudstone, underlies the northern-most extent of the Proposed Road Development Site.

Immediately to the east of the Proposed Road Development site, a geological boundary occurs between the Lucan formation and Meath formation; characterised as limestone and calcareous sandstone.

8.4.6 Hydrogeology

According to the GSI spatial resources viewer, the Proposed Road Development site is located across three bedrock aquifer units. The main unit is classed as a poor aquifer, with the bedrock being generally unproductive except for local zones. This relates to the Brittstown Formation, Navan Syenite and White Island Bridge Formation. To the east and west of these units, the Meath Formation is regarded as a locally important aquifer with the bedrock being moderately productive in local zones, as is the Lucan formation, which underlies the southern portion of the Proposed Road Development Site. Groundwater vulnerability varies in accordance with the variation in superficial and solid geology. Groundwater vulnerability is referred to as ‘extreme’ (E) surrounding the River Blackwater, with isolated areas of rock at or near surface (X). Further from the river, groundwater vulnerability is ‘high’ (H), decreasing to ‘moderate’ (M) with increasing distance.

According to the GSI website, there are no groundwater wells on the Proposed Road Development site. However, within a 1 km radius, four wells are noted:

- Approximately 300 m southeast of the N51/R147 Kells Road roundabout, groundwater well 2625NEW046 is located. This borehole extends to a depth of 49.2 m and is used for domestic purposes, with an abstraction rate of 218 m^3/day;
- Borehole 2625NEW136 is located c. 500 m to the east of the Proposed Road Development site and is owned by the Department of Agriculture with the purpose of monitoring carcass trim in meat factories. The well has a yield of 19 m^3/day;

- Northwest of the Proposed Road Development site (c. 500 m), borehole 2625NEW104 extends 9.1 m bgl and is used for public supply (Local Authority) with a yield of 7.6 m^3/day; and
- Beyond this, at a distance of 700 m northwest of the Proposed Road Development site, borehole 2625NEW009 extends to 14 m bgl and is owned by the Applicant. No information regarding yield volumes or abstraction rate is available for this well.

The current status (i.e. whether they are in use) of the wells described above is unknown. It should be noted that there is no requirement to register abstraction wells with the GSI and there may be unregistered wells in the vicinity of the Proposed Road Development Site.

The Proposed Road Development site is not located within a groundwater Source Protection Area. In addition, there are no gravel aquifers in the vicinity of the Proposed Road Development site.

8.4.7 Designated Sites

The closest Ecological Protected Site is the River Blackwater and River Boyne SAC, flowing west to east through the southern portion of the Proposed Road Development Site. Features of interest include: Alkaline fens, Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*), *Lampetra fluviatilis* (River Lamprey), *Salmo salar* (Salmon) and *Lutra lutra* (Otter). River Blackwater and River Boyne is also a SPA, with *Alcedo atthis* (Kingfisher) being the feature of interest. These are discussed further in Chapter 7 (Biodiversity) of this EIAR.

There are no surrounding pNHA, nature reserves or national parks within 1 km of the Proposed Road Development site.

8.4.8 Ground Investigation Results

A GI for the Proposed Road Development site was scoped, specified and supervised by AECOM, and conducted by IGSL Ltd (Appendix A8-1; Volume 4). The Site Operations of the investigation were performed during the period 09 July to 30 July 2019.

The investigations were conducted in accordance with the *Specification and related documents for ground investigation in Ireland* (Engineers Ireland, 2016). In addition, they complied with the requirements of Eurocode 7 (National Standards Authority of Ireland, 2005a, 2005b and 2007).

The exploratory holes of the investigations comprised:

1. Eight boreholes (BH01 to BH08) advanced, in 200 mm diameter, by Dando 2000 cable percussion boring rigs, to between 1.3 and 6.4 m below ground level. They were terminated with refusal to progress through very stiff/hard glacial clay, dense gravels or on an obstruction.
2. SPT were carried out at 1 m intervals. Small and bulk disturbed samples were also taken within the soil strata.
3. Rotary drilled boreholes put down from ground level adjacent to three of the cable percussion boreholes. The rotary boreholes were numbered similarly to the cable percussion holes with prefix “RC”. Drilling employed a Knebel truck-mounted rig using:
   - rotary coring of firm to very stiff clay, using a Geobor-S geotechnical core barrel, producing nominal 102mm diameter cores. It is considered a Category A sampling method, capable of producing Class 1 samples suitable for laboratory testing to determine compressibility and shear strength (National Standards Authority of Ireland, 2007).
   - Rotary coring of very strong to strong Limestone to confirm bedrock and obtain samples for geotechnical testing
4. Ten trial pits (TP01 to TP10) excavated to between 1.6 and 4.5 m below ground level. Representative bulk disturbed samples were taken of the soil strata encountered. Where possible hand shear vanes were obtained within the trial pit walls. The trial pits were accompanied by DCPs.

8.4.8.1 Superficial deposits

Based on the results of the site investigations the superficial deposits along the route can be summarised as follows:

- Made Ground (MG);

- Topsoil (TS);
- Alluvium (ALV);
- Glacial Till (GF & GC)

8.4.8.2 Made Ground

Made ground was encountered in BH08, TP01, TP09, and TP10, ranging from 0.5 to 1.3 m below ground level.

TP01 is located at the northern extent of the scheme, while the remaining made ground was encountered in the OPW lands to the south of the River Blackwater.

The thickest extents of made ground (1.1 m and 1.4 m respectively) were encountered in TP09 and TP10 to the south of the River Blackwater.

8.4.8.3 Topsoil

Topsoil was encountered in all trial pits with a recorded thickness ranging from 0.15 and 0.4 m.

8.4.8.4 Alluvium

Alluvium deposits were encountered in BH03, BH04, and BH07 with a recorded thickness of between 0.4 and 3 m. These boreholes were located within the floodplain. The alluvium generally consisted of very soft dark brown sandy SILT/CLAY with some gravel. SPT blow counts ranged from 2 to 7 blows per 300 mm.

8.4.8.5 Glacial Deposits

Glacial deposits are widespread throughout the route. The constituent parts and matrix proportions of these deposits vary considerably. For engineering purposes these deposits are divided into Glacial Till fine-grained and Glacial Till coarse-grained in accordance with BS5930 which defines fine grained soils as containing more than 35% fines passing the 63 micron sieve size.

The fine-grained glacial deposits range from soft slight sandy SILTS to firm to stiff sandy gravelly Clays/Silts. Fine-grained glacial deposits were encountered in all boreholes apart from BH03 and BH07 which encountered shallow Limestone bedrock. SPT blow counts ranged from 10 to in excess of 50 blows per 300 mm.

The largest extent of Glacial Till extended from 1.0 m (bgl) to termination at 22.5 m (bgl) in RC04. The Glacial Till is generally slightly sandy slightly gravelly CLAY with more gravelly layers at depth. No rock was proven within this borehole.

A coarse grained deposit of sandy silty Gravel with cobbles and boulders was generally encountered within several trial pits at depths of approximately 3.6 to 4.6 m bgl. This deposit was encountered at 0.9 m bgl in TP08. Where encountered in boreholes, there was refusal within this layer. This granular layer was approximately 4 m thick in RC04. SPT blow counts ranged from 45 to in excess of 50 blows per 300 mm.

The online Groundwater Public Viewer of the GSI indicates that the Glacial Tills encountered to the north of the river are generally derived from sandstone and shales. The Glaciofluvial sand and gravels adjacent to the river and Glacial Tills to the south of the river are derived from Limestones.

8.4.8.6 Bedrock

Strong to medium strong limestone bedrock was encountered to the north of the river in RC03 and RC07 at 1.7 m bgl and 1.5 m bgl and is consistent with the GSI online viewer.

No bedrock was encountered to the south of the river in RC04 at a depth of 22.5 m bgl.

8.4.9 Summary of Baseline Conditions

A summary of baseline conditions at the site is presented in Table 8.2 below.

Table 8-2 Summary of Baseline Conditions

Item	Description
Context	The Proposed Road Development Site comprises primarily greenfield / agricultural lands with a wooded area in the north and a disused OPW building in the south. According to information available on the GSI website, ground conditions vary significantly across the length of the Proposed Road Development site.

Item	Description
	Superficial deposits comprise made ground beneath the OPW building in the southern-most section of the Proposed Road Development Site. North of this, alluvium is associated with the River Blackwater. Basic shallow rocky material underlies a narrow area in the middle of the Proposed Road Development Site, while most of the northern portion is underlain by acidic, peaty, poorly drained mineral soil. Discrete areas of infill comprising concrete and rubble at ground surface were observed during the site walkover at the boundary between Blackwater Park and the neighbouring agricultural fields. Bedrock comprises dark limestone and shale of the Lucan Formation in the southern portion of the Proposed Road Development Site. Well bedded volcaniclastic rocks, lavas, siltstone and shale (Brittstown Formation) underlie the middle section of the Proposed Road Development. An igneous intrusion (Navan Syenite Formation) underlies the northern portion of the Proposed Road Development site. GI identified water strikes in six of ten trial pits. These were observed at depths between c.. 2 m to 4 m. The soil stratigraphy of the trial pits and boreholes identified topsoil, silt and sands with some trial pits and bore holes also identifying areas of clay and gravel. Made ground was encountered in Trial Pit 01 (TP 01) between the depths of 0.10 – 0.50 m, at TP 09 between the depths of 0.20 m and 1.30 m and at TP 10 between the depths of 0.20 and 1.60 m gl.
Character	Bedrock beneath the majority of the Proposed Road Development site is classified as ‘a poor aquifer’; however, the Lucan Formation underlying the southern portion is classified as a ‘locally important aquifer’. Groundwater vulnerability also varies across the Proposed Road Development Site: surrounding the River Blackwater, groundwater vulnerability is referred to as ‘extreme’ (E), with isolated areas of rock at or near surface (X). Further from the river, groundwater vulnerability is ‘high’ (H), decreasing to ‘moderate’ (M) with increasing distance. The Proposed Road Development site is not located within a groundwater source protection area. A search of the GSI well database identified four groundwater abstraction wells within a 1km radius of the site. The yield of these wells varied from poor to good and they were described as having domestic, agricultural and public supply use. The River Blackwater and River Boyne SAC and SPA partially lie within the Proposed Road Development Site. A number of drainage ditches were observed during the site walkover located west of the playground and along the western boundary of Blackwater Park. Raised embankments were present along the southern half of the boundary. Lands to the south and north of the River Blackwater slope notably 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 / parkland on the periphery of Navan town centre. The River Blackwater and River Boyne SAC and SPA partially lie within the Proposed Road Development Site as the River Blackwater flows from west to east through the southern portion. This area of the Proposed Road Development Site is protected under the designation of SAC and SPA and significance could be described as designated. This aspect is assessed in more detail in Chapter 7 (Biodiversity) of this EIAR.
Sensitivity	Ground conditions beneath the Proposed Road Development Site vary, generally consisting of limited areas of made ground, alluvium and poorly drained soils which overly bedrock made up of limestone and shale in the southern part, volcaniclastic rocks in the central portion and igneous intrusions in the northern part of the Proposed Road Development Site. The bedrock aquifer varies from poor in the northern part of the Proposed Road Development Site to locally important in the southern part of the Proposed Development site, 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 within 1km radius. Surface water from the Blackwater river is used as a drinking supply. The soil environment can be considered of **LOW** sensitivity, while the groundwater environment can be considered **MEDIUM** sensitivity.

8.5 Assessment of Impacts

An analysis of the potential impacts from the Proposed Road Development on the soils, geology 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 9 (Water) and will be discussed in relation to water in that chapter.

8.5.1 Do Nothing Scenario

In the case where no road is developed there would be no resulting impacts on soils, geology and hydrogeology along the site of the Proposed Road Development.

8.5.2 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 proposed road alignment and grades, as presented elsewhere in this EIAR. The assessed impacts include:

- Soil excavation and filling;
- Accidental spills and leaks;
- Use of natural resources; and
- Use of concrete and lime.

Excavation and Infilling

Excavation earthwork impacts will mainly relate to removal of topsoil and shallow subsoils, while infill earthwork will mainly relate to the import and compaction of acceptable fill material for the construction of embankments either side of the proposed bridge structure to achieve the required engineering design and road grades.

To achieve the required engineering design, the Proposed Road Development will consist of approximately 20% at grade, 20% cut and 60% formed along raised embankments either side of the bridge river crossing.

Table 8-3 At Grade, Embankment and Cutting Requirements for the Proposed Road Development.

TOTAL:	Overall Length [m]	%
AT-GRADE	250	21.7%
EMBANKMENT	625	54.3%
CUTTING	275	23.9%
Total	1,150	100%

The Proposed Road Development has a gross earthworks deficit with a total general fill requirement (excluding capping) of 35,000 m^3 consisting of an import volume of 30,800 m^3 required to be brought onto the site and a re-use volume of 4,200 m^3. The total fill requirement including capping material is approximately 34,300 m^3.

The balance of materials is shown in the table below. The total volume of unacceptable material (U1) requiring disposal is also indicated.

Table 8-4 Earthworks Volumes

Item	Earthworks Aspect	Volume (m^3)
1	Total general cut volume	10,600
2	Acceptable material for re-use bulked	4,200
3	Unacceptable material bulked	8,500
4	Fill requirements for embankments	26,500
5	Excavation and Fill requirements to replace Alluvium / Made Ground	8,500
6	Class 4 fill requirements (visual and noise bunds)	1,900
7	Total general fill required excluding capping	35,000
8	Cut to Fill excluding capping	30,800
9	Disposal volume of unsuitable soils (U1)	15,100
10	Import requirement (including capping)	34,300
11	Total topsoil volume to be removed	8,200
12	Capping volume	3,500
13	Pavement volume (including Sub-base)	6,000

The imported fill required for the construction of embankments is not available in full from the existing soils present on the Proposed Road Development site and additional fill material will therefore be imported from off-site locations.

Excavation of soils (Alluvium and Made Ground) will be required as part of the bridge foundation construction for the river crossing and, in the areas, surrounding the commercial building on the south side of the river. These excavations are likely to be limited in area and depth.

The classification of groundwater vulnerability beneath the Proposed Road Development Site varies from Moderate to Extreme. Approximately 20% of the Proposed Road Development will require soil removal. This will consist of topsoil (8,200m^3) and general cut (10,600 m^3). Where subsoil removal is required it will be replaced by fill material and paved road surfaces, groundwater vulnerability from this action 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.

Excavation and infilling impacts are considered to result in permanent direct effects 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 low effect on a soil environment of low/medium significance/sensitivity and the significance of the effect is considered slight.

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 oils and fuels from construction machinery or site vehicles; and
- Spillage of oil or fuel from refuelling machinery on site.

Accidental spillage of fuels or chemicals may 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.

The impact is considered to result in a direct negative effect but unlikely to occur 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. Therefore, it is considered to be a medium effect on a low/medium significance/sensitivity environment and the significance of the effect is moderate.

Use of Natural Resources

It is expected that there will be a requirement for c. 34,300 m^3 of ‘clean’ fill material for the road embankment works comprising general fill and capping 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 be imported to the Proposed Road Development site for use in the establishment of contractor’s compounds, building works and the road and other works. The sourcing of these aggregates from reputable, authorised quarries is mandated by development requirements and for ensuring regulatory compliance.

Use of natural resources is considered to result in permanent direct effects of neutral quality which will be imperceptible on the quality or character of the wider environment but is certain to occur and irreversible. The use of natural resources is considered to be a low effect on a soil/ environment of low/medium significance/sensitivity and the significance of the effect is considered slight.

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 and concreting for culverts.

The impacts are considered to result in direct negative effects 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 medium effect to a low/medium significance/sensitivity environment and the significance of the effect is moderate.

8.5.3 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 and grades as presented elsewhere in this EIAR. The assessed impacts include:

- Accidental spills and leaks;
- Water balance changes (flooding); and
- Use of natural resources.

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 site (See Chapter 2 (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 a surface water siltation and attenuation pond/tanks before entering the River Blackwater.

In addition to this, the outlet of the attenuation pond/tanks will be fitted with a shut-down facility so that, in the event of a catastrophic spill, the spillage would be contained within the attenuation pond/tanks to be removed by tanker.

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 would be temporary in nature. Therefore, it is considered to be a low effect on a low/medium significance/sensitivity environment and the significance of the effect is slight. Specific mitigation measures are therefore not required.

Water Balance Changes

The construction of impermeable areas such as road and footpath pavement areas, which will cover approximately 3.1 Ha of the 8.63 Ha Proposed Road Development site, 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 settlement pond/tanks to the river this will result in a reduction in the amount of current rainfall recharge to groundwater below the Proposed Road Development site but an insignificant reduction in the amount of discharge to the river. An impact could be due to flooding of low lying areas leading to possible erosion of soil beneath bridge structures; however, the results of the hydraulic modelling displayed a maximum increase of 0.008 m in the water level immediately upstream of the proposed bridge structure and no change was indicated in the water level immediately downstream of the proposed bridge structure for a 1%AEP event.

Overall water balance changes are considered to be a negligible effect to a low/medium significance/sensitivity environment and the significance of the effect is imperceptible. Specific mitigation measures are therefore not required to address potential water balance changes.

Land Use

Potential impacts on existing land use during the construction and operational phase are outlined and assessed in Chapter 14 (Material Assets).

8.6 Mitigation Measures

8.6.1 Construction Phase

In order to prevent / minimise potential significant effects, a number of mitigation measures will be adopted as part of the construction works on Proposed Road Development site. 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 natural resources - sources of fill and aggregates for the project; and
- Use of concrete and lime - concrete and cement during road and culvert construction.

An 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 CESCP and a C&D WMP, to be prepared in accordance with Department of Environment, Community & Local Government guidelines[46] 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.

8.6.1.1 Soil Excavation and Filling

Temporary storage of soil will be carefully managed in such a way as to prevent potential negative effects 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; 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 18,800 m^3 of spoil will be generated from the removal of topsoil and bridge foundation excavations. This spoil will primarily consist of topsoil and fluvial subsoils.

Soil requiring off-site 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 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 along this route during construction stage will be reused (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. Surface water runoff from the Proposed Road Development site may impact the surrounding soils and groundwater introducing silts and increased chemical concentrations to the existing environment. The effect of surface water runoff from road works during the construction stage to the surrounding land and groundwater is considered 'not significant' (as any imported fill material brought to Proposed Road Development Site will be assessed to determine its suitability for use prior to use) and to be 'temporary' in duration.

A construction compound will be required along, or in the vicinity of the Proposed Road Development. It will be located within the Proposed Road Development site and site access will be approved by the Local Authority. It is anticipated that the compound will be 4,000 m^2 in size and will include stores, offices, material storage areas, plant storage and parking for site and staff vehicles. The construction compound is proposed to remain in place for the duration of the contract but may be scaled up or down during particular activities on the Proposed Road Development.

[46] 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

The construction compound will incorporate the protection and mitigation measures outlined in the EIAR and conform to the requirements outlined in the CESCP, NIS and planning conditions. Following completion of construction, the compound area will be re-instated.

8.6.1.2 Fuel and Chemical Handling

In order to prevent spillages to ground of fuels, and to prevent any 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 for all oils, solvents and chemicals used during construction. Oil and fuel storage tanks will be bunded to a volume of 125% of the capacity of the largest tank/container within the bunded area. 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. The pump or valve will be locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training.

8.6.1.3 Control of Concrete and Lime

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.

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 on-site, it will be carried out in carefully managed on-site wash out areas.

In order to minimize potential impacts to the river and floodplain SAC and SPA from the bridge construction works, abutments and embankments will be set back from the river as far as practical in order to minimise disturbance to the SAC and SPA. During construction works suitable drainage, settlement and silt control measures will be implemented to mitigate disturbance to the SAC and SPA. The bridge span will be constructed using precast beams.

8.6.1.4 Sources of Aggregates and Clean Fill for the Project

It is estimated that a small volume (approximately 4,200 m^3) of soils from the Proposed Road Development site will be suitable for re-use within the Proposed Road Development. The source of the remaining fill material requirement will be sourced where possible from local quarries. A number of local quarries have been identified in Chapter 4 (Description of the Proposed Road Development) 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 necessary 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. will 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 8-5 Active Quarries Identified Within 20km of the Proposed Road Development

Quarry Name	Resource and Yearly Output	Distance from Proposed Road Development Site (approx.)
Faughan Hill Quarry	Occasional extraction of limestone, yearly output 8,000 tonnes	6.6 km west
Slane Quarry	Basalt, yearly output not known	8.7 km northeast
Kilmessan Quarry	Limestone, yearly output not known	11.2 km south
Ballynamona Pit	Sand and gravel, yearly output not known	15.8 km south
Duleek Quarry	Limestone, yearly output not known	16.3 km east
Rathmoylon Quarry	Limestone, yearly output 100,000 tonnes	19.4 km southwest
Mullaghcrone Quarry	Limestone, yearly output not known	19.6 km east
Trammon Quarry	Limestone, yearly output not known	19.7 km southwest

Source: Geological Survey of Ireland Spatial Resources Website (Sept 2018)

8.6.2 Operational Phase

The operation of the Proposed Road Development is unlikely to 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 4 (Description of the Proposed Road Development).

There will be no direct discharges to groundwater or soil environment during the operational phase.

8.7 Cumulative Impacts

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 (200 m of the Proposed Road Development site boundary) within the last four years is presented in Chapter 6 (Population and Human Health).

The following nine planning applications were recorded in Chapter 6 (Population and Human Health); they are generally related to the redevelopment of existing commercial premises as ongoing commercial premises with the exception of the first two which relate to medium and small housing developments (see Chapter 6; Population and Human Health) and the last, which relates to underground mining.

Table 8-6 Summary of Planning Application Review

Planning Reference Number	Development Address	Brief Development Description	Grant Date
NA151301	Moathill, Navan, Co. Meath	The proposed development will consist of 99 no. residential units comprising 32 no. duplex/apartments and 67 no. 2 storey detached and semi-detached houses. The development will also include, a 2 storey crèche with play area, bin shelters, bicycle parking and car parking spaces, 2 no. landscaped public open spaces, a footpath and cycleway along the N51 National Road, a new vehicular access from the N51 National Road and associated revised junction layout, and all associated site and drainage works.	June 2016
NA161020	Ratholdron Old, Abbeyland, Navan Co. Meath	Construction of 6 no. dwelling houses consisting of 3 no. semi-detached blocks, connection to public water main, public sewer and associated site development and ancillary works including development of a vehicular entrance and service road, open space provision, all landscaping works, site	April 2017

Planning Reference Number	Development Address	Brief Development Description	Grant Date
		boundary treatment and associated drainage works. Significant further information/revised plans submitted on this application	
NA160363	Windtown, Navan, Co. Meath	The proposed development will consist of a new single storey support services building with car parking, connect to existing entrance to public road and connect to existing mains water, mains sewerage and surface water with ancillary site works.	July 2016
NA150427	Blackwater Retail Park, Navan, Co. Meath	The proposed development will consist of the construction of a single storey Coffee Shop and a single storey Drive Thru Restaurant including associated Drive Thru Lane, external yard and bin store. The proposed development also includes signage on the elevations of the building, external seating areas, minor alterations to the existing carpark, alterations to the eastern boundary and all ancillary site development site services and hard and soft landscaping works.	August 2015
NA140992	St. Patrick's Classical School, Moatlands (Kells Road), Navan Co. Meath.	The development will consist of the demolition of part of existing structure and construction of a fully serviced single storey extension to the existing school containing 1 no. woodwork room together with ancillary stores, plant, circulation space and associated works	February 2015
NA140993	St. Patrick's Classical School, Moatlands (Kells Road), Navan Co. Meath	The development will consist of the demolition of part of existing structure and construction of a fully serviced 2 storey extension to the existing school containing 1 no. music/drama room and 1 no. science laboratory and preparation room together with ancillary stairs, stores, circulation spaces and associated works	February 2015
NA180163	Balmoral Estate, Kells Road Navan, Co. Meath	The upgrading, reconfiguration and change of use of existing car showroom and retail units to provide for 2 no. car showrooms (781 sq.m), workshop (563 sq.m.), parts store (150 sq.m.) and ancillary staff facilities and public toilet (109 sq.m.) The proposed development will also include: 2 no. free standing double sided signs, upgrades to the existing signage and shopfronts including new glazing and cladding, reconfiguration of the existing car park and yard to provide for 92 no. car parking spaces, concrete paved forecourt area and reconfiguration of internal road. The proposed development includes all engineering works, landscaping works, boundary treatments and site development works on the approx. 0.70 hectare site.	
NA171476	Balmoral Estate, Kells Road, Navan Co. Meath	Demolition of existing single and two storey warehouse buildings; Construction of a 6 no. storey mixed use building over basemen: Provision of a discount food store at ground floor level to include all ancillary areas; provision of a 135 sq.m retail unit at first floor level (south) and c. 5,412 sq.m of office/medical floor space from first to fifth floors; landscaped surface car park (90 no. car parking spaces, 70 no. bicycle parking spaces, goods delivery/reception area; provision of a basement car park to serve the medical/office uses; reconfiguration of internal road and provision of ramp to basement of proposed development; Upgrades to the existing footpath along Kells Road and provision of a landscape plaza area at the junction of the Kells Road and the existing access road to Balmoral Industrial Estate; provision of 7 sq. m of illuminated signage located on the northern and eastern elevation; all associated and ancillary site development and landscaping works.	
NA171232	Nevinstown, Navan, Co. Meath	The development of the resumption of underground mining in the Nevinstown orebody. Previously planning permission was granted by An Bord Pleanála, ref PL17.204034. Mining will follow a cyclic pattern resulting in the removal of underground ore, hoisting to surface for processing followed by the filling of the extraction voids using cemented backfill. The surface characteristics and features of the Nevinstown townland will not be altered by mining activity. There will be no additional above ground structure/infrastructure associated with the development.	October 2018

Source: Chapter 6 of the EIAR <www.myplan.ie>

As the consented applications mainly deal with redevelopment, the associated cumulative land take is not significant. The potential for underground mining to resume at a site to the west of the Proposed Road Development is likely to have a more significant effect on geology and groundwater than the Proposed Road Development.

Following a review of the above proposed and consented projects there were no cumulative effects on the geology and groundwater as a result of the Proposed Road Development identified.

8.8 Residual Impacts

Residual impacts are those that will occur after the proposed mitigation measures have taken effect as described in the preceding sections. These are discussed below in terms of the construction and operational phases.

8.8.1 Construction Phase

The implementation of mitigation measures highlighted above will significantly reduce the likelihood and magnitude of the potential effects on land and soils occurring during the construction phase. The magnitude of the potential residual effects during construction phase is therefore considered to be low on an environment of low/medium significance/sensitivity, therefore the significance of the potential effect of the Proposed Road Development is considered to be slight (short term and long term) on the surrounding land and hydrogeological environment.

8.8.2 Operational Phase

There are no likely significant permanent geological or hydrogeological effects associated with the Proposed Road Development.

The embedded control measures outlined in Chapter 4 (Description of the Proposed Road Development) will significantly reduce the likelihood and magnitude of the potential effects on land and soils occurring during the operational phase.

8.9 Difficulties Encountered

No major difficulties were encountered while undertaking this assessment.

8.10 References

- Boliden. (2018). *Boliden Tara*. Accessed 20 August 2018 [https://www.boliden.com/operations/mines/boliden-tara/]
- Department of the Environment, Heritage and Local Government. (2006). *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- EPA. (2002). *EPA Guidelines on the information to be contained in Environmental Impact Statements*, EPA, Wexford, Ireland.
- EPA. (2003.) *EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements*, EPA, Wexford, Ireland.
- EPA. (2017). *EPA Guidelines on the information to be contained in Environmental Assessment Reports, Draft, August 2017*, EPA, Wexford, Ireland.
- EPA. (2018). *EPA Maps*. Accessed 20 August 2018 [https://gis.epa.ie/EPAMaps/].
- European Council, 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 Text with EEA relevance.
- Geological Survey of Ireland, 2018, *Geological Survey Ireland Spatial Resources*. Accessed 20 August 2018 [http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228]
- IGI, 2013, *Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements*, Institute of Geologists of Ireland, Dublin.
- National Standards Authority of Ireland. (2005a). IS EN 1997-1:2005 Eurocode 7. *Geotechnical design - Part 1 General rules*
- National Standards Authority of Ireland. (2005b). NA to IS EN 1997-1:2005. Irish National Annex to Eurocode 7: *Geotechnical design - Part 1 General rules*
- National Standards Authority of Ireland. (2007). IS EN 1997-2. 2007. Eurocode 7. *Geotechnical design - Part 2 Ground investigation and testing*

- NPWS. (2018). *National Parks and Wildlife Services Map Viewer*. National Parks and Wildlife Service. Accessed 20 August 2018 [http://webgis.npws.ie/npwsviewer/]
- NRA. (2008). *Environmental Impact Assessment of National Road Schemes – A Practical Guide*, National Roads Authority, Dublin, Ireland.
- NRA. (2008). *Guidelines of Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*, Dublin, Ireland.
- OPW. (2018). *Flood Maps*. Office of Public Works. Accessed 20 August 2018 [http://www.floodinfo.ie/map/floodmaps/]
- OSI. (2017). *GeoHive.* Ordnance Survey of Ireland. Accessed 20 August 2018 [http://map.geohive.ie/mapviewer.html]
- Topographic Map, 2018, *Topographic Map*. Accessed 20 August 2018 [http://en-ie.topographic-map.com]

Chapter 09: Water

09

9. Water

9.1 Introduction

This chapter of the EIAR has been prepared to assess potentially significant effects upon the water environment as a result of constructing and operating the Proposed Road Development.

Essentially, the assessment considers the potential for non-conformance with the EU WFD (European Council, 2000) objectives including:

- The need for the avoidance and reduction of effects on the water environment to be taken fully into account in the environmental evaluation; and
- The selection of appropriate means of preventing any significant predicted effect is being 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.

It describes water, hydrology and flooding issues associated with the Proposed Road Development and should be read in conjunction with Chapter 7 (Biodiversity) and Chapter 8 (Land and Soils), which pay particular attention to the potential for impacts upon the aquatic/riparian and hydrogeological environments respectively.

9.2 Methodology

This assessment meets the requirements for an EIAR as outlined in the relevant National and EU legislation. This chapter has been prepared in accordance with the EPA Draft guidance document EPA's '*Guidelines on the Information to be Contained in Environmental Impact Assessment Reports*' (2017), EPA's guidance documents '*Guidelines on the Information to be Contained in Environmental Impact Statements'* (2002), EPA's '*Advice Notes on Current Practice in the Preparation of Environmental Impact Statements*' (2003).

9.2.1 Sources of Information

This assessment has been prepared from both a desktop review of existing information and a site-specific investigation. The following is a list of sources of information consulted for use in this chapter:

- OPW national flood hazard mapping (www.floodmaps.ie);
- OPW CFRAM Study (www.cfram.ie);
- EPA (www.epa.ie);
- GSI (www.gsi.ie);
- IGSL 2019 Ground Investigation Report (Appendix A8-1; Volume 4); and
- FRA Report (Appendix A8-2; Volume 4).

9.2.2 Appraisals Methodology

The appraisal methodology considered a description of the impact i.e. the "quality" of the effects (i.e. whether it is adverse or beneficial), the "significance" of the effects (i.e. the magnitude of the effect in terms of the environment), the "probability" of the event occurring, and the "duration" of the effects (i.e. whether it is short or long term) and also considers the significance/sensitivity of the existing environment. Terminology for describing the quality, significance, extent, probability and duration of effects is set out in Section 3.7.3 of the 2017 EPA EIAR guidance (EPA, 2017).

A qualitative approach was used in this evaluation and Figure 9-1 taken from the EPA EIAR guidance shows how comparison of the character of the predicted impact to the sensitivity of the receiving environment can determine the significance of the effect.

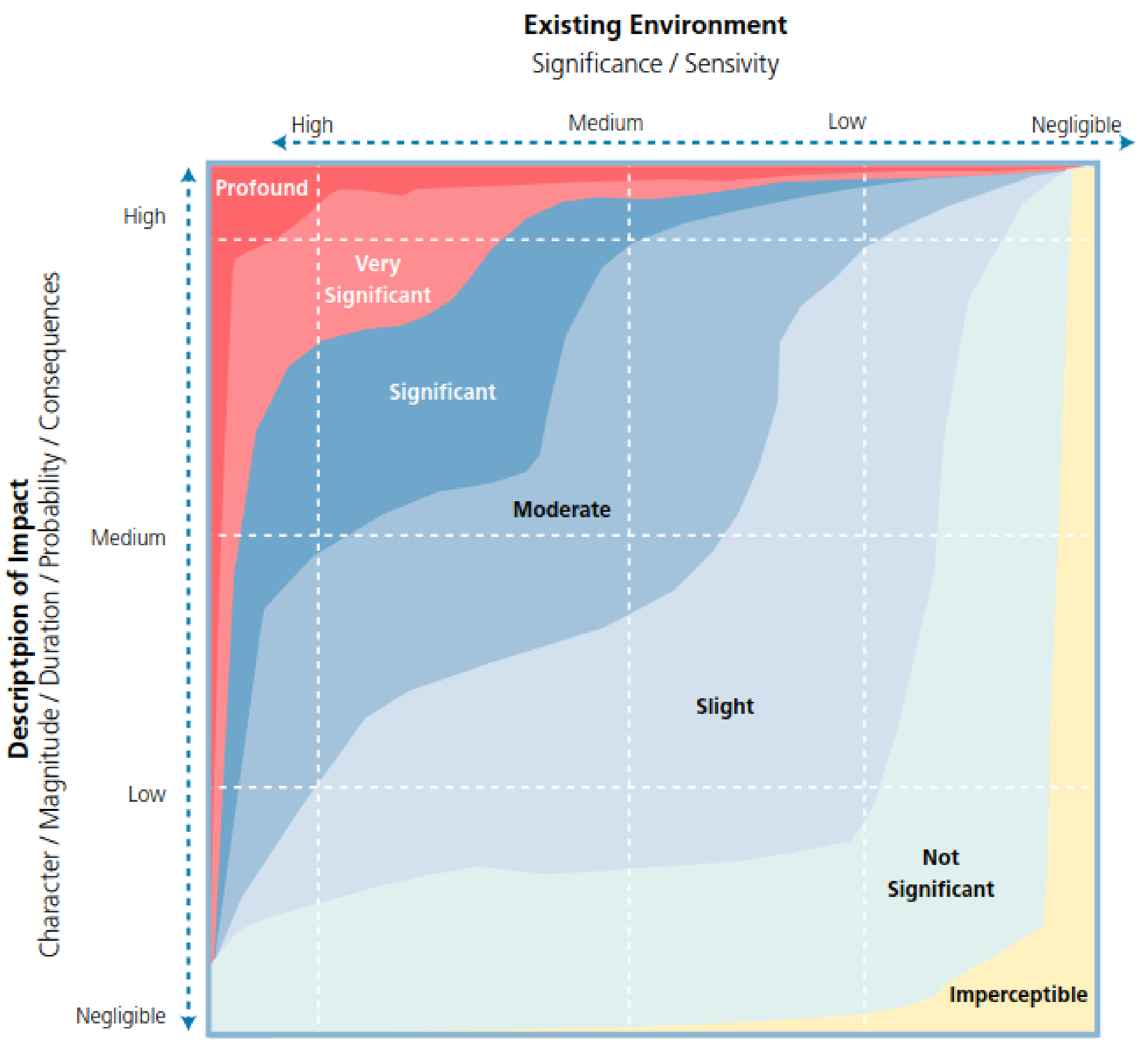


Figure 9-1 Determination of the Significance of the Effect (EPA, 2017)

Table 9-1 Describing the Significance of Effects

Significance Level	Description
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.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound Effects	An effect which obliterates sensitive characteristics

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

9.2.2.1 Limitations in the Methodology and Gaps in Information

There were no significant gaps in the desk top data available at the time. There were no limitations to access during the site walkover survey on 16 August 2018 and all areas where access was required was possible.

9.3 Characteristics of the Proposed Road Development

The Proposed Road Development comprises a c. 1.15 km local distributor road consisting of an urban Arterial Street, incorporating both footpath and cycle path provisions.

The southern section of the Proposed Road Development site contains the River Blackwater and continuing to the south the scheme meets the N51/R147 Kells Road, which is lined by both residential and commercial properties. The River Blackwater is in a SAC and SPA.

The Proposed Road Development includes an embankment road section either side of a new bridge crossing over the River Blackwater in order to address road gradient and levels. To achieve the required engineering design, the Proposed Road Development will consist of approximately 20% at grade, 20% cut and 60% formed along raised embankments either side of the bridge river crossing. A culvert over an existing stream/field ditch will also be required in the northern portion of the scheme. There will be a new interchange/connection at both the northern and southern extents of the Proposed Road Development with the existing road network.

The Proposed Road Development will provide road surface water runoff collection and treatment facilities so that rainfall from all paved areas is effectively removed from the road surface and treated before discharge to the existing water environment. This includes the provision for cut-off and storage in the event of a road accident causing spillage of deleterious materials.

An illustration of the Proposed Road Development Plan and Profile is presented in Figure 4.5 to 4.7 inclusive contained in Volume 3 of this EIAR. A detailed description of the Proposed Road Development can be found in Chapter 4 (Description of the Proposed Road Development).

9.3.1 Construction Activities

The overall construction duration of the Proposed Road Development will be approximately 15 – 18 months. The earthworks construction will involve the excavation and placement of materials for the construction of embankments as well as the hauling and importation of materials to complete the sub-formation and road formation. The construction of the structures will involve the delivery of fill materials. The civil works of relevance to the water environment include the following activities:

- Preliminary works, including clearance, levelling, site roads/pedestrian access and establishment of lay-down and fabrication area;
- Construction of bridge and abutment structures;
- Drainage works - the installation of pipes, culverts, surface water channels, filter drains, ditches and attenuation systems; and
- Landscaping and reinstatement.

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

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

9.3.2 Operational Activities

There will be surface water runoff discharge, via a sealed system of gullies and kerb drains, feeding into downstream attenuation systems. The proposed road drainage system will be divided into three separate networks, A, B and C. Network A (chainage 0+000 – 0+225) will service the northern portion of the Proposed Road

Development. This section will connect into an existing Surface Water Outfall via a petrol interceptor and storage tank.

Network B (chainage 0+225 – 0+900) will service the central portion of the Proposed Road Development. This section will discharge first via a petrol interceptor into a lined attenuation pond on the western side of the mainline at approximately Ch.0+800. The attenuation pond will discharge to the northern bank of the River Blackwater via a vegetated interceptor ditch.

Network C (chainage 0+900 – 1+150) will service the southern portion of the Proposed Road Development. Runoff from this section will flow via a petrol interceptor into an attenuation tank. A vegetated interceptor ditch will be constructed at the tank outlet, upstream of the River Blackwater.

All tanks and the attenuation pond will be fitted with a flow control device and shut off valve. Flows will be attenuated prior to discharge to the receiving watercourse so that the post development peak flow rate is not greater than the original greenfield runoff rate (2.3 l/sec/ha). The attenuation systems will be designed to accommodate a 1 in 100-year event plus 20% for climate change without increasing the discharge rate to the receiving watercourse.

During the operation of the Proposed Road Development the tanks, attenuation pond and interceptors will be maintained by the Local Authority.

There will be no significant storage or use of hazardous / water polluting materials during the operational phase of the Proposed Road Development.

During operation the road will have an expected traffic volume of 3,138 vehicle movements northbound and 2,841 vehicle movements south bound in 2022 (AADT, see Chapter 5). Any fuel loss from accidental spills should they occur on the Proposed Road Development will be diverted to the closed drainage system detailed above. A shut-down valve at the outlet to each outfall will allow any potential spillage to be accommodated within the attenuation system.

9.4 Description of the Existing Environment

9.4.1 Site Area Description

The Proposed Road Development will connect the N51/R147 Kells Road to the L3409 Ratholdron Road through Abbeyland. The location is characterised by the presence of agricultural land with some wooded areas in the section north of the River Blackwater, which runs to the west of Blackwater Park. The southern section of the Proposed Road Development site contains the River Blackwater and continuing to the south then meets the N51/R147 Kells Road replacing a disused OPW building. Kells Road is lined by both residential and commercial properties. See Figure 4.5 to 4.7 inclusive contained in Volume 3 of this EIAR.

The Proposed Road Development site encompasses an area of maintained woodland in the northern portion. The route then crosses one ditch (orientated northwest to southeast) which runs along a field boundary to the west of a playground at Blackwater Park and crosses both agricultural land and parkland. A small copse with steep slopes is located immediately north of the River Blackwater which corresponds with the location of a small quarry which can be seen on historical maps. From this point, lands slope notably downwards to the River Blackwater. To the south of the river, land rises again to the south. The Proposed Road Development runs across OPW lands, which comprise a small area of rough vegetated ground, raised by approximately 1 m above surrounding lands, to the north of a tarmac car park and a disused building with an access lane to the west. A row of residential properties are located immediately west of the OPW site with gardens to the rear (north) and an area of undeveloped low lying ground north of the gardens towards the River Blackwater.

9.4.2 Topography

The land upon which the northern portion of the Proposed Road Development site is situated on slopes gently downwards to the south, the southern half of the Proposed Road Development site is characterised by more notable downward slopes towards the River Blackwater from the south and the north. According to the large-scale topographical map, ground elevation at River Blackwater is approximately 35 m OD. Moving north and south away from the river, the ground slopes upwards to an elevation of approximately 45 m OD at the southern site boundary and 48 m OD at the northern Proposed Road Development site boundary.

Lands to the west and east of the site are at a similar elevation to the site. Higher elevations (above 54 m OD) are noted to the north / northeast and to the southwest as distance increase away from the River Blackwater.

9.4.3 Drainage and Natural Surface Water Bodies

The locations of the local watercourses are shown in Figure 4.5 to 4.7 inclusive contained in Volume 3 of this EIAR.

9.4.3.1 Regional Hydrology

The River Boyne is the principal surface water body in the area. At its closest point, it is located approximately 1km east of the Proposed Road Development where it meets with the River Blackwater.

Regionally, the Proposed Road Development site lies within the Boyne hydrometric area and WFD catchment (hydrometric area 07 and WFD catchment 07). The Proposed Road Development site lies within the Boyne sub catchment (Boyne_SC_100) of the Blackwater (Kells) WFD River Sub Basin (Blackwater (Kells)_120).

The River Blackwater originates to the north of Lough Ramor, in County Cavan, flowing to the southeast through the Lough and onwards to the Proposed Road Development site and Navan to join the River Boyne, which flows northeast from Carbury in County Kildare to Navan and onwards to Drogheda to discharge into the Irish Sea.

9.4.3.2 Local Hydrology

The River Blackwater flows from east to west through the southern portion of the Proposed Road Development site. In the northwest, a drainage ditch was identified (orientated northwest to southeast) which runs along a field boundary to the west of the playground at Blackwater Park. The ditch was observed to be approximately 3 to 4 m to the water surface and approximately 3 m wide at the point where the Proposed Road Development would cross it. Water with no discernible flow was observed in the base of the ditch. It was not possible to determine the depth of water within the ditch at the time of the site walkover due to heavy vegetation and unsafe access at the time. Shallower, dry ditches were observed along the western boundary of Blackwater Park.

There is the potential for buried field drains to be present within the agricultural lands and Blackwater Park. Lands to the south and north of the River Blackwater slope notably downward towards the river, indicating that surface run-off currently enters the river either directly or via field drains / ditches.

A stream originates c. 180 m west of the Proposed Road Development site, flowing southwest to merge with River Blackwater c. 60 0 m to the west. Several tailing ponds associated with Tara Mines are located in the vicinity of the Proposed Road Development site, the closest of which located c. 440 m to the southwest.

9.4.3.3 Flood Risk

Fluvial flooding data from the OPW CFRAM provide an indication of areas that may be prone to flooding. Floodplain locations relative to the Proposed Road Development site are presented in Table 9-3.

Table 9-2 Flood plain locations

Event probability	Location	Extent
1% AEP	Low lying areas to the north and south of the River Blackwater	Approximately 40m north of the river and 10m south of the river at the proposed crossing point. The 1% AEP flood plain extends further to the north of the river across lands to the west of the Proposed Road Development.
	Field drain orientated northwest to southeast which will be intersected by Proposed Road Development	The 1% AEP flood plain extends along the drain, to within 40m of the Blackwater Park boundary.
	Proposed junction with Ratholdron Road	Discrete linear areas along an east to west access lane which intersects with Ratholdron Road at the proposed junction location are within the 1% AEP flood plain.
0.1% AEP	Low lying areas to the north and south of the River Blackwater	The 0.1% AEP flood plain extends approximately 50m north of the river and 20m south of the river at the proposed crossing point.
	Field drain orientated northwest to southeast which will be intersected by Proposed Road Development	The 0.1% AEP flood plain extends along the full length of the drain and along the boundary of Blackwater Park.

	Proposed junction with Ratholdron Road	The proposed junction and surrounding areas to the northeast and southwest are within the 0.1% AEP flood plain.

One flooding event at the Proposed Road Development site is recorded on the OPW CFRAM database. The recorded event occurred in November 2000, when the River Blackwater burst its banks due to high winds and heavy rain.

Onsite observations confirmed that the lands immediately adjacent to the 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 7 (Biodiversity).

9.4.4 Water Quality

The river has a WFD Status of 'moderate', with the general conditions having a 'pass' status. However, the river is deemed 'at risk' (IE_EA_07B011800) by the EPA. The Proposed Road Development site is underlain by two groundwater bodies (Wilkinstown and Trim). Both groundwater bodies are classed as 'at risk' according to the EPA online map viewer, however classed as 'good' under WFD Status 2010 – 2015.

According to the EPA online map viewer, a national water monitoring station (RS07B011700 - BLACKWATER (KELLS) - Railway Br Nevinstown) is located c. 300 m west of the Proposed Road Development site. A second monitoring station is located downstream, (RS07B011790 - 100m d/s New Bypass Br) approximately 740 m east from the Proposed Road Development site.

Records consulted as part of this assessment do not indicate any discharge licences issued under Section 4 of the Local Government (Water Pollution) Act 1977, as amended in 1990, in respect of the discharge of trade effluent and / or sewage effluent to surface water or groundwater in the vicinity of the Proposed Road Development site.

While the River Blackwater is not listed as being protected under European Salmonid Waters, c. 1 km east of the Proposed Road Development site, the River Blackwater flows into the River Boyne which is a protected river under European Salmonid Waters.

9.4.5 Designated Sites

The closest Ecological Protected Sites are the River Blackwater and River Boyne SAC, flowing west to east through the southern portion of the Proposed Road Development site. Features of interest include: Alkaline fens, Alluvial forests with *Alnus glutinosa* and *Fraxinus excelsior* (*Alno-Padion*, *Alnion incanae*, *Salicion albae*), *Lampetra fluviatilis* (River Lamprey), *Salmo salar* (Salmon) and *Lutra lutra* (Otter). River Blackwater and River Boyne is also a SPA, with *Alcedo atthis* (Kingfisher) being the feature of interest. These are discussed further in Chapter 7 (Biodiversity) of this EIAR.

There are no surrounding pNHA, nature reserves or national parks within 1 km of the Proposed Road Development site.

9.4.6 Ground Investigation Results

A geotechnical investigation for the site was scoped, specified and supervised by AECOM, and conducted by IGSL Ltd (Appendix A8-1; Volume 4). The Site Operations of the investigation were performed during the period 09 July to 30 July 2019.

The investigations were conducted in accordance with the *Specification and related documents for ground investigation in Ireland* (Engineers Ireland, 2016). In addition, they complied with the requirements of Eurocode 7 (National Standards Authority of Ireland, 2005a, 2005b and 2007).

The exploratory holes of the investigations comprised:

1. Eight boreholes (BH01 to BH08) advanced, in 200 mm diameter, by Dando 2000 cable percussion boring rigs, to between 1.3 and 6.4 m below ground level. They were terminated with refusal to progress through very stiff/hard glacial clay, dense gravels or on an obstruction.
2. SPT were carried out at 1 m intervals. Small and bulk disturbed samples were also taken within the soil strata.

3. Rotary drilled boreholes put down from ground level adjacent to three of the cable percussion boreholes. The rotary boreholes were numbered similarly to the cable percussion holes with prefix “RC”. Drilling employed a Knebel truck-mounted rig using:
   - rotary coring of firm to very stiff clay, using a Geobor-S geotechnical core barrel, producing nominal 102 mm diameter cores. It is considered a Category A sampling method, capable of producing Class 1 samples suitable for laboratory testing to determine compressibility and shear strength (National Standards Authority of Ireland, 2007).
   - Rotary coring of very strong to strong Limestone to confirm bedrock and obtain samples for geotechnical testing
4. Ten trial pits (TP01 to TP10) excavated to between 1.6 and 4.5 m below ground level. Representative bulk disturbed samples were taken of the soil strata encountered. Where possible hand shear vanes were obtained within the trial pit walls. The trial pits were accompanied by DCPs.

9.4.6.1 Superficial deposits

Based on the results of the site investigations the superficial deposits along the route can be summarised as follows:

- Made Ground (MG);
- Topsoil (TS);
- Alluvium (ALV);
- Glacial Till (GF & GC)

9.4.6.2 Made Ground

Made ground was encountered in BH08, TP01, TP09, and TP10, ranging from 0.5 to 1.3 m below ground level.

TP01 is located at the northern extent of the scheme, while the remaining made ground was encountered in the OPW lands to the south of the River Blackwater.

The thickest extents of made ground (1.1 m and 1.4 m respectively) were encountered in TP09 and TP10 to the south of the River Blackwater.

9.4.6.3 Topsoil

Topsoil was encountered in all trial pits with a recorded thickness ranging from 0.15 and 0.4 m.

9.4.6.4 Alluvium

Alluvium deposits were encountered in BH03, BH04, and BH07 with a recorded thickness of between 0.4 and 3 m. These boreholes were located within the floodplain. The alluvium generally consisted of very soft dark brown sandy SILT/CLAY with some gravel. SPT blow counts ranged from 2 to 7 blows per 300 mm.

9.4.6.5 Glacial Deposits

Glacial deposits are widespread throughout the route. The constituent parts and matrix proportions of these deposits vary considerably. For engineering purposes these deposits are divided into Glacial Till fine-grained and Glacial Till coarse-grained in accordance with BS5930 which defines fine grained soils as containing more than 35% fines passing the 63 micron sieve size.

The fine-grained glacial deposits range from soft slight sandy SILTS to firm to stiff sandy gravelly Clays/Silts. Fine-grained glacial deposits were encountered in all boreholes apart from BH03 and BH07 which encountered shallow Limestone bedrock. SPT blow counts ranged from 10 to in excess of 50 blows per 300 mm.

The largest extent of Glacial Till extended from 1.0 m bgl to termination at 22.5 m (bgl) in RC04. The Glacial Till is generally slightly sandy slightly gravelly CLAY with more gravelly layers at depth. No rock was proven within this borehole.

A coarse grained deposit of sandy silty Gravel with cobbles and boulders was generally encountered within several trial pits at depths of approximately 3.6 to 4.6 m bgl. This deposit was encountered at 0.9 m bgl in TP08. Where encountered in boreholes, there was refusal within this layer. This granular layer was approximately 4 m thick in RC04. SPT blow counts ranged from 45 to in excess of 50 blows per 300 mm.

The online Groundwater Public Viewer of the GSI indicates that the Glacial Tills encountered to the north of the river are generally derived from sandstone and shales. The Glaciofluvial sand and gravels adjacent to the river and Glacial Tills to the south of the river are derived from Limestones.

9.4.6.6 Bedrock

Strong to medium strong limestone bedrock was encountered to the north of the river in RC03 and RC07 at 1.7 m bgl and 1.5 m bgl and is consistent with the GSI online viewer.

No bedrock was encountered to the south of the river in RC04 at a depth of 22.5 m bgl.

9.4.7 Summary of Baseline Conditions

In line with EPA EIAR guidance, a summary of the existing environment baseline conditions at the Proposed Road Development site is presented in Table 9-3.

Table 9-3 Summary of Baseline Conditions

Item	Description
Context	The Proposed Road Development Site comprises primarily greenfield / agricultural lands with a wooded area in the north and a disused OPW building in the south. The route crosses both the River Blackwater between chainage 900 and 950 and a ditch which follows a field boundary between chainage 200 and 250. Shallow dry ditches are present along the western boundary of Blackwater Park and there remains the possibility for buried field drains to be present in the area. Regionally, the Proposed Road Development Site lies within the Boyne hydrometric area and WFD catchment (hydrometric area 07 and WFD catchment 07). The Proposed Road Development Site lies within the Boyne sub catchment (Boyne_SC_100) of the Blackwater (Kells) WFD River Sub Basin (Blackwater (Kells)_120). The River Blackwater originates to the north of Lough Ramor, in County Cavan, flowing to the southeast through the Lough and onwards to the Proposed Road Development Site and Navan to join the River Boyne, which flows northeast from Carbury in County Kildare to Navan and onwards to Drogheda to discharge into the Irish Sea.
Character	Lands to the south and north of the River Blackwater slope notably downward towards the river, indicating that surface run-off currently enters the river directly or via field drains / ditches. Lands immediately adjacent to the River Blackwater, and along the drainage ditch in the northwest of the Proposed Road Development Site, are noted to be within the 1% AEP and 0.1% AEP flood plains. The River Blackwater is identified on the EPA map viewer as a drinking water river in accordance with European Communities (Drinking Water) (No. 2) Regulations 207 (SI no. 278/2007); however it is unlikely that there are abstractions downstream of the Proposed Road Development as the river enters the urban area of Navan. The river has a WFD Status of ‘moderate’, with the general conditions having a ‘pass’ status. However, the river is deemed ‘at risk’ (IE_EA_07B011800) by the EPA. The River Blackwater and River Boyne SAC and SPA partially lie within the Proposed Road Development Site.
Significance	The majority of the Proposed Road Development Site consists primarily of agricultural land / parkland on the periphery of Navan town centre. The River Blackwater and River Boyne SAC and SPA partially lie within the Proposed Road Development Site as the River Blackwater flows from west to east through the southern portion. This area of the Proposed Road Development Site is protected under the designation of SAC and SPA and could be described as designated. This aspect is assessed in more detail in Chapter 7 (Biodiversity) of this EIAR.
Sensitivity	The water environment can be considered HIGH sensitivity.

9.5 Assessment of Impacts

The Proposed Road Development could have several potential impacts on the drainage regime and hydrology of the surrounding area during both the construction and operational phases as outlined below.

The existing surface water environment is considered to be an environment of high significance/sensitivity given the designation of the River Blackwater within a SAC and SPA at the Proposed Road Development site. Water quality in the River Blackwater is classified as ‘moderate’, with the general conditions having a ‘pass’ status.

9.5.1 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.

9.5.2 Construction Phase

The risk of potential significant effects occurring during the construction phase (in the absence of adequate management and mitigation measures) can arise from several activities. These typically would include:

- Polluted drainage and discharges from 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;
  - 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;
- Works within water; and
- Outfall points.

During construction, pollution from mobilised suspended solids would 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.

Sedimentation (Suspended Solids)

Various construction activities have the potential to release sediment and cause unacceptable sediment levels in the catchment area. Site stripping and bulk earthworks would 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 may also be caused by runoff from material stockpiles.

Runoff containing large amounts of suspended solids could potentially adversely impact on surface water. The impact is considered a direct effect of a negative nature and temporary duration given it is only associated with the construction programme. Runoff containing large amounts of suspended solids is considered unlikely to occur and should it occur is likely to be temporary. Therefore, it is considered to be a medium effect to an environment of high sensitivity/significance and the significance of the effect is significant**.**

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 may 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 is considered a direct effect of negative nature and temporary duration given it is only associated with the construction programme. Accidental spillages and leaks are considered unlikely to occur and should they occur are likely to be temporary. Therefore, it is considered to be a medium effect to an environment of high significance/sensitivity and the significance of the effect is significant**.**

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 is considered a direct effect of a negative nature and of a temporary duration given it is only 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 medium effect to an environment of high significance/sensitivity and the significance of the effect is significant.

Bridge Construction

Construction activities within or adjacent to the River Blackwater could form an impediment to flow therefore altering the existing floodplain, affect water quality and damage the river bed and bank morphology. Erosion and deposition rates could also be altered in the vicinity of the works and further downstream. Disturbance of the river bed could increase the amount of suspended solids in the water body. The results of the hydraulic modelling displayed a maximum increase of 0.008 m in the water level immediately upstream for all bridge options and no change was indicated in the water level immediately downstream of the proposed bridge for a 1% AEP event. It was concluded from the results of the hydraulic modelling that the development of the bridge would have limited impact on the flow and water levels.

The potential impact to the water environment is therefore considered to be a low effect to a high significance/sensitivity environment and the significance of the effect is moderate.

Culverting and Drainage Works

A single culvert is proposed at chainage 0+225. The construction of culverts has the potential to impact surface waters by reducing the interaction with shallow groundwater, increasing flow rates in straight channels and introduction of potential pollutants during construction, such as temporarily altering pH.

Construction works have the potential to impact on unknown field drains should they be encountered. The disruption of surface water or shallow groundwater drainage through these field drains could result in increased temporary ponding or flooding during heavy rain.

It is therefore considered that the general construction phase works will pose a medium effect to a low significance/sensitivity environment (land drains) and the significance of the effect is slight. Additional specific mitigation measures are therefore not required.

Foul Sewer

Foul sewage arising from temporary toilets and sanitary facilities on the Proposed Road Development site will initially be discharged to an on-site 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 on-site 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 a high significance/sensitivity environment and the significance of the effect is not significant. Additional specific mitigation measures are therefore not required to address foul sewage during the construction phase and are not discussed further in following sections.

9.5.3 Operational Phase

The potential adverse impacts during the operational phase, in the absence of adequate management and mitigation measures are as follows:

- Potential alteration of flooding risk;
- Siltation of storm water drainage system and attenuation pond/tanks; and
- Infiltration of contaminated groundwater into surface water network.

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 4 (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 a surface water siltation and attenuation pond/tanks before entering the River Blackwater.

In addition to this, the outlet of the attenuation pond/tanks will be fitted with a shut-down facility so that, in the event of a catastrophic spill, the spillage would be contained within the attenuation pond/tanks to be removed by tanker.

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 would be temporary in nature. Therefore, it is considered to be a low effect on a low/medium significance/sensitivity environment and the significance of the effect is slight. Specific mitigation measures are therefore not required.

Flooding and Drainage

The support abutment of proposed bridge is located within the flood plain. Hydraulic modelling carried out for this option demonstrated there is limited potential to impact on the flood regime of the River Blackwater, thus flood storage and the morphology of the river channel will not be impacted. There is the potential for point loading and localised increased flows in the River Blackwater at discharge points from the drainage network. However, the attenuation pond/tanks 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 would also assist in the prevention of bank erosion within the channel, lowering sediment release and the subsequent potential for adverse impact on the fish population. The attenuation pond/tanks 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. The attenuation pond/tanks will be designed to facilitate a 1-in-100 year flood event plus a 20% allowance for climate change. A regular drainage maintenance regime will be implemented by MCC.

Routine road runoff from the operation of the Proposed Road Development has the potential to impact water quality in receiving watercourses due to the presence of a range of contaminants, typically including heavy metals, hydrocarbons, suspended solids and de-icing agents. However, as mentioned above, potential contaminated runoff 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 a surface water siltation and attenuation pond/tanks before entering the River Blackwater.

To minimise sediment build up within the storm water drainage network, trapped inlets will be used at all points of entry and key manholes will have sumps to collect material.

Impacts from flooding and drainage are therefore considered to be unlikely, arising from rare events resulting in a low effect on an environment of high significance/sensitivity and the significance of the effect is slight. Specific mitigation measures are therefore not required.

9.6 Mitigation and Monitoring Measures

The following mitigation measures have been proposed for the construction and operational phase:

9.6.1 Construction Phase

9.6.1.1 Construction Environmental Management Plan

A CEMP will be prepared for the Proposed Road Development which incorporates relevant environmental avoidance or mitigation measures to reduce potential environmental impact. Prior to construction, the contractor will further refine and develop the CEMP into a detailed site-specific CEMP. 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[47] 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.

Works will be undertaken in accordance with the following guidance for construction work on, over or near water:

[47] 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

- CIRIA C532 Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors; and
- CIRIA C648 Control of Water Pollution from Linear Construction Projects.

9.6.1.2 Sedimentation (Suspended Solids)

During the construction phase, the mitigation measures will ensure that no sediment contamination, contaminated runoff or untreated wastewater will enter watercourses on or near the Proposed Road Development Site.

Drainage channels and streams will be clearly identified on site and shown on method statements and site plans. Construction compounds will be located at a minimum distance of 25m from watercourses and out of the 1% AEP floodplain.

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.

During the construction activities there will be a requirement for diverting rain water 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 River Blackwater will be put in place by the contractor during construction activity on 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 dewatering water and groundwater 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. Runoff from spoil heaps will be prevented from entering watercourses by diverting it through on-site settlement ponds and removing material as soon as possible to designated storage areas.

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 should 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.

9.6.1.3 Accidental Spillages 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:

- A construction compound will be required along or in the vicinity of the Proposed Road Development. It was proposed that the primary construction compound would be located in the land located to the south-west of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. An alternative and secondary compound is proposed to the north of the existing N51/R147 roundabout on the land currently occupied by a commercial building to be demolished.
- 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

- 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 or valve will be locked shut when not in use. Each bowser will carry a spill kit and each bowser operator will have spill response training.

9.6.2 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.

There will be no direct discharges to surface waters during the operational phase.

Although no significant adverse effects were identified, the following mitigation measures are proposed:

9.6.2.1 Surface Water/Storm Water Drainage

The attenuation pond will be lined and the surface water drainage network sealed in order to prevent infiltration of contaminated groundwater into surface water network. Solids removal is one of the main features of attenuation ponds, and high removal rates are possible. Nutrient and trace metals removal is more modest with potential uptake by some of the vegetation species within the pond.

A regular maintenance regime, including monitoring, will be put in place to remove any excess build-up of material. MCC will be responsible for the maintenance of the drainage network during the operational phase.

9.7 Cumulative Impacts

The cumulative impacts of the Proposed Road Development with consented projects in its vicinity are discussed below.

A planning search of granted and pending planning applications made within the vicinity of the site (200 m of the Proposed Road Development site boundary) within the last four years is presented in Chapter 6 (Population and Human Health).

The following eight planning applications were recorded in Chapter 6 (Population and Human Health); they are generally related to the redevelopment of existing commercial premises as ongoing commercial premises with the exception of the first two which relate to medium and small housing developments (see Chapter 6).

Table 9-4 Summary of Planning Application Review

Planning Reference Number	Development Address	Brief Development Description	Grant Date
NA151301	Moathill, Navan, Co. Meath	The proposed development will consist of 99 no. residential units comprising 32 no. duplex/apartments and 67 no. 2 storey detached and semi-detached houses. The development will also include, a 2 storey crèche with play area, bin shelters, bicycle parking and car parking spaces, 2 no. landscaped public open spaces, a footpath and cycleway along the N51 National Road, a new vehicular access from the N51 National Road and associated revised junction layout, and all associated site and drainage works.	June 2016
NA161020	Ratholdron Old, Abbeyland, Navan Co. Meath	Construction of 6 no. dwelling houses consisting of 3 no. semi-detached blocks, connection to public water main, public sewer and associated site development and ancillary works including development of a vehicular entrance and service road, open space provision, all landscaping works, site boundary treatment and associated drainage works. Significant further information/revised plans submitted on this application	April 2017
NA160363	Windtown, Navan, Co. Meath	The proposed development will consist of a new single storey support services building with car parking, connect to existing entrance to public road and connect to existing mains water, mains sewerage and surface water with ancillary site works.	July 2016
NA150427	Blackwater Retail Park,	The proposed development will consist of the construction of a single storey Coffee Shop and a single storey Drive Thru Restaurant including	August 2015

Planning Reference Number	Development Address	Brief Development Description	Grant Date
	Navan, Co. Meath	associated Drive Thru Lane, external yard and bin store. The proposed development also includes signage on the elevations of the building, external seating areas, minor alterations to the existing carpark, alterations to the eastern boundary and all ancillary site development site services and hard and soft landscaping works.	
NA140992	St. Patrick's Classical School, Moatlands (Kells Road), Navan Co. Meath.	The development will consist of the demolition of part of existing structure and construction of a fully serviced single storey extension to the existing school containing 1 no. woodwork room together with ancillary stores, plant, circulation space and associated works	February 2015
NA140993	St. Patrick's Classical School, Moatlands (Kells Road), Navan Co. Meath	The development will consist of the demolition of part of existing structure and construction of a fully serviced 2 storey extension to the existing school containing 1 no. music/drama room and 1 no. science laboratory and preparation room together with ancillary stairs, stores, circulation spaces and associated works	February 2015
NA180163	Balmoral Estate, Kells Road Navan, Co. Meath	The upgrading, reconfiguration and change of use of existing car showroom and retail units to provide for 2 no. car showrooms (781 sq.m), workshop (563 sq.m.), parts store (150 sq.m.) and ancillary staff facilities and public toilet (109 sq.m.) The proposed development will also include: 2 no. free standing double sided signs, upgrades to the existing signage and shopfronts including new glazing and cladding, reconfiguration of the existing car park and yard to provide for 92 no. car parking spaces, concrete paved forecourt area and reconfiguration of internal road. The proposed development includes all engineering works, landscaping works, boundary treatments and site development works on the approx. 0.70 hectare site.	
NA171476	Balmoral Estate, Kells Road, Navan Co. Meath	Demolition of existing single and two storey warehouse buildings; Construction of a 6 no. storey mixed use building over basemen: Provision of a discount food store at ground floor level to include all ancillary areas; provision of a 135 sq.m retail unit at first floor level (south) and c. 5,412 sq.m of office/medical floor space from first to fifth floors; landscaped surface car park (90 no. car parking spaces, 70 no. bicycle parking spaces, goods delivery/reception area; provision of a basement car park to serve the medical/office uses; reconfiguration of internal road and provision of ramp to basement of proposed development; Upgrades to the existing footpath along Kells Road and provision of a landscape plaza area at the junction of the Kells Road and the existing access road to Balmoral Industrial Estate; provision of 7 sq. m of illuminated signage located on the northern and eastern elevation; all associated and ancillary site development and landscaping works.	
NA171232	Nevinstown, Navan, Co. Meath	The development of the resumption of underground mining in the Nevinstown orebody. Previously planning permission was granted by An Bord Pleanála, ref PL17.204034. Mining will follow a cyclic pattern resulting in the removal of underground ore, hoisting to surface for processing followed by the filling of the extraction voids using cemented backfill. The surface characteristics and features of the Nevinstown townland will not be altered by mining activity. There will be no additional above ground structure/infrastructure associated with the development.	October 2018

Source: Chapter 6 (Population and Human Health) of the EIAR <www.myplan.ie>

Following a review of the above proposed and consented projects and based on the drainage network A, B & C design parameters that will limit the discharge rates at or close to greenfield discharge rates, there were no cumulative effects on the water environment as a result of the Proposed Road Development identified.

9.8 Residual Impacts

Residual impacts are those that will occur after the proposed mitigation measures have taken effect as described in the preceding sections. These are discussed below in terms of the construction and operational phases.

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 occurring during the construction phase. The magnitude of the potential residual effects during construction phase is therefore considered to be low on an environment of high significance/sensitivity, therefore the significance of the potential effect of the Proposed Road Development is considered to be slight (short term and long term) on the surrounding water environment.

9.8.2 Operational Phase

There are no likely significant permanent water effects associated with the Proposed Road Development.

Embedded control measures outlined in Chapter 4 (Description of the Proposed Road Development) and mitigation measures outlined in Section 9.6.2 will significantly reduce the likelihood and magnitude of the potential effects on the water environment occurring during the operational phase.

9.9 Difficulties Encountered

No major difficulties were encountered while undertaking this assessment.

9.10 References

- DECLG. (2006). *Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Projects*, Department of the Environment, Heritage and Local Government, Dublin, Ireland.
- EPA. (2002). *EPA Guidelines on the information to be contained in Environmental Impact Statements*, EPA, Wexford, Ireland,
- EPA. (2003*). EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements*, EPA, Wexford, Ireland.
- EPA. (2017). *EPA Guidelines on the information to be contained in Environmental Assessment Reports, Draft, August 2017*, EPA, Wexford, Ireland.
- EPA. (2018.) *EPA Maps*. Accessed 20 August 2018 [https://gis.epa.ie/EPAMaps/]
- European Council. (2000). 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
- European Council. (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 Text with EEA relevance
- GSI. (2018). *Geological Survey Ireland Spatial Resources*, Geological Survey of Ireland, Accessed 20 August 2018 [http://dcenr.maps.arcgis.com/apps/MapSeries/index.html?appid=a30af518e87a4c0ab2fbde2aaac3c228]
- NPWS. (2018). *National Parks and Wildlife Services Map Viewer*, National Parks and Wildlife Service, Accessed 20 August 2018 [http://webgis.npws.ie/npwsviewer/]
- NRA. (2008). *Environmental Impact Assessment of National Road Schemes – A Practical Guide*, National Roads Authority, Dublin, Ireland.
- NRA. (2008). *Guidelines of Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*, National Roads Authority, Dublin, Ireland.
- OPW. (2018). *Flood Maps,* Office of Public Works. Accessed 20 August 2018 [http://www.floodinfo.ie/map/floodmaps/]
- OSI. (2017). *GeoHive.* Ordnance Survey of Ireland. Accessed 20 August 2018 [http://map.geohive.ie/mapviewer.html]
- Topographic Map. (2018.) *Topographic Map*. Accessed 20 August 2018 [http://en-ie.topographic-map.com]

Chapter 10: Air Quality

10

10. Air Quality

10.1 Introduction

Compounds released to the air by motor vehicles, both Light Duty Vehicles (LDV) including cars and small vans and Heavy-Duty Vehicles (HDV) including buses and articulated lorries, result in a variety of environmental effects. Emitted pollutants can travel for various distances through the air and can be greater at certain times of the day depending on traffic volume, wind direction and wind speed. Over time, repeated exposure to vehicle fumes can cause soiling of buildings and materials, as well as having a detrimental effect on human health.

A new road project, such as a local distributor road, would typically alter traffic flows in the locality in terms of vehicle numbers and speed, and will have a corresponding impact on air quality. Road projects are usually perceived as having only negative effects; however, in the majority of cases, the overall effect can be beneficial. One of the project objectives of this scheme is to provide a high-quality corridor between the north of Navan and the M3 Motorway, reducing traffic congestion at the Round'O junction and in the town centre by improving the segregation of regional through-traffic and locally generated trips from across Navan town. Consequently, a distributor road to the west of the town not only has the potential to relieve congestion on the existing road network but could lower emissions and subsequently reduce overall pollutant levels by keeping traffic flowing steadily throughout the region.

Whilst the Proposed Road Development (as shown on Figures 4.1 to 4.4 inclusive contained in Volume 3 of this EIAR) is described in detail within Chapter 04 of this EIAR, it would connect the N51 at its junction with the R147 Kells Road to the L3409 Ratholdron Road through Abbeyland, and would include junctions, footways, cycleways, street lighting, an attenuation pond/tanks, and service duct provision. The location is characterised by presence of an open greenfield area (Blackwater Park) with some wooded areas in the section north of the River Blackwater, which flows through the southern portion of the study area in a west to east direction. Continuing southwards, the scheme meets the N51/R147 Kells Road, which is lined by both residential and commercial properties. The River Blackwater is designated as a SAC and SPA.

The principal objective of this air quality assessment is to indicate whether there are likely to be significant air quality effects associated with the Proposed Road Development ('Do-Something') in comparison with the 'Do-Minimum' scenario, and existing 'Base Year' (2017) conditions. Effects must be assessed and reported by comparing a scenario with the Proposed Road Development against one without, in accordance with the EIA Directive. The absence and presence of a Proposed Road Development are referred to as the 'Do-Minimum' and 'Do-Something' scenarios respectively. The 'Do-Minimum' scenario represents the future baseline with minimal interventions and without new infrastructure.

In order to fully appraise the potential impact of the project on existing air quality, both local and regional air quality assessments were conducted in accordance with the procedures detailed in the NRA's '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*' (Revision 1, May 2011). The NRA is now TII after merging with the Railway Procurement Agency.

In preparing this chapter, regard has also been given to the Environmental Protection Agency's (EPA) '*Guidelines on the Information to be contained in Environmental Impact Statements'* (2002), the NRA's 2008 '*Environmental Impact Assessment of National Road Schemes – A Practical Guide*' and the Draft EPA's 2017 '*Guidelines on the Information to be contained in Environmental Impact Assessment Reports*'.

In terms of the assessment of climatic impacts associated with the Proposed Road Development, this is separately addressed within Chapter 16 (Climate) of this EIAR, which reports the findings of an assessment of the likely significant effects on the climate and also considers the resilience of the Proposed Road Development to the physical impacts of future climate change.

10.2 Methodology

The methodology that has been adopted for the assessment of air quality impacts has been prepared in accordance with the NRA's '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* (Revision 1, May 2011).

The objective at this stage is to undertake a sufficiently detailed assessment to identify if there would be any air quality impacts associated with the Proposed Road Development that would result in significant environmental effects. In consideration of the potential for environmental and human health impacts related to emissions from the construction and operational phase of the Proposed Road Development, the study area has been defined.

In general, the potential impacts of any operational or construction related emissions would be intrinsically related to the level of exposure. Typically, receptors which are located in closest proximity to the source of the emission would be subject to the highest level of exposure. Whether or not the environmental and health impacts are likely to be significant, they are likely to be confined to within the first 50–100 m from the Proposed Road Development. However, some impacts, (such as regional) would obviously have a wider sphere of influence.

On this basis, the assessment examined whether existing air quality conditions would change due to emissions or influences associated with the construction and operation phase of the Proposed Road Development, by adopting the following approach where necessary:

- Consider any changes to baseline air quality since publication of the '*Local Distributor Road 4 Abbeyland Navan – Route Selection Report'* (AECOM, 2018). This includes characterising the baseline air quality and climatic environment utilising EPA and/or Met Éireann data for the region, undertaking monitoring as necessary and reviewing information about existing pollution sources;
- Characterise the existing built environment, paying particular attention to sensitive receptors, such as 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), within 200 m of the Proposed Road Development and the existing route;
- Calculate the Index of Overall Change in Exposure for the existing route and the Proposed Road Development, if predicted traffic flows or road alignments have changed or new sensitive receptors have been identified;
- Determine the changes in pollutant concentrations alongside roads with a significant change in traffic at a sufficient number of sensitive receptor locations. The study should specifically consider receptors at all road links where a greater than 5% change in flows or speeds is predicted for the "Do-Something" option. Predictions should be carried out for the Baseline (2017), Opening (2022) and Design (2037) years;
- Compare the predicted pollutant concentrations with the Air Quality Standards given in Table 10-1. An assessment with regard to the $PM_{2.5}$ limit values is also required;
- Consider the wider-scale impacts of the Proposed Road Development by calculating the change in total emissions of nitrogen oxides (NO_x) and carbon dioxide (CO_2) for the current (Baseline - 2017), Opening (2022) and Design (2037) years;
- Provide any additional information required to complete an assessment of impacts on any ecologically sensitive habitats;
- Qualitatively assess the potential impacts of construction works. The main impacts during the construction phase would typically be related to the airborne dust generated by construction activities;
- Specify ameliorative, remedial or reductive mitigation measures to control the impact associated with either the construction or operational phases of the Proposed Road Development; and
- Demonstrate that all likely significant effects (beneficial or adverse) are identified, considering the sensitivity of the environment, the magnitude of any potential impacts associated with the Proposed Road Development, and the proposed mitigation measures.

The overall approach to the air quality assessment at this stage is outlined in Figure 10-1.

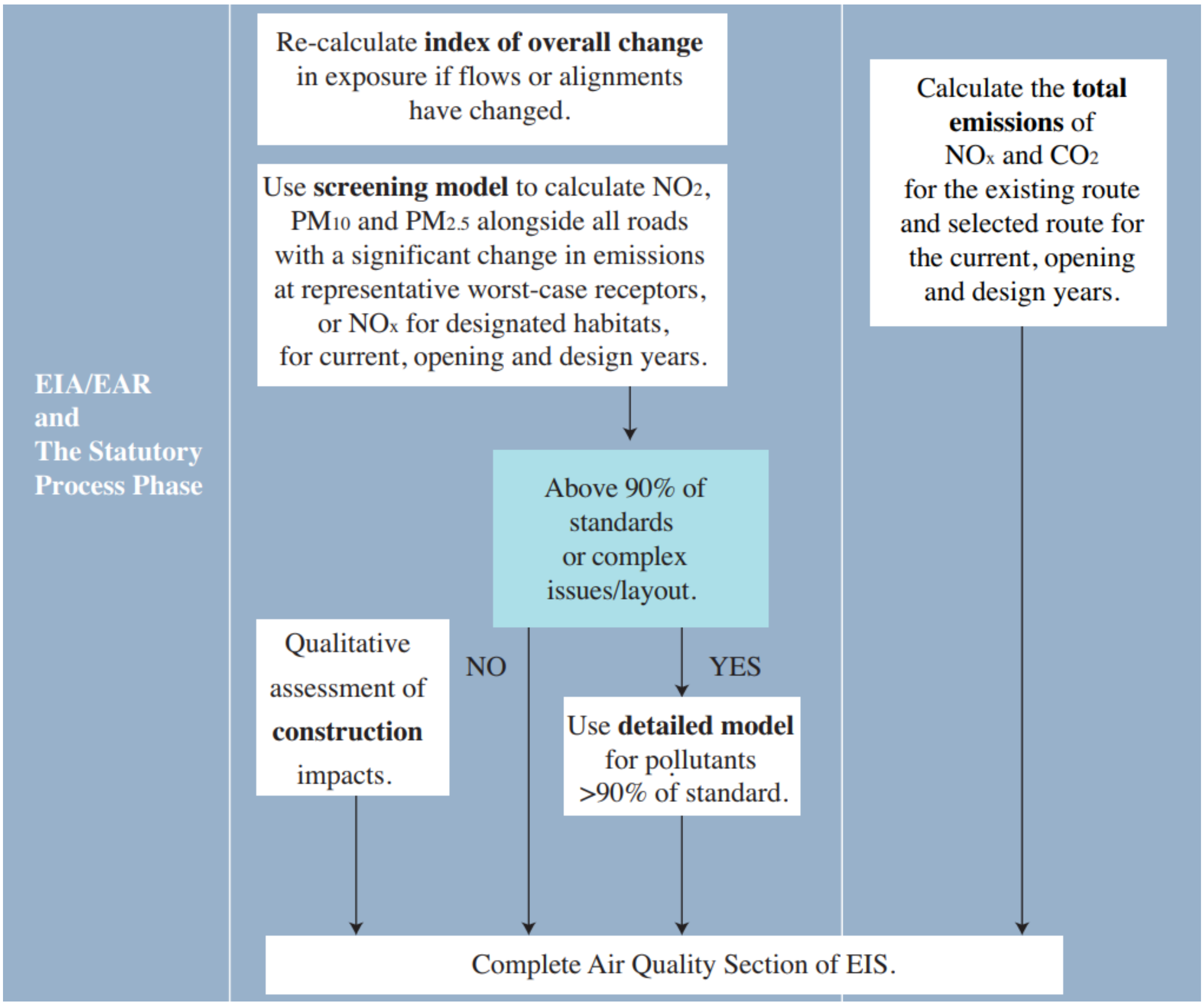


Figure 10-1 Air Quality Assessment of Road Projects – EIA and the Statutory Process Phase

Source: 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes' (Revision 1, May 2011).

10.2.1 Index of Overall Change

The methodology adopted for calculating the Index of Overall Change has been prepared in accordance with Appendix 3: Calculation of Index of Overall Change in Exposure of the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* (Revision 1, May 2011).

Calculation of the Index of Overall Change in exposure allows a comparison of the overall impact on sensitive receptor locations to be carried out. The Index is based on taking the number of sensitive receptor locations (i.e. residential properties) within 50m of the carriageway of all road links that would experience a significant change in traffic associated with the Proposed Road Development. This represents the distance within which detectable impacts of a road might be found, while a significant change can be considered to be an increase or decrease in traffic flow (AADT) of 5% or more.

The number of properties is then multiplied by the predicted change in the emission rate along that link, and then summed across all links. The steps and actions for calculating the Index of Overall Change are listed below:

1. Collate basic traffic information for each link covering traffic flows (for the Opening Year), composition and speeds, as well as link lengths;
2. Define the study area, which as a minimum includes the proposed and existing road, and any other roads with 'significant' changes in emissions (determined as road links with ±5% change in traffic flow);
3. Calculate total emissions for each link based on link length, vehicle flow, %HDV (Heavy Goods Vehicles (HGV) + buses + Other Goods Vehicles (OGV)) and average speed using the 'Regional Impact Assessment' function in the DMRB spreadsheet;

4. Calculate the difference between Do-Minimum and Do-Something emissions for each link;
5. Count the number of sensitive locations within 50m of the carriageway for each link;
6. Calculate the change in emission rate (kg/km/yr) for each link being considered in the study area;
7. Multiply the change in emission rate from each link by the number of properties within 50m;
8. Add together the total numbers for each link to determine an Overall Exposure Index; and
9. Compare the Exposure Index for the existing route and Proposed Road Development. A negative score indicates that there would be an overall reduction in exposure to pollution (i.e. a benefit); a positive score indicates an increase in exposure to pollution (i.e. adverse impact).

10.2.2 Calculation of Local-Scale Pollutant Concentrations

The methodology adopted for calculating local-scale pollutant concentrations has been prepared in accordance with Appendix 4: Approach to Dispersion Modelling of the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* (Revision 1, May 2011). This Appendix provides a description of the various approaches that may be taken for dispersion modelling studies.

10.2.2.1 DMRB Screening Model

A 'Simple' local air quality assessment utilising the DMRB Screening Model was deemed 'fit-for-purpose', based upon the NRA/TII guidelines, complexity of the project, projected traffic volumes, baseline conditions, professional judgement and the approach set out in Figure 10-1 of this chapter.

As detailed within paragraph A4.4 (DMRB Screening Model) of Appendix 4 (Approach to Dispersion Modelling) of the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* (Revision 1, May 2011), the DMRB Screening Model provides a simple and straightforward means of predicting pollutant concentrations associated with road traffic emissions. The method is not intended to provide accurate predictions of air quality, but it is a suitable approach in circumstances where the predicted environmental concentrations (i.e. ambient background + predicted concentration) lie sufficiently below the air quality standards (taken to be <90% of the standard), and where there are no complex or unusual features (e.g. grade-separated junctions, road links with gradients >2.5%), as is the case with this particular project.

Although the Proposed Road Development would result in a change to the existing road network, traffic flows throughout the locale and proximity to receptors, these changes would not be of such a magnitude to warrant a 'Detailed' assessment. A detailed assessment should be only applied where there exists the potential to cause significant effects on environmental resources and receptors. A simple assessment is sufficient if it established confidently that the forecast environmental effect would not be a fundamental issue in the decision-making process.

The specific input requirements for a local impact assessment include:

- Input of annual mean background pollutant concentrations making use of existing air quality data (i.e. air quality monitoring carried out at one or more locations along the existing route/Proposed Road Development and/or collected as part of national or local government programmes, or as part of air quality assessments related to other development projects);
- Selecting receptors to include relevant locations where the impact of the Proposed Road Development is expected to be greatest because of significant changes in traffic conditions. The assessment should also take account of receptors where there is an expected improvement to air quality due to the Proposed Road Development. Consideration should also be given to junctions or areas of congested traffic; and
- obtaining refined traffic data for 'Base Year', 'Do-Minimum' and 'Do-Something' scenarios, for the years of assessment for roads likely to be affected by the Proposed Road Development. Affected roads are those for which the road alignment will change by 5m or more; daily traffic flow will change by 1000 AADT or more; HDV flows will change by 200 AADT or more; daily average speed will change by 10km/hr or more; or peak hour speed will change by 20km/hr or more.

10.2.2.1.1 Output of the DMRB Model

The DMRB model predicts annual mean concentrations of NO_x and PM_{10}. It provides a test that is designed to establish whether a road project should be subject to a more 'Detailed' air quality assessment and is intended to give a reliable answer quickly. The DMRB model uses conservative emission factors. These worst-case concentrations are then added to the existing background concentrations to give the worst-case predicted ambient concentrations. The worst-case ambient concentrations are then compared with the relevant ambient air quality standards to assess the compliance of the Proposed Road Development with these standards. Pollutant concentrations estimated by this Screening Model are so conservative that it is not deemed necessary to even consider local meteorological conditions.

The DMRB Screening Model was modified in July 2007 to include the latest information at that time on emission factors, fleet composition, background concentrations, the relationship between NO_x and NO_2, and the relationships between the annual mean concentrations and the metrics specified in the air quality criteria. With the latest DMRB spreadsheet (Version 1.03c), estimates were made of annual mean concentrations of NO_x, NO_2 and PM_{10}.

The Screening Model does not however predict concentrations of $PM_{2.5}$ (though PM_{10} can be used as an indicator of estimated $PM_{2.5}$ levels). The Airborne Particles Expert Group (APEG, 1999) suggested a $PM_{2.5}$ to PM_{10} ratio of 0.8 for non-catalyst petrol vehicles, and 0.9 for all other vehicles (NRA, 2011). The current DMRB database shows that non-catalyst petrol vehicles comprised only 4% of the vehicle fleet in 2008, gradually declining in years thereafter. It is not practicable to apply different $PM_{2.5}$ ratios to different vehicle types but given the small number of non-catalyst petrol vehicles on the road, this is unlikely to introduce any significant error. A worst-case approach should be taken, assuming a 0.9 ratio (which is very conservative) for all vehicles is applied. To estimate $PM_{2.5}$ concentrations, the predicted road PM_{10} contribution should be factored by 0.9 and then added to the background $PM_{2.5}$ concentration.

In terms of accuracy, the ratio of predicted road traffic contribution to the concentrations of NO_x and PM_{10} can be described as a function of traffic flow (weighted for distance from the receptor where more than one road is being considered). The application of these functions to the road traffic component substantially improved the prediction accuracy of the method, and they have been incorporated into the DMRB spreadsheet. With regards to the accuracy of NO_2 concentrations, the DMRB Screening Model converts NO_x concentrations (which comprise primarily Nitric Oxide (NO) and a small percentage of NO_2) to NO_2, based on measurements made between 1999 and 2001. However, according to the Department for Environment, Food & Rural Affairs (Defra – the body responsible for local air quality management in the UK), evidence has shown that the proportion of primary NO_2 in vehicle exhaust has increased, meaning that the relationship between NO_x and NO_2 at the roadside has changed from that currently used in the model. As such, in 2010 Defra introduced a NO_x to NO_2 calculator to adjust NO_2 concentrations from the modelled roadside NO_x contributions and background NO_x and NO_2 levels. This calculator was updated in June 2016 (version 5.1), and it is this version which has been used for this assessment.

Further to this, Interim Advice Note (IAN) 170/12 v3 (‘*Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3, Part 1* ‘Air Quality’) was published in November 2013 (HA, 2013). It enables project assessments (using the DMRB Screening Model) to take into account the impact of future alternative NO_2 projections as published by Defra in July 2011, in a report examining the long-term air quality trends in NO_x and NO_2 concentrations. This indicated that there has been a clear decrease in NO_2 concentrations between 1996 and 2002. Thereafter, NO_2 concentrations have stabilised with little to no reduction between 2004 and 2010. Defra’s report presents a similar pattern for the change in NO_x concentrations over the same time period. In terms of long-term trends, Defra concluded that there is now a gap between current projected vehicle emission reductions and projections on the annual rate of improvements in ambient air quality as previously published in Defra’s technical guidance and observed trends. Analysis was undertaken by the Highways Agency (HA) of long-term monitored NO_2 concentrations, based on monitoring data collected between 2006 and 2010. The outcome of the analysis indicated the same trends as identified by Defra’s July 2011 report.

The IAN suggests air quality modelling should continue to be completed in accordance with the assessment methodology set out in HA 207/07 and with reference to Defra’s Local Air Quality Management Technical Guidance (LAQM.TG (09)) (Defra, 2011) where applicable. However, the verified modelled NO_2 concentrations should be adjusted using a HA spreadsheet which has been developed to support project assessments.

10.2.3 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 NRA ‘*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*’ (Revision 1, May 2011). Reference has also been made to the NRA’s ‘*Guidelines for Assessment of Ecological Impacts of National Road Schemes*’ (Rev. 2, NRA, 2009) and to ‘*Appropriate Assessment of Plans and Projects in Ireland – Guidance for Planning Authorities*’ (Department of the Environment, Heritage and Local Government, 2010) for details regarding the regime governing the legal protection of designated conservation areas.

If a designated ecological site has been identified as likely to be affected by a Proposed Road Development, NO_x concentrations and Nitrogen Deposition rates are calculated in a transect up to 200m away from each of the affected roads, within or near the site. The calculations are for the 'Base Year' (2017) and the assumed year of Opening (2022), for both the 'Do-Minimum' and 'Do-Something' scenarios. The estimates are also made using the 'Local' application of the DMRB Screening Model. The concentrations are then compared with the vegetation criterion for NO_x and the critical load levels for Nitrogen Deposition and the change in concentration due to the Proposed Road Development, determined in the assumed year of Opening.

10.2.4 Impacts at National/International Level

The methodology adopted for assessing impacts at national/international level has been prepared in accordance with Appendix 7: Impacts at National/International of the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*' (Revision 1, May 2011). This Appendix provides a description of the various approaches that may be taken for dispersion modelling studies.

10.2.4.1 DMRB Regional Impact Assessment

The regional air quality assessment seeks to establish the total and change in emissions that would result with the Proposed Road Development, as compared with the 'Base Year' (2017) and future year 'Do-Minimum' alternative. This is used to identify the concentration of pollutants that contribute to a wider spread decline in air quality, such as acid rain deposition or an enhancement of the natural greenhouse effect.

As with local air quality, the method takes into account AADT, road length, road type, annual average speed, percentage of HDV, traffic growth, and changes in exhaust emissions with time. Estimates are then made for (a) 'Base Year' (2017), (b) 'Do-Minimum' and 'Do-Something' scenarios in the assumed 'Opening Year' (2022), and (c) 'Do-Minimum' and 'Do-Something' scenarios in the 'Design Year' (2037) for the total emissions of carbon monoxide (CO), Total HydroCarbons (THC), NO_x, PM_{10} and Carbon (C). The procedure requires the calculation of total forecast emissions after the Proposed Road Development has been built, and deduction of the estimated emissions from the existing road network, where traffic patterns are affected by the project. As a result of the global nature of the impact of some pollutants, a consideration of the change in emissions resulting from the Proposed Road Development is therefore useful in the context of regional air pollution.

Again, the regional assessment incorporates all roads likely to be affected by the Proposed Road Development. Affected roads are those expected to have:

- a change of more than 10% in AADT; or
- a change of more than 10% to the number of HDVs; or
- a change in daily average speed of more than 20km/hr.

If no roads meet these criteria, then it is not necessary to undertake any calculations. If any roads are likely to be affected by the Proposed Road Development, calculations are undertaken using the 'Regional' application of the DMRB Screening Model Version 1.03c.

10.2.5 Assessment of Construction Impacts

The methodology adopted for assessing construction impacts has been prepared in accordance with Appendix 8: Assessment of Construction Impacts of the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*' (Revision 1, May 2011).

Dust is defined as all particulate matter up to 75µm (microns) in diameter and comprising both suspended and deposited dust, whereas PM_{10} is a mass fraction of airborne particles of diameter of 10 microns or less. The health impacts associated with dust include eye, nose and throat irritation in addition to the nuisance caused by deposition on cars, windows and property. Dust and PM_{10} emissions arise from a number of sources, so both construction activities and emissions from vehicles associated with the construction site need to be considered.

For identifying the likely distance from the Proposed Road Development that dust impacts may be experienced, the criteria listed in Table 10-1 have been used, which are drawn from professional experience of many different types of project, discussions with practitioners in the field, and published reports. Together with a consideration of the scale and duration of construction activities close to sensitive receptors, these criteria form the basis of the evaluation of significance and severity of effects.

Table 10-1 Assessment Criteria for Dust and PM_{10} from Construction Activities

Source Description	Potential Distance from Source for Significant Effects			
	Scale	Duration*	Soiling	PM_{10}**
No Mitigation				
Large Sites, high use of haul routes	Major	Year or more	500 m	100 m
Moderate Sites, Moderate use of haul routes	Moderate	Months	200 m	50 m
Minor Sites, Limited use of haul routes	Minor	Weeks	100 m	25 m
Mitigation				
Large Sites, high use of haul routes	Major	Year or more	100 m	25 m
Moderate Sites, Moderate use of haul routes	Moderate	Months	50 m	15 m
Minor Sites, Limited use of haul routes	Minor	Weeks	25 m	10 m

**duration applies to a time near to a particular receptor*
***significance is based on the 24-hour PM_{10} objective*

Source: 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes' (Revision 1, May 2011).

10.2.6 Assessment of Predicted Impacts and Residual Effects (Significance of Effects)

The determination of the significance of effects is a key stage in the environmental impact assessment process. Accordingly, the significance criteria utilised in the assessment of Predicted Impacts and Residual Effects (Significance of Effects) has been prepared in accordance with Appendix 10: Significance Criteria of the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*' (Revision 1, May 2011).

In general, significance of effects has been defined using a combination of the sensitivity (e.g. High, Medium or Low) of the environmental feature, and the magnitude of impacts (e.g. Small, Medium, Large) where appropriate. The criteria for assessing sensitivity and magnitude level have been defined below.

10.2.6.1 Sensitivity (or Value)

If the receptor is the facade of a residential building, then it should be assumed that any member of the general public could be present within the building including the elderly, infants or other vulnerable groups. No distinction should be made between the sensitivity of dwellings, hospitals, schools, etc. and all should be considered as being of equal sensitivity for the purposes of the assessment. All sensitive locations for human exposure and for ecosystems are judged to be of 'high' sensitivity.

10.2.7 Assessing the Significance of Effects

It is not sufficient to simply assess the size and probability of possible impacts; their significance should also be assessed. The significance of the effect is formulated as a function of the receptor or resource's environmental value (or sensitivity) and the magnitude of project impacts (change). In other words, significance criteria are used to report the effect of the impact.

The Institute of Air Quality Management (IAQM) has recommended an approach to defining the magnitude of changes and describing air quality impacts at specific receptors, as set out in Table 10-2.

Table 10-2 Magnitude of Impacts for changes in Annual Mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at a receptor

Magnitude of Change	Annual Mean Change (NO_2, PM_{10})	Annual Mean Change $PM_{2.5}$
Large	Increase/Decrease ≥4µg/m^3	Increase/Decrease ≥2.5µg/m^3
Medium	Increase/Decrease 2 - <4µg/m^3	Increase/Decrease 1.25 – <2.5µg/m^3
Small	Increase/Decrease 0.4 - <2µg/m^3	Increase/Decrease 0.25 - <1.25µg/m^3
Imperceptible	Increase/Decrease <0.4µg/m^3	Increase/Decrease <0.25µg/m^3

Source: 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes' (Revision 1, May 2011).

When describing an air quality impact, the actual concentration at that specific receptor should be taken into account, in combination with the magnitude of impacts as a means of estimating the significance of potential effects, as detailed in Table 10-3. Professional judgement and awareness of the relative balance of importance between sensitivity and magnitude allows the overall significance of effect to be assessed with mitigation (if required) to define residual effects.

Table 10-3 Air Quality impact descriptors for changes to annual mean NO_2, PM_{10} and $PM_{2.5}$ concentrations at a receptor

Absolute Concentration in relation to Objective/Limit Value	Small	Medium	Large
Increase with Scheme			
Above Objective/Limit Value *with* Scheme (≥40µg/m^3 of NO_2 or PM_{10}) (≥25µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Substantial Adverse
Just Below Objective/Limit Value *with* Scheme (36 - <40µg/m^3 of NO_2 or PM_{10}) (22.5µg/m^3 - <25µg/m^3 of $PM_{2.5}$)	Slight Adverse	Moderate Adverse	Moderate Adverse
Below Objective/Limit Value *with* Scheme (30 - <36µg/m^3 of NO_2 or PM_{10}) (18.75µg/m^3 - <22.5µg/m^3 of $PM_{2.5}$)	Negligible	Slight Adverse	Slight Adverse
Well Below Objective/Limit Value *with* Scheme (<30µg/m^3 of NO_2 or PM_{10}) (<18.75µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Adverse
Decrease with Scheme			
Above Objective/Limit Value *without* Scheme (≥40µg/m^3 of NO_2 or PM_{10}) (≥25µg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Substantial Beneficial
Just Below Objective/Limit Value *without* Scheme (36 - <40µg/m^3 of NO_2 or PM_{10}) (22.5µg/m^3 - <25µg/m^3 of $PM_{2.5}$)	Slight Beneficial	Moderate Beneficial	Moderate Beneficial
Below Objective/Limit Value *without* Scheme (30 - <36µg/m^3 of NO_2 or PM_{10}) (18.75µg/m^3 - <22.5µg/m^3 of $PM_{2.5}$)	Negligible	Slight Beneficial	Slight Beneficial
Well Below Objective/Limit Value *without* Scheme (<30µg/m^3 of NO_2 or PM_{10}) (<18.75µg/m^3 of $PM_{2.5}$)	Negligible	Negligible	Slight Beneficial

Source: 'Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes' (Revision 1, May 2011).

IAN 174/13 (June 2013), 'Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 Air Quality (HA 207/07)', outlines amendments to the reporting of significant local air quality effects for public exposure and designated ecosystems. This advice is only applicable to assessments which identify exceedances to air quality thresholds in either the 'without scheme' scenario and/or 'with scheme' scenario.

Any change which is greater than 'Imperceptible' (as outlined in Table 10-2), due to the project, which causes any of the below to occur at receptor:

- worsening of air quality objective above the objective limit;
- creation of a new exceedance above the objective limit;
- improvement of an air quality objective already above objective; or
- removal of an existing exceedance of an objective limit.

would be subject to further evaluation against key criteria as to its overall significance.

10.3 Legislation and Guidelines

10.3.1 Pollutants of Concern and Air Quality Standards

Road transport sources account for a large proportion of emissions of several airborne pollutants, although most of the pollutants emitted by road vehicles are also produced by a wide range of industrial, commercial and domestic processes.

Pollutant emissions from road traffic causes impacts at both the local and national/international level. At a local level, the pollutants of most concern near roads are Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10} and $PM_{2.5}$) in relation to human health, and Oxides of Nitrogen (NO_x) in relation to vegetation and ecosystems. Evidence has shown that there is no risk of emissions from road traffic leading to exceedances of the relevant air quality standards for any other pollutants, at even the most heavily-trafficked locations.

At the national/international level, emissions of oxides of nitrogen (NO_x) are of concern with respect to nitrogen deposition and the formation of ozone, while emissions of carbon dioxide (CO_2) are associated with climate change.

10.3.1.1 Ambient Air Quality Standards

The Clean Air for Europe (CAFE) programme revisited the management of Air Quality within the EU and replaced the EU Framework Directive 96/62/EC (Council of European Communities, 1996), its associated Daughter Directives 1999/30/EC (Council of European Communities, 1999), 2000/69/EC (Council of European Communities, 2000), 2002/3/EC (Council of European Communities, 2002), and the Council Decision 97/101/EC (Council of European Communities, 1997) with a single legal act, the Ambient Air Quality and Cleaner Air for Europe Directive 2008/50/EC (Council of European Communities, 2008).

Directive 2008/50/EC is the principal instrument for governing outdoor ambient air quality policy in the EU. It sets health and environmental objectives and emission reduction targets for the key air pollutants associated with human health and ecological impacts. It proposes to deliver the objectives in stages, and make it possible to protect EU citizens from exposure to particulate matter and ozone, and protect European ecosystems more effectively from acid rain, excess nutrient nitrogen (in the form of ammonia and nitrogen oxides, which disrupts plant communities, and leaches into fresh waters, leading in each case to a loss of biodiversity), and ozone.

This Directive is currently transposed into Irish law by the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011). The Regulations introduce a limit value to $PM_{2.5}$ in addition to the existing limit values for PM_{10}, NO_2 and oxides of nitrogen, sulphur dioxide, lead, ozone, carbon monoxide and benzene. These limit values are binding in the Republic of Ireland and have been set with the aim of avoiding, preventing and reducing harmful effects on human health and on the environment as a whole. Air quality limit values are an appropriate measure to use in assessing the significance of effects on air quality sensitive receptors.

In relation to the Proposed Road Development, the limit values (as detailed within Schedule 11 of the Regulations) for pollutants specific to protection of human health are contained within Table 10-4.

Table 10-4 Relevant Air Quality Standards for the Protection of Human Health

Pollutant	Averaging Period	Limit Value	Maximum Permitted Exceedances	Target Year
Nitrogen Dioxide (NO_2)	Annual Mean	40µg/m^3	None	2010
	Hourly Mean	200µg/m^3	18 times per year	
Particulate Matter (PM_{10})	Annual Mean	40µg/m^3	None	2005
	24-Hour	50µg/m^3	35 times per year	
Fine Particulate Matter ($PM_{2.5}$)	Annual Mean	25µg/m^3	None	2015
	Annual Mean	20µg/m^3	None	2020

Source: Air Quality Standards Regulations (S.I. 180 of 2011)

The EPA is the competent authority for the purpose of Directive 2008/50/EC and these Regulations. As detailed within the NRA '*Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes'* (Revision 1, May 2011), the national exposure reduction target is focused on reducing average exposures across the most heavily populated areas of Ireland and is therefore not directly relevant to individual road projects. Air quality assessments of road projects should, however, take account of the $PM_{2.5}$ limit values.

The EPA also has a duty to ensure that critical levels for the protection of vegetation, as detailed in Schedule 6 of the Regulations, are not exceeded. In relation to the proposed road development, the critical levels for pollutants specific to the protection of vegetation are contained within Table 10-5.

Table 10-5 Critical levels for the Protection of Vegetation specific to the assessment of road projects

Pollutant	Critical Level	
	Concentration	**Measured as**
Oxides of Nitrogen (NO_x)	30 µg/m^3	Annual Mean

Source: Air Quality Standards Regulations (S.I. 180 of 2011)

10.3.1.2 European Union Clean Air Policy

Ireland is implementing the EU Clean Air Package. It contains a suite of policies and legislative proposals to update and modernise EU clean air legislation. This will reflect improved scientific knowledge and understanding of the health and environment impacts of air pollution. The Clean Air Programme for Europe describes the problem. It sets out new interim objectives for reducing health and environmental impacts up to 2030.

The main components include:

- a new Clean Air Programme for Europe with measures to ensure we meet existing targets in the short term, and new air quality objectives for the period up to 2030. The package also includes support measures to help cut air pollution, with a focus on improving air quality in cities, supporting research and innovation, and promoting international cooperation;
- a revised National Emission Ceilings Directive (NEC Directive 2016/2284) with more ambitious and protective national emission ceilings for key pollutants; and
- a new Directive to reduce pollution from medium-sized combustion installations, such as small energy plants for street blocks, large buildings and small industry.

The European Union (National Emission Ceilings) Regulations 2018 (S.I. No. 232/2018) transposes the NEC Directive on the reduction of national emissions of certain atmospheric pollutants, amending Directive 2003/35/EC and repealing Directive 2001/81/EC. It aims to ensure that annual anthropogenic emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), non-methane volatile organic compounds (NMVOC), ammonia (NH3), and fine particulate matter ($PM_{2.5}$) are limited in accordance with the emission reduction commitments specified for each pollutant in Tables A and B of Schedule 2 of the regulations, in accordance with the timeframe specified in those tables.

It is required by the regulations that the 2025 anthropogenic emissions of sulphur dioxide (SO_2), nitrogen oxides (NO_x), NMVOC, ammonia (NH3), and fine particulate matter ($PM_{2.5}$), are consistent with a linear reduction trajectory established between the pollutants' emission levels defined by the emission reduction commitments for 2020-2029 in Schedule 2 and the emission levels defined by the emission reduction commitments for 2030 in Schedule 2. Of those relevant to the climatic assessment of road transportation impacts, are set out below. The reduction commitments have the year 2005 as base year, and for road transport, apply to emissions calculated on the basis of fuels sold:

For NOx, it is expected that a 49% reduction should be achieved compared with 2005 for any year from 2020 to 2029 and 69% for any year from 2030 onwards. 2005 values for NOx equated to 126.4kt with the corresponding targeting reduction equating to 61.9kt and 87.2kt respectively.

For NMVOC, it is expected that a 25% reduction should be achieved compared with 2005 for any year from 2020 to 2029 and 32% for any year from 2030 onwards. 2005 values for NMVOC equated to 58.8.4kt with the corresponding targeting reduction equating of 14.7kt and 18.8kt respectively.

For Particulate Matter, it is expected that a 18% reduction should be achieved compared with 2005 for any year from 2020 to 2029 and 41% for any year from 2030 onwards. There is no 2005 data for comparison.

10.3.2 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994, and the Kyoto Protocol in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the European Union burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012.

With reference to '*Ireland's Greenhouse Gas Emission Projections 2012-2030*' (EPA, 2013), Ireland is on track to meet its commitment under the Kyoto Protocol. This is in marked contrast to the projection in Ireland's 2007 National Climate Change Strategy which forecast a total distance to target of 18Mtonnes of CO_{2eq}. The reason Ireland is on track was primarily as a direct result of economic recession and economic outlook for the future. Nevertheless, as the economy recovers, there continues to be a significant risk that Ireland will not meet its 2020 EU targets, even under the most ambitious emission reduction scenario, as detailed below.

With reference to '*Ireland's Environment – An Assessment 2016'* (EPA, 2016), the EU 2020 target is based on a combination of annual targets from 2013 to 2020 to give an overall reduction by 2020. Official projections of GHG emissions to 2020 are provided annually by the EPA based on two scenarios: (1) with current policies, regulations and incentives (i.e. With Measures, WM) and (2) with additional policies, regulations and incentives (i.e. With Additional Measures, WAM).

Based on current policies, Ireland is projected to exceed its annual limits in 2016 and, even with additional polices, this limit would be exceeded in 2017. For the period 2014−2020, agriculture emissions are projected to increase by 6–7%. Transport emissions are projected to show strong growth over the period to 2020, with a 10–16% increase on 2014 levels. Based on the two emissions scenarios described above, total emissions are projected to be 6% (scenario 1) or 11% (scenario 2) below 2005 levels in 2020 (i.e. WM and WAM). The target is a 20% reduction.

These projections are therefore a cause for significant concern in the context of the anticipated requirements for further reductions in GHG emissions in the period 2021−2030. Failure to meet the 2020 target would make future compliance challenges more difficult and costly. In addition, the analysis suggests that Ireland is not on track for, or projected to be moving in the right direction, to meet its National Policy Position, which aims to achieve a least 80% reductions in carbon dioxide emissions by 2050 relative to 1990 levels and achieving neutrality in the agriculture and land use sectors.

Further polices, regulations and incentives are therefore urgently needed to meet existing targets and to move to a pathway to achieve the 2050 transformation objective. Increased strategic planning, investment and resources are also needed to achieve this in the overall framework of EU and global commitments.

In December 2015, at a meeting of the UNFCCC in Paris, a new global agreement was reached to address climate change (UN, 2015). Expected to enter into force in 2020, the agreement aims to:

- hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C;
- increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development in a manner that does not threaten food production; and
- make finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.

With reference to '*Ireland's Environment – An Assessment 2016'* (EPA, 2016), to achieve this, GHG emissions must peak as soon as possible and then be reduced rapidly in order "*to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century*".

The Agreement establishes a long-term adaptation goal of "*enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the 2°C temperature goal*". This makes it clear that, if mitigation activities succeed in limiting the rise in global temperature, less adaptation will be needed.

For Ireland, climate change mitigation and adaptation actions are therefore framed and informed by UN, EU and national policy. These include the UNFCC, the Kyoto Protocol, the UN Paris Agreement, the EU Strategy on Adaptation to Climate Change, the EU Climate and Energy Package, the National Policy Position on Climate Change (DECLG, 2014) and the Climate Action and Low Carbon Development Act 2015.

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. Emissions of carbon dioxide must be reduced to net-zero before this time. Ireland's emissions have to follow a similar trajectory on a shorter timeline, as per the National Policy Statement on Climate Change (DECLG, 2014).

In the context of the Proposed Road Development, the private car remains the dominant mode of transport in Ireland. As detailed within '*Ireland's Environment – An Assessment 2016'* (EPA, 2016) the private car accounts, on average, for 74% of all journeys and 79% of all journeys outside Dublin. The dependency on car transport outside Dublin can be partially explained by the low-density, dispersed nature of the rural population, making it very difficult to effectively operate a public transport service in rural Ireland. This high dependency has a very significant environmental impact in terms of both GHG and air pollutant emissions.

The total number of licensed vehicles on Irish roads exceeded 2.5 million for the first time in 2014 which included over 1.9 million private cars. With reference to the latest DTTASs bulletin of Vehicle and Driver Statistics (March 2019):

- The total number of licensed (taxed) vehicles recorded on Irish roads at the 31st December 2018 is 2,717,722. This represents an increase of 41,843 vehicles (1.56%) on the previous year. The main components of the vehicle fleet include 2,106,369 private cars, 355,273 goods vehicles, 75,196 agricultural tractors and 40,198 motorcycles
- In the passenger car category, the number of vehicles at 2,106,369 represents an increase from 2,066,112 in the previous year (1.95% increase).
- A total of 1,386,208 passenger cars are now taxed based on their Co2 emissions rating. This represents an increase of 191,052 (15.99%) units on the previous year figures and the CO2 based vehicles now represents 65.8% of the overall passenger car fleet. There are 87.45% of vehicles bases in the 'A' and 'B' CO2 bands less than 141g/km.

While private car ownership levels in Ireland are still below the EU average, the challenge for 'policymakers' is to try to develop a sustainable transport model that can meet the DTTAS sustainable transport vision of:

- maximising efficiency and alleviating congestion;
- minimising the impacts of air pollutants and GHG emissions; and
- reducing overall travel demand and commuting distances by private car.

By implementing the Proposed Road Development, the last of the three points is obviously a visionary objective that the scheme does not facilitate the achievement of. As the Proposed Road Development is intended to be a cost-effective solution to provide necessary relief to congestion within Navan, its purpose is to redistribute traffic movements to maximise efficiency and alleviate congestion (as per the first visionary objective). In doing so, conformance with the second visionary objective (minimising the impacts of air pollutants and GHG emissions) is the focus of the air quality (Local) and climate (Regional) assessment undertaken throughout this chapter.

As detailed within the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* (Revision 1, May 2011), there are no standards applicable to the assessment of national/international impacts (i.e. GHG emissions). The significance of the climate impact is based on relative changes in emissions on a 'Regional Scale', as considered within the Regional air quality assessment which seeks to establish the total and change in emissions that would result with implementation of the Proposed Road Development.

10.3.2.1 The National Climate Change Strategy 2007 – 2012

Under the Kyoto Protocol, Ireland made a commitment to reduce its greenhouse gas emissions to protect the environment. This is to be achieved through legally binding limits to the production of those gases. The National Climate Change Strategy sets out a programme of actions for achieving those limits. The main focus is on reducing transport emissions, encouraging renewable energy, changing agricultural practices, and changing waste disposal policies and plans. The strategy both feeds into, and is reinforced by, other national level plans including Smarter Travel, the National Energy Efficiency Action Plan, and the National Development Plan. The Regional Planning Guidelines 2010-2022 (RPGs) are cognisant of the need to promote measures and actions which seek to address the issue of climate change and its potential impacts on current and future planning.

Having regard to the issues and policy context outlined above, it is an aim of the RPGs 2010-2022 to facilitate and integrate climate change issues and concerns into regional planning policy insofar as reasonably achievable within a regional environment. It is foreseen that the policies and recommendations outlined within these guidelines will result in a development infrastructure and built ecosystem more aware of, and in harmony with, natural ecosystems within the region and the impacts of climate change upon them.

As detailed within the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* (Revision 1, May 2011), there are no standards applicable to the assessment of national/international impacts. The significance of the effect is normally based on relative changes in emissions on a regional scale, as considered within the regional air quality assessment which seeks to establish the total and change in emissions that would result with the Proposed Road Development.

10.3.2.2 National Policy Statement on Climate Change 2014

The '*National Policy Statement on Climate Change*' (DECLG, 2014) facilitates a transitional vision towards a competitive, low-carbon, climate-resilient and environmentally sustainable Irish economy by 2050; based on:

- an aggregate reduction in CO2 emissions of at least 80% (relative to 1990 levels) by 2050 across the electricity generation, built environment and transport sectors; and
- an approach to carbon neutrality in the agricultural and land use sector.

10.3.2.3 The Climate Action and Low Carbon Development Act 2015

The Climate Action and Low Carbon Development Act 2015 provides, inter alia, for approval of 'plans' by the Government in relation to climate change mitigation and adaptation for the purpose of pursuing the transition as described in the National Policy Statement on Climate Change and meeting international obligations and targets to 2020 and 2030. Key provisions of the Act include:

- the preparation and submission to Government for approval of successive 5-yearly National Mitigation Plans, which will specify the policy measures to reduce GHG emissions in Ireland;
- the preparation of a National Adaptation Framework, which will reduce the vulnerability of the State to the negative effects of climate change and avail of any positive effects that may occur; it will be reviewed not less than once every 5 years, in keeping with the continued development of the evidence base and actions on adaptation and mitigation.

In addition to the National Mitigation Plan, there will be development of sectoral plans (e.g. transport, agriculture) and Local Authority plans.

The first National Mitigation Plan and the National Adaptation Framework must be submitted to Government by June and December 2017, respectively. The Minister for Communications, Climate Action and Environment, together with other relevant ministers (e.g. for transport, heritage and agriculture), will present annual transition statements to the Oireachtas on progress relating to climate mitigation and adaptation.

For Ireland to continue to comply with its international commitments on air quality and air emissions, industrial emissions of pollutants into the air must continue to be rigorously controlled and policies should be implemented to increase the use of alternatives to the private car and to improve efficiencies of motorised transport. Government departments, national agencies and local authorities need to make air quality an integral part of their traffic management and planning processes, with respect to the levels of particulate matter and polycyclic aromatic hydrocarbons (PAHs) observed across Ireland.

10.3.3 Ireland's Greenhouse Gas Emissions Projections 2018-2040

This report provides an updated assessment of Ireland's total projected greenhouse gas emissions out to 2040 which includes an assessment of progress towards achieving its emission reduction targets out to 2020 and 2030 set under the EU Effort Sharing Decision (Decision No 406/2009/EU) and Effort Sharing Regulation (Regulation (EU) 2018/842).

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, which was published in 2018. This is evident in the With Additional Measures scenario which assumes full implementation of the programmes, policies and measures included in the National Development Plan.

Fossil fuels such as coal, peat and gas continue to be key contributors to emissions from the power generation sector. However, a significant reduction in emissions over the longer term is projected as a result of the expansion of renewables (e.g. wind), assumed to reach 41-54% by 2030, with a move away from coal and peat.

A growth in emissions from the transport sector continues to be projected which is largely attributed to fuel consumption from diesel cars and diesel freight. A decrease in emissions over the longer term, most notably in the With Additional Measures scenario, is largely attributed to assumed accelerated deployment of 500,000 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 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.

The 2019 emission projections do not consider the impact of new policies and measures that will be included in the forthcoming Government Climate Plan. It is anticipated that emission projections prepared later in 2019 to inform the preparation of Ireland's final National Energy and Climate Plan (due by 31st December 2019)2 will include the additional impact of the Government Climate Plan.

10.3.4 Smarter Travel – A Sustainable Transport Future (A New Transport Policy for Ireland 2009 – 2020)

The actions set out in the DTTAS '*Smarter Travel – A Sustainable Transport Future*' should be implemented to improve air quality. 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.

It is the aim of this policy that by 2020, Transport will make a meaningful contribution to Ireland's commitment under the proposed EU effort-sharing arrangement in relation to climate change and real reductions on current levels of emissions will be achieved. The full extent of this target cannot be determined until the broader national targets under a revised National Climate Change Strategy are determined in response to any agreement on Ireland's target for emissions at EU level. Depending on a number of factors, including any final decisions by Government on fiscal measures, carbon related emissions could fall by between 4Mtonnes to 8Mtonnes of CO_2 equivalents.

10.3.5 Meath County Development Plan 2013-2019

The MCDP 2013-2019 (MCC, 2013) sets out a vision and an overall strategy for the proper planning and sustainable development of the County for a six-year period. It also sets out guiding policies and objectives for the development of the County in terms of physical growth and renewal, economic, social and cultural activity, and environmental protection and enhancement.

This plan acknowledges that factors such as environmental, educational, economic and social status influence the health status of the population. The MCC has therefore a role to ensure that the natural environment such as air, water and soil quality is protected. A good quality-built environment is also important factor with the design of buildings, sufficient open space, playgrounds, pedestrian and cycle ways among others assisting in achieving the overall goal of promoting a healthy lifestyle.

In terms of pollution control, the importance of a clean environment for the economic and social life of the County is recognised in the Plan. In this regard, continuous effective monitoring and enforcement in relation to pollution control measures is imperative and will continue over the period of the Plan. The Council's role in relation to air is to monitor and promote a reduction in air pollution, through the implementation of relevant legislation and through the provision of advice and guidance on best practice.

In terms of policy, the council seeks to preserve and maintain air quality in the County in accordance with good practice and relevant legislation (**PC POL 1**).

10.3.6 Navan Development Plan 2009-2015 (Variations No.1, No.2 & No.3)

The NDP was adopted by MCC and Navan Town Council on the 2nd and 3rd of November 2009 respectively. The aim of this Plan is to establish a framework for the planned, co-ordinated and sustainable development of Navan and for the conservation and enhancement of its natural and built environment over the Plan period and beyond.

In terms of transportation, a well-developed transport network and improvising accessibility and connectivity is central to the sustainable development of Navan. It is critical that this is balanced across all the various modes of transport by facilitating walking and cycling, the use of public transport and an efficient road network. It also involves reducing overall travel demand in the first instance by prioritising mixed use development and the development of areas in proximity to existing services and facilities. This approach to transport will fulfil social objectives such as reducing isolation by lessening dependence on access to private transport and supports economic activity by promoting easy access to and within Navan. It will also minimize the negative impacts of transport on the local and global environment through reducing localised air pollutants and greenhouse gas emissions.

The NDP 2009-2015 outlines a series of proposed new road schemes planned to support the sustainable development of the town. The Proposed Road Development is identified as one of these road schemes, the development of which is recommended as part of Infrastructure Objective 2(b).

10.4 Description of Receiving Environment

10.4.1 Meteorological Environment

The climate of the region has a significant influence on the spatial and temporal concentrations of air pollutants measured. The nearest representative weather station collating detailed weather records is Dunsany Automatic Weather Station (AWS) in Boycetown County Meath, located approximately 14km south of Navan.

Prevailing wind conditions have a major influence on the levels of receptor exposure to air pollutants, depending upon speed and direction. Within the region, the prevailing wind is from a south–southwest direction, with an average annual speed of approximately 5 m/s, as sourced from https://www.met.ie/climate/.

For most of the year, emissions are easily dispersed, and periods of elevated pollution levels are relatively infrequent. Pollutant concentrations are generally inversely related to wind speed; therefore, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$ - PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} are a non-linear function of wind speed.

10.4.2 National Ambient Air Quality Monitoring Programme 2017-2022

The new National Ambient Air Quality Monitoring Programme (AAMP) will involve a greatly expanded national monitoring network providing enhanced real-time information to the public, supplemented by an additional increased local authority capacity to conduct local monitoring. The network will be supported and augmented by increased modelling and forecasting capability, with the aim of providing an ongoing air quality forecast to the public. Supporting both of these elements will be citizen engagement and citizen science initiatives to encourage greater understanding and involvement of the public in air quality issues. The national AAMP is built around three key pillars:

- a greatly expanded national monitoring network with 38 new automatic monitoring stations, providing enhanced real-time information to the public.
- modelling and forecasting capability, to provide an ongoing air quality forecast to the public; and
- encouraging greater understanding and involvement of the public in air quality issues utilising citizen engagement and citizen science initiatives.

A new national monitoring network will be established which will provide improved spatial coverage across rural and urban centres. The siting of the stations is based on the criteria of population size, vulnerability to air quality issues and spatial distribution. The network of sites will monitor a range of important air quality parameters including particulates, heavy metals, inorganic and organic gases.

There is an increasing awareness of the need for Ireland to develop its capacity and capability in ambient air quality modelling. The programme aims to provide, on a phased basis, the following modelling capability:

- general ambient air quality modelling at urban and regional scales; and
- ambient air quality forecast modelling.

Air quality related citizen engagement and citizen science will be progressed to raise awareness and understanding of air quality issues and encourage individual participation in improving air quality.

The first year of the AAMP is on track to expand the National Monitoring Network by 16 new stations in 2018, as well as upgrades to 10 existing stations to real-time particulate monitoring. These will more than double the number of stations giving real-time information. As part of this, a NO_2 and particulate matter (PM_{10} and $PM_{2.5}$) monitoring station has recently been installed in Navan, with the data soon to be captured and made available to the general public.

10.4.3 Trends in Air Quality

Ambient air quality monitoring is the responsibility of the EPA, with air quality assessment covered by local authorities informed by the national air quality monitoring network. Under the provisions of the EPA Act 1992, the EPA has overall responsibility for the co-ordination of ambient air quality monitoring in Ireland in accordance with EU and national legislation. The most recent annual report on air quality '*Air Quality in Ireland 2017*' (EPA, 2018), details the range and scope of monitoring undertaken throughout Ireland.

As detailed within this report, air monitoring data from 29 stations in the National Ambient Air Quality Monitoring Network was assessed against EU legislative limits and target values for the protection of human health and vegetation.

No levels above the EU legislative limit values were recorded at any of the ambient air quality network monitoring sites in Ireland in 2017. Particulate matter from solid fuel burning remains the greatest threat to good air quality in Ireland. This is closely followed by NO_2 from transport emissions in urban areas.

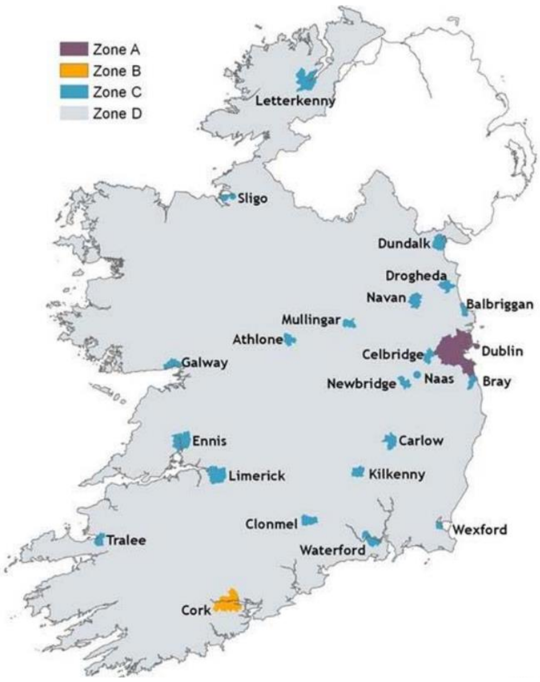


Figure 10-2 Air Quality Management and Assessment Territories for Ireland

Source: 'Air Quality In Ireland 2016' (EPA, 2017)

The Air Quality Framework Directive requires that Member States divide their territory into zones for the assessment and management of air quality. The zones adopted in Ireland are shown in Figure 10-2.. The study area is classified as being within Zone C, which is made up of the 23 large towns in Ireland with a population higher than 15,000.

The air quality in each zone is assessed and classified with respect to upper and lower assessment thresholds, based on the measurements over the previous five years. Upper and lower assessment thresholds are prescribed in the legislation for each pollutant. The number of monitoring locations required is dependent on population size and whether ambient air quality concentrations exceed the upper assessment threshold, are between the upper and lower assessment thresholds, or are below the lower assessment threshold.

10.4.3.1 Pollutants of Concern

10.4.3.1.1 Nitrogen Oxides (NO_x)

Nitrogen Oxides (NO_X) comprise nitric oxide (NO) and nitrogen dioxide (NO_2). The majority of NO_X emitted from vehicles is in the form of NO, which is oxidised in air to produce NO_2. The conversion of NO to NO_2 takes place via reactions with chemically active species, such as ozone.

Elevated NO_2 exposure can lead to health impacts, including respiratory-related issues and liver impacts. NO_2 concentrations are closely associated with traffic volumes. As a result, sensitive individuals including asthmatics, elderly people and children are more susceptible to NO_2 exposure closer to heavily trafficked roads.

Elevated NO_x concentrations impact on ecosystems, contributing to the acidification and eutrophication of soils and water, which can lead to changes in species diversity. NO_x also acts as a precursor to ozone and particulates formation. It can also damage buildings.

As outlined within Table 10-1, the Irish government has adopted two air quality standards for nitrogen dioxide (NO_2):

- an annual mean concentration of 40µg/m^3; and
- a 1-hour mean concentration of 200µg/m^3, to be exceeded no more than 18 times per year.

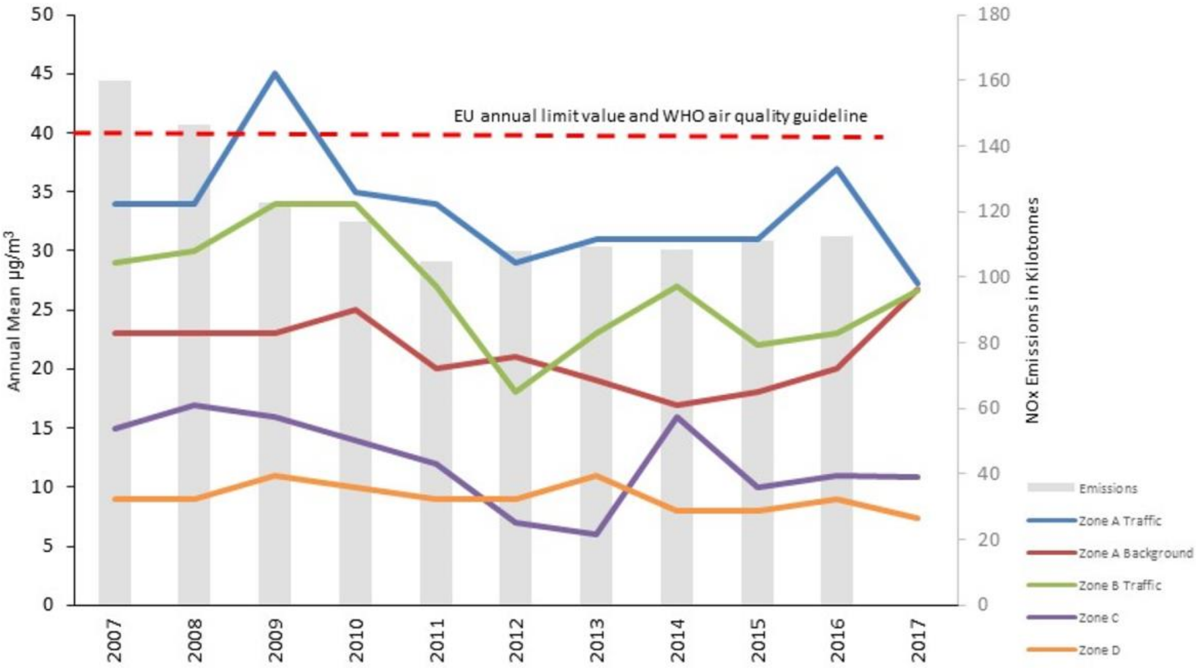


Figure 10-3 Trend in NO_2 concentrations for zones in Ireland 2007 – 2017

Source: 'Air Quality in Ireland 2017' (EPA, 2018)

With reference to the '*Air Quality in Ireland 2017*' (EPA, 2018), NO_2 concentrations were monitored at 14 locations across Ireland in 2017. NO_2 values for all monitoring sites in Ireland were below the EU annual limit value and WHO annual air quality guideline value in 2017, as shown on Figure 10-3 and well below the annual limit value for Zone C.

Figure 10-3 also shows the annual mean NO2 concentrations at monitoring stations from each zone in Ireland from 2007 to 2017 together with NO_x emissions data from 2007 - 2016. Ambient NO_2 has shown a slight downward trend in this period which reflects the downward trend in NO_x emissions, however it must be noted that ambient concentrations in urban areas in Ireland are still close to the EU annual limit value. Increases in traffic or weather conditions unfavourable to dispersion of pollutants could result in exceedances of the limit value at these locations in the future unless mitigation steps are taken.

With reference to Table A19 in the summary section of the '*Air Quality in Ireland 2017*' (EPA, 2018) report, Zone C has been classified as being below the lower assessment threshold for NO_2.

10.4.3.1.2 Particulate Matter (PM_{10})

Particulate matter is composed of a wide range of materials arising from a variety of sources, and is typically assessed as total suspended particulates, or as a mass size fraction. The European air quality standards have historically adopted the PM_{10} standard for the assessment of fine particulate matter. This expresses particulate concentrations as the total mass size fraction at or below an aerodynamic diameter of 10 µm. Particles of this size have the greatest likelihood of reaching the lung. Elevated levels of PM_{10} can cause cardiovascular disease, lung diseases, heart attacks and arrhythmias.

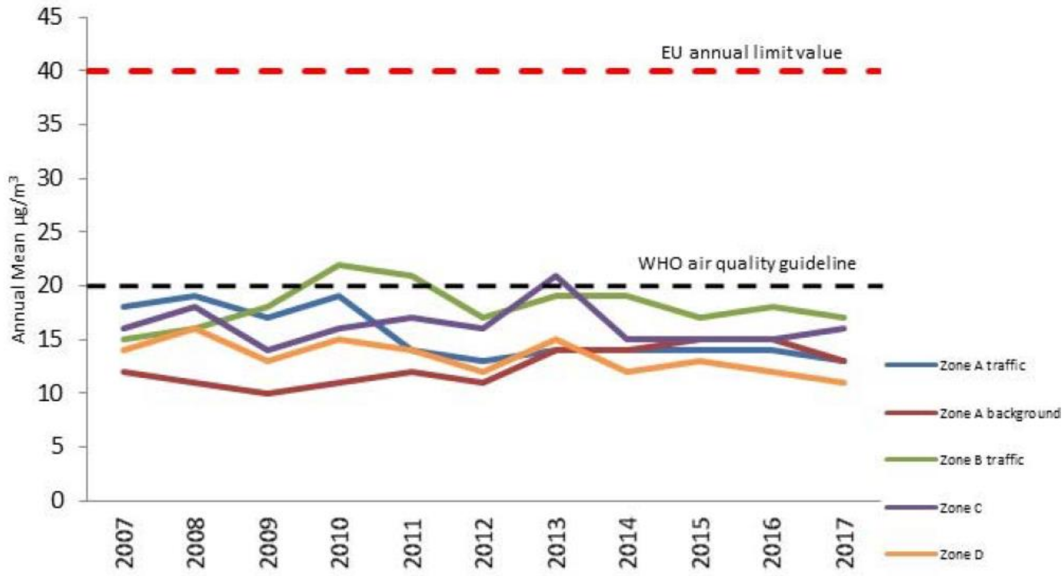


Figure 10-4 Trend in annual mean PM_{10} concentrations for zones in Ireland 2007 – 2017

Source: 'Air Quality in Ireland 2017' (EPA, 2018)

The Irish government adopted two Air Quality Standards for PM_{10}, to be achieved by the end of 2004:

- an annual mean concentration of 40µg/m^3 (gravimetric); and
- a 24-hour mean concentration of 50µg/m^3 (gravimetric) to be exceeded no more than 35 times per year.

With reference to the '*Air Quality in Ireland 2017*' (EPA, 2018), PM_{10} was monitored at 15 stations across Ireland in 2017. Mean concentrations are below the annual limit value of 40µg/m^3 as shown on Figure 10-4. There were also no exceedances of the EU daily limit value.

Figure 10-4 also depicts the trend in PM_{10} annual mean concentration from 2007 to 2017. Concentrations have consistently been hovering around the WHO air quality guideline value over this period. In cities, traffic emissions are the main source of PM_{10}, while in smaller towns or those areas not connected to the natural gas grid, emissions from residential solid fuel combustion dominate. The air quality in cities benefits from increased use of gas in place of solid fuel, and a ban on the use of bituminous coal, with the result that levels of PM_{10} are similar across all zones.

With reference to Table A19 in the summary section of the '*Air Quality in Ireland 2017'* (EPA, 2018) report, Zone C has been classified as being above the lower assessment threshold for PM_{10}.

10.4.3.1.3 Particulate Matter ($PM_{2.5}$)

$PM_{2.5}$ is defined as particulate matter with a diameter of less than 2.5 µm. This fraction is often described as the fine fraction of PM_{10}. This fraction can be further divided into primary and secondary $PM_{2.5}$. The former refers to particles arising directly from combustion sources, predominantly road traffic. Secondary particles are those formed by chemical reactions in the atmosphere following the emission of precursor gases. These are largely composed of sulphates and nitrates. There are theoretical and toxicological arguments, which suggest that $PM_{2.5}$ contains the most toxic component of particulate matter.

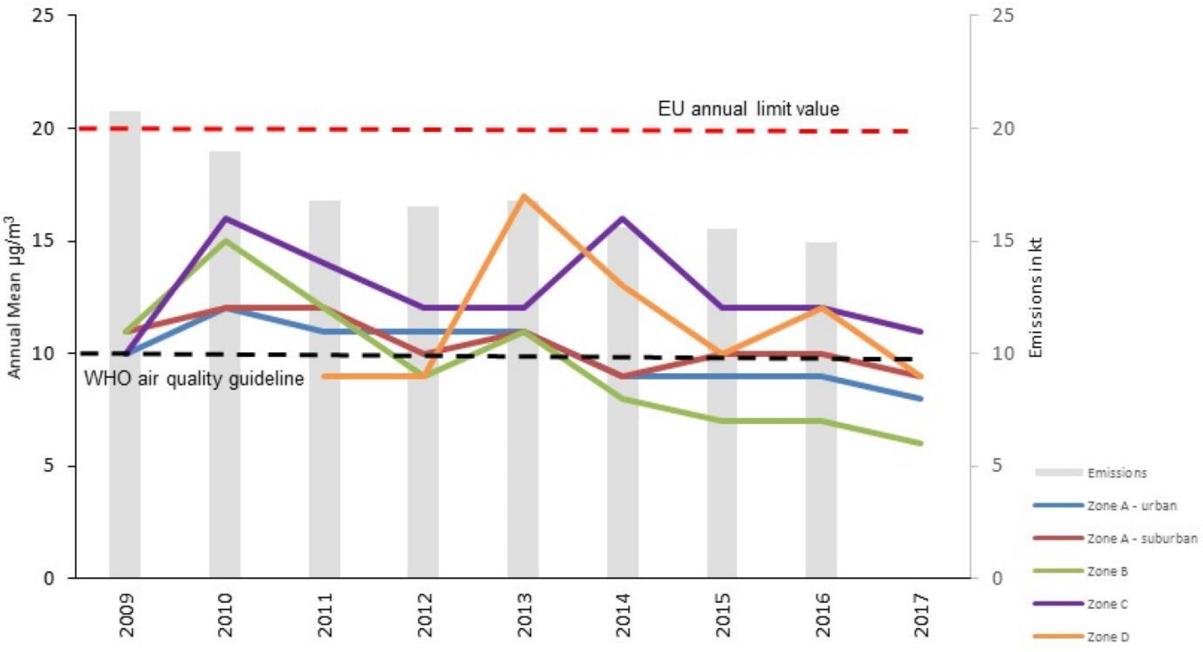


Figure 10-5 Trend in annual mean $PM_{2.5}$ concentrations 2009 – 2017

Source: 'Air Quality in Ireland 2017' (EPA, 2018)

With reference to the '*Air Quality in Ireland 2017*' (EPA, 2018), $PM_{2.5}$ was monitored at nine stations in 2017. All observed concentrations were below the EU annual limit value as shown on Figure 10-5. Whilst there have been historical issues in meeting the WHO air quality guidelines, in terms of demonstrable trends, concentrations were below the annual air quality guideline value at all but one of the monitoring stations in 2017 (Ennis). All nine monitoring stations had exceedances of the daily WHO air quality guideline value. With reference to Table A19: Assessment Zone Classifications of the '*Air Quality in Ireland 2017'* (EPA, 2018) summary report, Zone C has been classified as being below the lower assessment threshold for $PM_{2.5}$.

To date, $PM_{2.5}$ levels in Ireland have been below the EU limit value (25ug/m^3). Trend analysis of historic data at sites containing both PM_{10} and $PM_{2.5}$ show an increase in the ratio of $PM_{2.5}$ to PM_{10}. This suggests that human activities are leading to an increase in the amount of $PM_{2.5}$ measured. This increase could be due to a number of different sources, given the variety of sources that contribute. As the economy continues to recover, increased emissions are expected from the commercial, industrial, and agriculture sectors. Under the National Emissions Reduction Target (NERT) set for each country by the European Commission, Ireland's obligation is to decrease $PM_{2.5}$ concentrations by 10% by 2020. The timely implementation of sectoral emission reduction polices will be key to achieving this target.

10.4.3.2 Ambient Air Monitoring

An assessment of air quality was carried out in Navan town by the EPA, from 26th April 2007 until 28th February 2008. No limit values were exceeded during the measurement period.

Concentrations of carbon monoxide, nitrogen dioxide, sulphur dioxide, benzene and lead were below their respective lower assessment thresholds. Concentrations of PM_{10} exceeded the upper assessment threshold for this pollutant.

10.4.3.3 Site Specific Ambient Air Monitoring

As noted within the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes'* (Revision 1, May 2011), it is important to accurately define baseline air quality conditions for the EIAR. Information collated for the Route Selection and Design Phases should be reviewed, and the requirement to undertake any additional monitoring to support the EIAR should be reassessed.

Site-specific monitoring of NO_2 levels was undertaken at various locations within the study area, as shown on Figure 10.1 in Volume 3. This was undertaken to identify existing pollutant trends and to provide useful information on the spatial variation of concentrations within the urban and suburban elements of the study area.

Passive diffusion tubes were used to assess the existing ground level concentrations of NO_2. Monitoring was carried out over a three-month period at four locations. At each location, levels of NO_2 were measured using a specially prepared diffusion tube with adsorbent material. The tubes were then analysed using UV spectrophotometry, at a United Kingdom Accreditation Service (UKAS) accredited laboratory (Enviro Technology Services, Gloucestershire), giving an average concentration over the exposure period. The results are included in Table 10-6 below.

Table 10-6 Results of NO_2 Diffusion Tube Monitoring for the Proposed Abbeyland Navan Local Distributor Road 4 Scheme (15/08/18 - 13/11/18)

Location	Description	NO_2 Concentration (µg/m^3)				
		Aug-Sept	Sept-Oct	Oct-Nov	Measured Average	Calculated annual average concentration
A1	On N51, adjacent to roundabout junction with R147, at OPW building	22.52	23.68	36.51	**27.57**	**31.52**
A2	At T-junction intersection of Ratholdron Road and Clonmagadden Road (L34094)	11.36	13.01	21.02	**15.13**	**17.3**
A3	Adjacent to the playing field in Blackwater Park	7.45	8.87	15.17	**10.5**	**12.0**
A4	On N51, north of bridge over River Blackwater	17.99	20.38	25.10	**21.16**	**24.2**

Notably, all NO_2 concentrations measured over the three-month period were well below the annual limit value. As expected, the results from the site-specific monitoring indicated a typical spatial variation of lower concentrations away from the more heavily trafficked road network (i.e. within the suburban/greenfield areas) and higher concentrations were measured closer to the more heavily trafficked road network (i.e. within the town centre along the N51 road corridor), as shown within Table 10-6.

TII consider that additional monitoring surveys for NO_2, PM_{10} and $PM_{2.5}$ are likely to be required for the EIAR, unless there are adequate data already available, and/or it can be confidently demonstrated that the pollutant concentrations are well below the air quality standards/limit values (well below can be taken to be <75% of the relevant standard). As detailed throughout Sub-Section 10.4.3, based on a review of the data available for this project and the wider area (i.e. Zone C), it has been confidently demonstrated that pollutant concentrations on average are well below the air quality standards/limit values and thus do not warrant additional monitoring surveys.

10.4.4 Climate

With reference to the EPA 2019 GHG Emissions Projections Report, 2019 greenhouse gas emissions projections show total emissions increasing from current levels by 1% and 6% by 2020 and 2030 respectively under the With Existing Measures scenario. Under the With Additional Measures emissions are estimated to decrease by 0.4% and 10% by 2020 and 2030 respectively.

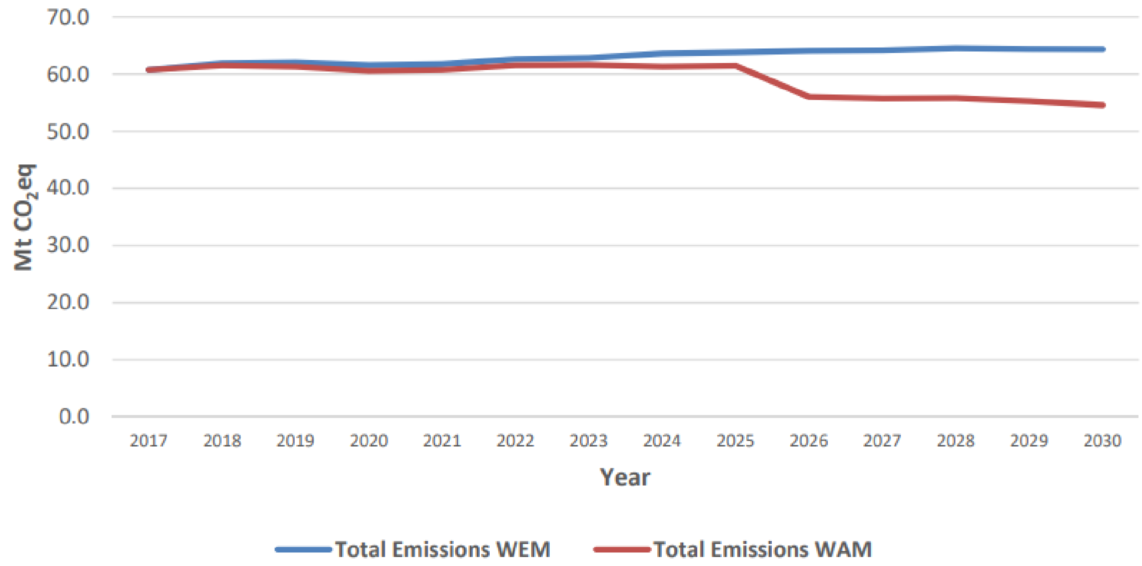


Figure 10-6 Total Greenhouse Gas Emissions under the With Existing Measures (WEM) and With Additional Measures (WEM)

Source: 'EPA 2019 GHG Emissions Projections Report'

Transport contributes to 21% of these emissions. The main source of emissions from the transport sector is road transportation, accounting for approximately 96% of emissions in 2017. Freight transport energy demand is strongly influenced by the level of commercial activity in the economy. Personal transport energy demand is influenced by both the level of employment as well as the oil price.

Under the With Existing Measures scenario, transport emissions are projected to increase by 8% over the period 2018 – 2020 to 12.9 Mt CO2eq and 11% over the period 2018-2030 to 13.3 Mt CO2eq.

The main policy instruments impacting transport emissions are the Biofuels Obligations Scheme and uptake of electric vehicles, with biofuels having the most impact. The Biofuel Obligation Scheme places an obligation on fuel suppliers to blend an increasing percentage of biofuel with their fuel. In terms of biofuels used in road transport fuel in the With Existing Measures Scenario it is assumed that the statutory target remains at current level of approximately 9%. In terms of Electric Vehicles, the With Existing Measures scenario assumes approximately 250,000 Electric Vehicles on the road by 2030 which is assumed to comprise 75% battery electric vehicles and 25% plug in hybrid electric vehicles. This is in line with the assumptions agreed during the preparation of the energy projections16.

Under the With Additional Measures scenario, transport emissions are projected to increase by 6% over the period 2018 – 2020 to 12.6 Mt CO2eq and decrease by 1% over the period 2018-2030 to 11.8 Mt CO2eq.

For the With Additional Measures scenario, it is assumed that the Biofuel Obligations Scheme places a statutory target of approximately 11% from 1 January 2019 on fuel suppliers and approximately 12% from 1 January 2020. Blending levels reaching a 10% blend of ethanol and gasoline (E10) and a 12% blend of biodiesel (B12) by 2030 with statutory blend increasing in two-year increments are assumed. This scenario also assumes 500,000 Electric Vehicles on the road by 2030, as outlined in the National Development Plan, with 75% comprising battery electric vehicles and 25% plug in hybrid electric vehicles.

Other key policies and measures assumed in the transport emissions projections include Vehicle Registration Tax and Motor Tax Rebalancing which have less impact compared to the biofuels over the longer term.

Figure 10-7 below shows the projected trend in emissions from the transport sector out to 2030 under the With Existing Measures and With Additional Measures scenario. The graph also shows a sensitivity assessment performed on the With Existing Measures scenario which is based on lower fuel prices. This has the impact of significantly increasing energy demand and associated emissions from the sector (by approximately 29 Mt CO2eq over the 2018-2030 projected period).

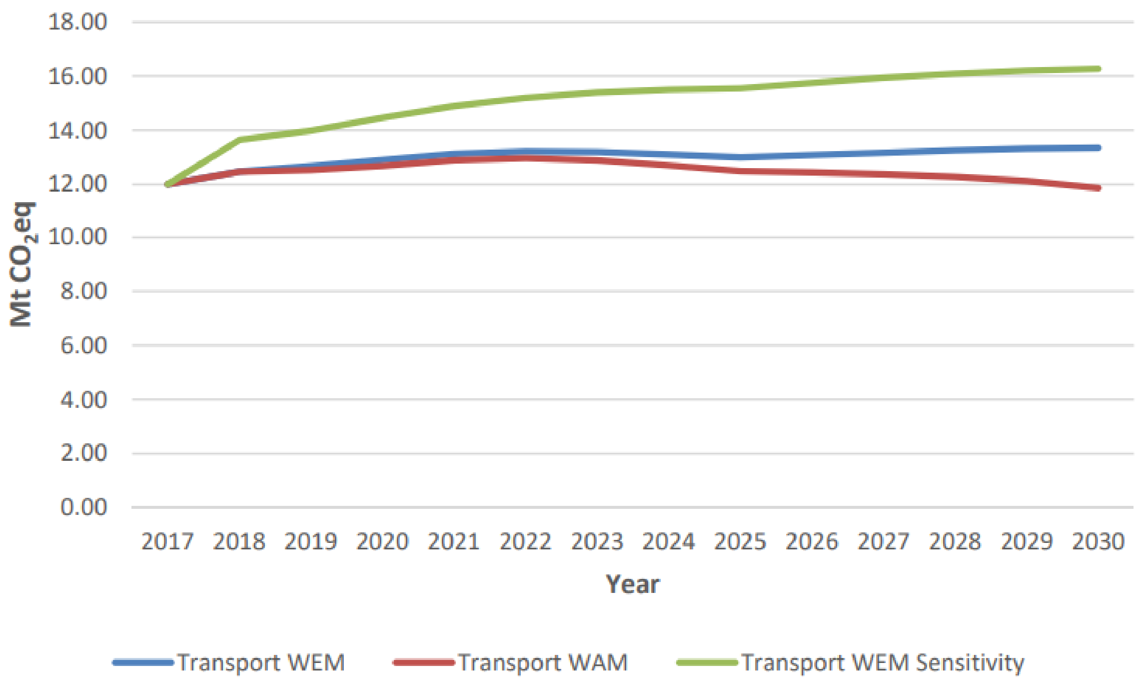


Figure 10-7 Greenhouse Gas Emissions Projections from the Transport Sector under the With Existing Measures (WEM) and With Additional Measures (WAM) scenario out to 2030, including a sensitivity assessment for the WEM scenario based on lower fuel prices

Source: 'EPA 2019 GHG Emissions Projections Report'

As noted previously, the regional air quality assessment seeks to establish the total and change in emissions that would result with the Proposed Road Development to identify the concentration of pollutants that contribute to a wider spread decline in air quality, such as acid rain deposition or an enhancement of the natural greenhouse effect.

Estimates are made for (a) 'Base Year' (2017), (b) 'Do-Minimum' and 'Do-Something' scenarios in the assumed 'Opening Year' (2022), and (c) 'Do-Minimum' and 'Do-Something' scenarios in the 'Design Year' (2037) for the total emissions of CO, THC, NOx, PM_{10} and C.

With reference to the Ireland 2019 Greenhouse Gas Emissions Projections 2018-2040 (kt co_2 eq), the projections are as follows for the range of assessment scenarios;

- Base Year' (2017): 12470.81 kt co_2 eq;
- Opening Year (2022): 13215.71 kt co_2 eq: and
- Design Year (2037): 12890.34 kt co_2 eq.

10.4.5 The Built & Natural Environment

The town of Navan is located in central County Meath. It is situated along the N51 National Secondary Road (Kells Road), which links Navan to the M3 Motorway, southwest of the town. This dual/single carriageway road is a main arterial route into Navan from the southwest, providing a direct link through the town and to the northwest, towards Slane. The R147 regional route converges on the N51 from the southeast, which links Navan to Kells. Within Navan itself, the road forms a single carriageway, with numerous entrances to private dwellings and businesses.

As Navan is a key service centre in County Meath, a number of routes converge upon the town centre, including the N51, R147 (as mentioned previously), and R161. These roads consequently covey the highest traffic flows within the town. Some of the busiest points on the network are around the bridges crossing the River Boyne and River Blackwater. There are three crossings of the River Boyne (via the R153, Bóthar Sion, and R147), and two crossings of the River Blackwater (via the N51 and Flowerhill (R161/R162)). As Flowerhill is a one-way street, the N51 provides the only southbound crossing of the River Blackwater in the locale. As a result, Navan currently experiences traffic congestion issues within the town centre, and at the associated river crossing points.

In relation to the study area, Navan town centre lies to the southeast, the town's main residential area lies to the east and north, agricultural lands identified in the development plan for future development lie to the west and Tara

Mines to the southwest. To the south, the area is considerably more mixed use, including pockets of residential development, health facilities such as Our Lady's Hospital, educational facilities such as St Patrick's Classical School, recreational facilities such as the Meath County GAA ground and small pockets of commercial development.

The study area is predominantly greenfield (improved grassland and parkland). The surrounding land use in the immediate environs of the study area includes residential, industrial and commercial areas, and a public amenity area. The recently developed Blackwater Park amenity site shall not be considered usable lands for the purposes of the road development and encroachment upon the amenity zone, if needed, will be minimised with the objective of avoiding any impact on recently constructed or planned facilities.

The River Blackwater is located within the southern extent of the study area, bisecting it from west to east, acting as a linear constraint, before its confluence with the River Boyne to the east. The River Blackwater at this location is part of the River Boyne and River Blackwater SPA and SAC.

Mature trees and hedgerows are spread across the site, typically along field boundaries and close to the River Blackwater. The western boundary of the study area runs along a disused branch line from the Dublin - Navan railway line. This is currently reserved for future re-development and opening, as highlighted in the NDP under Infrastructure Objective 22. Housing developments and a disused historical mill, line the eastern edge.

In the very southern portion of the study area is a small residential area at Blackwater Park, which is contained by two commercial areas to its immediate east and west and is bounded by the R147 Kells Road and N51 to the south.

A summary of the surrounding environs is provided below.

10.4.5.1 North and North East

- Aura Leisurelink Navan is located approximately 130m north of the Proposed Road Development site;
- Scoil Naomh Eoin is located approximately 495m north of the Proposed Road Development site; and
- Residential estates dominate the land use to the north of the Proposed Road Development site.

10.4.5.2 East

- Blackwater Park (a public amenity park) is located within the Proposed Road Development site, the Proposed Road Development follows the western boundary of Blackwater Park;
- Additional residential housing estates are also located to the east of Blackwater Park.

10.4.5.3 West

- Agricultural pasture lands occur to the west of the Proposed Road Development site;
- The rail line between Navan and Kingscourt is also located to the west of the Proposed Road Development site.

10.4.5.4 South

- The River Blackwater is located within the Proposed Road Development site;
- St Patricks Classical School is located approximately 180 m south of the Proposed Road Development site;
- The Balmoral Industrial Estate is located approximately 185 m south of the Proposed Road Development site;
- Blackwater Retail Park is located approximately 192 m southwest of the Proposed Road Development site;
- Tara mines is located approximately 390 m southwest of the Proposed Road Development site;
- Navan town is located to the southeast of the Proposed Road Development.

10.4.5.5 Traffic Congestion

As noted previously, Navan currently experiences significant traffic congestion at a number of junctions within the town centre, and the associated crossing points of the River Blackwater. Due to the layout of Navan town and constraint of the rivers, there are very few cross-town routes beyond the main N51, R147, and R161.

The main junctions showing delays (primarily during peak periods) are in the vicinity of these bridges and the town centre. They include:

- N51 Bothar Beaufort / R147 Kells Road / Abbey Road / N51 Kells Road (AM & PM peaks);

- R147 Kells Road / R153 Kentstown Road / Market Square (AM & PM peaks);
- R161 Circular Road / R896 / Academy Street (PM peak only);
- N51 / R147 Kells Road (PM peak only); and
- R147 Dublin Road / Springfield Glen (AM & PM peaks).

There are relatively few delays throughout the day in other areas across the network. Further away from Navan town centre, delays are evident around the R147 / Old Balreask Woods (AM peak only) to the south east of the town.

10.4.5.6 Selected Sensitive Receptors

10.4.5.6.1 Receptors potentially affected by operational emissions

The concentration of pollutants associated with road traffic at the roadside or at sensitive receptors is influenced by a number of factors. These include background pollution levels and the amount of traffic emissions, which is dictated by traffic flow rates, composition and speed, which is in turn influenced by engine size, fuel type and type of vehicle (bus, car etc.).

All receptors that represent exposure of the public are of equal sensitivity, as any member of the public could be present at those locations over timescales that are relevant to an air quality objective. For example, an hourly mean objective would be relevant for a public building, but an annual mean value would not.

Impacts from Base Year (2017) road traffic emissions have been quantified at 11 existing representative receptors in the vicinity of the Proposed Road Development and existing route, the majority of which are residential. The receptors are listed in Table 10-7 and their location is shown on Figure 10.1 (Air Quality Receptors & Monitoring Locations) in Volume 3.

Table 10-7 Selected Sensitive Receptors

Receptor	Location	Irish Transverse Mercator Grid Reference	
		Easting	Northing
R1	10 Windtown Crescent	686115	769163
R2	Saint Patricks, Abbeylands, Ratholdren Road	686036	767752
R3	Blackwater Park Playground	686200	768847
R4	43a Silverlawn	686394	768845
R5	15 Abbeyville	686374	768923
R6	13 Blackwater Drive	686856	768502
R7	10 Flower Hill	687178	768144
R8	1 Dean Cogan Place	686174	767967
R9	1 Blackwater Park	686031	768043
R10	6 Blackwater Park	685979	768047
R11	12 Blackwater Park	685919	768053

10.4.5.7 Receptors potentially affected by emissions from construction phase works

When assessing the impact of particulate matter emissions, generated during construction works, receptors are defined as the nearest potentially sensitive receptor to the boundary of the site in each direction. These receptors have the potential to experience impacts of greater magnitude due to emissions of particulate matter generated by the works, when compared with other more distant receptors, or less sensitive receptors.

10.4.5.8 Local Air Quality

Baseline conditions for current year, as well as future construction and operational years, have been predicted at each receptor to allow for comparison between the future Do-Minimum scenarios and the Do-Something scenarios. The predicted pollutant concentrations for the 2017 Base Year scenario are shown in Table 10-8.

Table 10-8 Current (2017) Base Year scenario predicted pollutant concentrations

Receptor	Location	Predicted Annual Mean Concentration (µg/m^3)			Number of exceedances of 24-hour PM_{10} limit (days)
		NO_2	PM_{10}	$PM_{2.5}$	
R1	10 Windtown Crescent	8.43	10.84	7.10	0
R2	Saint Patricks, Abbeylands,	8.17	10.80	7.06	0
R3	Blackwater Park Playground	7.83	10.72	6.99	0
R4	43a Silverlawn	8.76	10.93	7.18	0
R5	15 Abbeyville	8.87	10.95	7.20	0
R6	13 Blackwater Drive	10.39	13.10	9.14	0
R7	10 Flower Hill	11.1	13.27	9.29	0
R8	1 Dean Cogan Place	12.49	11.86	8.02	0
R9	1 Blackwater Park	13.28	12.00	8.14	0
R10	6 Blackwater Park	9.7	11.19	7.41	0
R11	12 Blackwater Park	9.19	11.07	7.31	0

Under 'Base Year' (2017) conditions, all airborne contaminants screened at the various receptor locations fall well below the Air Quality Standard Limit Values for the protection of human health. They also fall below the lower assessment thresholds for all pollutants of concern.

As expected of the receptor sites selected, the lowest pollutant concentrations experienced would be away from the main road network (i.e. R3 Blackwater Park Playground). This is due to the fact that pollution concentration is related specifically to distance from the emission source, as increasing distance relates to the diminishing contribution that vehicle emissions make to local air pollution. Beyond 200m, the contribution of vehicle emissions from the roadside to local pollution levels is not significant and remains largely at background levels.

As expected, the locations with the highest NO_2, PM_{10} and $PM_{2.5}$ levels are those in closest proximity to the existing routes that convey the higher volumes of traffic through the town, namely Receptors R6 and R7. As noted previously, Navan currently experiences significant traffic congestion at a number of junctions within the town centre, and the associated crossing points of the River Blackwater. Due to the layout of Navan town and constraint of the rivers, there are very few cross-town routes beyond the main N51, R147, and R161. This has been reflected in the predicted pollutant concentrations, though the levels still remain well within the Air Quality Standard Limit Values.

Within the study area, there is a noticeable difference in local air quality between the northern portion of the study area and the southern, with latter experiencing slightly worse conditions. Again this is reflective of the higher volumes of traffic and layout of the existing road network through this part of Navan and the convergence of the N51 National Secondary Road (Kells Road), which links Navan to the M3 Motorway, southwest of the town.

The predicted pollutant concentrations for the 2022 Do-Minimum scenario are shown in Table 10-9.

Table 10-9 Year (2022) Do-Minimum Scenario annual mean pollutant concentrations

Receptor	Location	Predicted Annual Mean Concentration (µg/m^3)			Number of exceedances of 24-hour PM_{10} limit (days)
		NO_2	PM_{10}	$PM_{2.5}$	
R1	10 Windtown Crescent	8.10	10.56	6.83	0
R2	Saint Patricks, Abbeylands,	7.89	10.52	6.79	0
R3	Blackwater Park Playground	7.55	10.44	6.72	0
R4	43a Silverlawn	8.48	10.65	6.91	0
R5	15 Abbeyville	8.61	10.68	6.94	0
R6	13 Blackwater Drive	10.07	12.82	8.86	0
R7	10 Flower Hill	10.70	12.97	8.99	0
R8	1 Dean Cogan Place	12.39	11.65	7.81	0
R9	1 Blackwater Park	13.16	11.81	7.96	0
R10	6 Blackwater Park	9.29	10.91	7.15	0
R11	12 Blackwater Park	8.80	10.78	7.03	0

The predicted annual mean concentrations for the 2022 Do-Minimum scenario show that no receptor is predicted to experience an exceedance of any of the Air Quality Standard Limit Values for the protection of human health. The decrease in concentrations when compared to the 2017 Base Year is as a result of the limits set on the allowable emissions from the exhaust of individual vehicle types, supported by the introduction of regulations on the formulation and quality of road fuels. The adopted methodologies for compliance with this legislation has itself been twofold, with the development of improved engine technology, such as modifications to the engine map, and exhaust after-treatment systems including three-way catalysts; oxidation catalysts; exhaust gas recirculation; selective catalytic reduction; de-NOX traps; diesel particulate filters; and regenerative traps. These concentrations would however be adversely influenced by predicted changes in traffic flow and growth.

The predicted pollutant concentrations for the 2037 Do-Minimum scenario are shown in Table 10-10.

Table 10-10 Year (2037) Do-Minimum Scenario annual mean pollutant concentrations

Receptor	Location	Predicted Annual Mean Concentration (µg/m^3)			Number of exceedances of 24-hour PM_{10} limit (days)
		NO_2	PM_{10}	$PM_{2.5}$	
R1	10 Windtown Crescent	8.26	10.52	6.77	0
R2	Saint Patricks, Abbeylands,	7.46	10.36	6.63	0
R3	Blackwater Park Playground	7.09	10.27	6.55	0
R4	43a Silverlawn	8.39	10.57	6.82	0
R5	15 Abbeyville	8.21	10.54	6.79	0
R6	13 Blackwater Drive	10.33	12.87	8.88	0
R7	10 Flower Hill	10.92	13.01	9.01	0
R8	1 Dean Cogan Place	12.84	11.81	7.93	0
R9	1 Blackwater Park	13.39	11.95	8.06	0
R10	6 Blackwater Park	9.13	10.83	7.05	0
R11	12 Blackwater Park	8.55	10.67	6.91	0

The predicted results for the 2037 Do-Minimum scenario show that no receptor is predicted to experience an exceedance of any of the national limits for the pollutants of concern. Again, the change in concentrations when compared to the 2017 Base Year is due to predicted changes in traffic flow and expected improvements in engine technology, leading to lower concentrations (as described above).

10.4.5.9 Regional Air Quality

The regional air quality emission levels for the current Base Year and future Do-Minimum years have been predicted and are presented in Table 10-11.

Table 10-11 Regional Emissions in Current (2017) Base Year, Opening Year (2022) and Design Year (2037) Do-Minimum Scenarios

Year	C* (tonnes/year)	CO (Kg/year)	THC (Kg/year)	NOx (Kg/year)	PM_{10} (Kg/year)
2017	909	16,766	1,953	5,018	190
2022	951	17,506	2,079	5,409	201
2037	1,290	24,245	2,856	7,044	275

carbon bound in the emitted pollutants (carbon dioxide, carbon monoxide, hydrocarbons and particulate matter).

The results from the Base Year and Do-Minimum scenarios show that there is a predicted increase in all pollutants over the range of assessment periods. The changes in emissions are obviously influenced by changes in traffic flow, composition and speed as a consequence of anticipated growth within Navan. This represents an absolute worst-case scenario, in that no additional measures would be implemented to decrease in emissions over the longer term, such as the accelerated deployment of 500,000 electric vehicles and the impact of greater biofuel uptake.

10.4.5.10 Air Quality Impacts on Sensitive Ecosystems

As well as impacts on human health, some air pollutants also have an effect on vegetation. Concentrations of pollutants in air and deposition of particles can damage vegetation directly, or affect plant health and productivity. Deposition of pollutants to the ground and vegetation can alter the characteristics of the soil, affecting the pH and nitrogen availability that can then affect plant health, productivity and species composition. Increased greenhouse gas emissions on a global scale can affect the climate, such that the ability of existing species to tolerate local conditions can change.

The pollutant of most concern for sensitive vegetation near roads is NO_x, with a set EU limit value of 30µg/m^3 (annual mean) forming the critical load level for designated conservation sites. NO_x is composed of Nitric oxide (NO) and its oxidation product NO_2. The latter is taken up by plants principally through their stomata. Concentrations of NO_2 are higher close to roads, so vegetation in these areas is exposed to a larger source of Nitrogen (N).

Critical loads for the deposition of nitrogen, which represent the exposure below which there should be no significant harmful effects on sensitive elements of the ecosystem (according to current knowledge), have been established for certain habitats dependent on low nitrogen levels. Critical loads are expressed in deposition units of kg N ha^{-1} year^{-1}.

The NRA guidelines state that as the potential impact of a project is limited to a local level, detailed consideration need only be given to roads where there is a significant change to traffic flows (>5%) and the designated site lies within 200m of the road centre line. Designated sites with the potential to be affected at a local scale were identified within 200m of the existing route and Proposed Road Development, and assessed in accordance with the methodology set out in DMRB 11.3.1, Annex F.

As shown on Figure 10.1 in Volume 3, the works area would cross the River Blackwater which is designated as a SAC and SPA. The River Boyne and River Blackwater SAC is selected for the following habitats, Alkaline Fens, Alluvial Forests, River Lamprey (*Lampetra fluviatilis*), Atlantic Salmon (*Salmo salar*) and Otter (*Lutra lutra*). The SAC covers a large area, and is situated within Counties Cavan, Louth, Meath and Westmeath. However, both designations are congruent within the study area.

With reference to Table A9.1: UNECE (2003) Critical Loads for Nitrogen from Appendix 9: Impacts upon Sensitive Ecosystems of the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*' (Revision 1, May 2011) no critical loads for this vegetation has been identified. On this basis, a critical load level of 10 - 20 kg N ha^{-1} year^{-1} has been considered appropriate, based on similar vegetation types.

As noted earlier, NO_x concentrations and Nitrogen Deposition rates are calculated in a transect up to 200m away from each of the affected roads within or near the designated site. The annual mean NO_x concentrations and road contribution to Nitrogen Deposition rates at the designated site for 'Base Year' (2017) has been summarised in Table 10-12.

Table 10-12 Annual mean NOx concentrations and Road Contribution to Nitrogen Deposition rates at River Boyne and River Blackwater SAC for 'Base Year' (2017) within 200m of the existing route

Distance from Road (m)	NO_x annual mean ($\mu g/m^3$)	Road Contribution to Nitrogen Deposition (N) (kg N ha^{-1} $year^{-1}$)
20m	20.44	1.337
30m	18.24	1.22
40m	16.63	1.133
50m	15.42	1.068
60m	14.48	1.017
70m	13.74	0.976
80m	13.15	0.944
100m	12.68	0.918
120m	12.31	0.898
140m	12.02	0.882
160m	11.79	0.869
180m	11.62	0.86
200m	11.50	0.853

Under 'Base Year' conditions, the predicted levels of NO_x (the pollutant of most concern) varies throughout the study area, however in all cases falls well within the set EU critical load level of 30µg/m^3. As expected, the higher NO_x levels are experienced closer to the existing N51 route and the highest levels are reflective of the proximal volume of traffic using that particular stretch of road. The road contribution to the NO_2 dry deposition rate along the 200m transect is also well within the critical load level of 10 - 20 kg N ha^{-1} $year^{-1}$.

10.5 Assessment of Impacts

10.5.1 Construction Phase

Emissions from the construction phase are transient in nature and would include emissions from vehicles and plant, and dust-raising activities from earthworks and construction processes utilising concrete and aggregates. Dust and air pollution, including odours, can cause disruption to properties and the public adjacent to the construction works, and can also have adverse impacts upon other environmental receptors, including watercourses and ecologically designated sites.

To define the sensitivity of the area to these emissions, the following factors are taken into account:

- the specific sensitivities of receptors in the area;
- the proximity and number of those receptors;
- in the case of PM_{10}, the local background concentration; and
- site-specific factors, such as whether there are natural shelters, such as trees, to reduce the risk of wind-blown dust.

10.5.1.1 Construction Phase Road Traffic Emissions

It is envisaged that construction of the Proposed Road Development will be procured as a single construction contract lasting up to two years.

In terms of construction phase road traffic emissions, pre-construction works may include services and utilities diversions, particularly the high voltage electricity overhead cables crossing the mainline between Ch. 0+400 and 0+500 (approx.), but may also include other electricity, gas mains, telecommunications, water mains and other sanitary services. Advanced tree clearance, hedgerow clearance, archaeological testing and resolution, ground investigation and fencing contracts may be undertaken as these activities are dependent on the anticipated seasonal timing of the award of the main contract. These, however, are not likely to give rise to road traffic emissions that are likely to result in a perceptible deterioration in local air quality over a prolonged period of time during the construction phase.

The main works would consist predominantly of the construction of the River Blackwater bridge, in conjunction with earthworks and road pavement construction. The earthworks construction would involve the excavation and placement of materials for the construction of embankments as well as the hauling and importation of materials to complete the road formation and sub-formation. Materials for road construction would typically include gravels, crushed rock, bituminous pavement and surfacing materials. The construction of the bridge structure would involve the delivery of beams, reinforcement, concrete and granular fill materials. In addition to the structure, earthworks and pavement construction, the main activities would 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 construction of noise bunds and barriers, 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.

The use of construction plant itself, would result in generation of pollutants in the form of exhaust emissions including, but not limited to, NO_x, carbon monoxide, sulphur dioxide, particulate matter (including PM_{10} and $PM_{2.5}$), volatile organic compounds (VOCs) and PAHs. Consequently, during construction works, the levels of these pollutants would increase in the immediate vicinity of the plant during use. In terms of construction phase road traffic emissions, it is envisaged that as 1.15km of the mainline is entirely offline through a greenfield site (agricultural land), it can be constructed without significant effects upon the existing road network. On this basis, construction phase road traffic is unlikely to result in a perceptible change in local air quality and obviously, any changes that may be experienced would be transient in nature. The changes in emissions due to such traffic movements are not expected to be greater than those reported for the Opening Year (2022) Do-Something scenario and the effects are considered to be not significant.

10.5.1.2 Construction Dust Emissions

As with the majority of construction projects of this type, the early phases of the works would involve excavations and earthworks, temporary stockpiling of potentially dusty materials and use of unsurfaced haul roads. These activities are likely to be the principal sources of dust during these early phases.

During the middle phases (when the structures are being built), the principal sources of dust are likely to be from cutting and grinding of materials and the movement of construction plant and road vehicles.

The latter phases (when the majority of the structures and infrastructure are largely complete) would involve landscaping and finishing works. The principal sources of dust during these phases would include storage, handling and movement of materials generated during the associated earthworks.

The receptors close to the Proposed Road Development works area that may potentially be adversely affected are residential properties, particularly those situated within Windtown Crescent, Ratholdron Road, and Blackwater Park. The potential impacts considered at receptors in close proximity to the works area are:

- Effects on amenity and property including changes to the rate of deposition of particulate matter onto glossy surfaces and other property/materials; and
- Changes in 24-hr mean concentrations that might increase the risk of exposure to PM_{10} at levels which could exceed the 24-hr air quality limit values.

10.5.1.3 Sensitivities of People to Dust-Soiling Effects

The type of receptors at different distances from the site boundary or, if known, from the dust-generating activities, should be included. Consideration also should be given to the number of ‘human receptors’. Judgement is used to determine the approximate number of receptors (a residential unit is one receptor) within each distance band.

At this stage, it is possible to give an approximate indication of the likely number of dust sensitive receptors that may be disrupted due to construction, as outlined in Table 10-13 below.

Table 10-13 Number of dust sensitive receptors within 200m of the Proposed Road Development

Distance Band	Dust Sensitive Receptors	Other Sensitive Receptors
0-20	7	River Blackwater SAC
20-50m	16	-
50-100m	82	-
100-200m	291	Blackwater Park (playground)
TOTAL	**396**	**2**

As detailed previously, the study area centres on Abbeyland which serves as a valuable and diverse area of landscape and ecological importance. The study area forms a locally distinctive landscape to the west of the town. The main existing land uses that surround the road corridor are amenity and residential. Blackwater Park is the predominant land use which is considered a valuable area of active open space and recreation for Navan. It includes grassed open space areas, children's playground, parking area, and playing field.

As noted previously, receptors close to the Proposed Road Development works area that may potentially be adversely affected are residential properties, particularly those situated within Windtown Crescent, Ratholdron Road, and Blackwater Park, however as reflected in Table 10-13, very few are in close proximity to the works area, the closest being at the tie-ins with the existing road network (north and south).

On this basis, it is reasonable to expect that users within the area currently enjoy a high level of amenity, and that the appearance, aesthetics or value of adjacent properties would be diminished by potential soiling; and people or property would reasonably be expected to be present continuously, or at least regularly for extended periods, as part of the normal pattern of use of the land. As such, the receptors in this area, particularly those within 20 m of the scheme (through there are comparatively few), are deemed to be of high sensitivity to dust soiling impacts. Those within 50 m would be of a medium sensitivity and those beyond of a low sensitivity.

10.5.1.4 Sensitivities of People to the Health Effects of PM_{10}

For the sensitivity of people to the health effects of PM_{10}, the IAQM recommends that the sensitivity of the receptor is considered in relation to whether it is likely to be exposed to elevated concentrations over a 24-hour period.

Whilst there would be approximately seven properties less than 20m from the works area, it is considered that at worst they would be of medium sensitivity to the health effects of PM_{10}, as the estimated background pollutant levels of PM_{10} in the Navan area is well below the relevant PM_{10} Air Quality Standard for the protection of human health, so the risk is generally low. With increasing receptor distance from the works, the sensitivity of people to the health effects of PM_{10} would reduce to low.

10.5.1.5 Sensitivities of Receptors to Ecological Effects

Dust deposition due to earthworks, construction and trackout has the potential to affect sensitive habitats and plant communities. Dust can have two types of effect on vegetation: physical and chemical. Direct physical effects include reduced photosynthesis, respiration and transpiration through smothering. Chemical changes to soils or watercourses may lead to a loss of plants or animals, for example via changes in acidity. Indirect effects can include increased susceptibility to stresses such as pathogens and air pollution. These changes are likely to occur only as a result of long-term demolition and construction works adjacent to a sensitive habitat. Often impacts will be reversible once the works are completed, and dust emissions cease.

As shown on Figure 10.1 in Volume 3, the works area would cross the River Blackwater is designated as a Special Area of Conservation (SAC) and Special Protection Area (SPA). The River Boyne and River Blackwater SAC is selected for the following habitats, Alkaline Fens, Alluvial Forests, River Lamprey (*Lampetra fluviatilis*), Atlantic Salmon (*Salmo salar*) and Otter (*Lutra lutra*). The SAC covers a large area, and is situated within Counties Cavan, Louth, Meath and Westmeath. The SPA designated is due to the presence of Kingfisher (*Alcedo atthis*), but the site is not as extensive as the SAC. However, both designations are congruent within the study area.

10.5.1.6 Earthworks

Due to the relative low-lying nature of the site, the amount of activities associated with the earthworks would not be significant, primarily limited to site clearance and forming of embankments for bridging the River Blackwater. These activities, along with stockpiling of materials, represent the principal activities that have the potential to generate emissions of particulate matter.

The potential for stockpiles of materials to generate dust depends on the nature of the material. Earth is soft and friable compared to hardcore. Hardcore generally has a lower moisture content than soil, and consequently they can both be a potential source of dust.

The risk of amenity effects and the amount of mitigation effort required is strongly influenced by weather conditions at the time of the works. The nearest receptors are less than 20 m from the Proposed Road Development earthworks (i.e. at Blackwater Park), thus there is potential to generate dust impacts at these receptors. Given the likely methods of work, scale and materials involved in the earthworks, it is considered that with good site practice, they would have a slight adverse effect on amenity, and a negligible effect on short-term PM_{10} concentrations at all receptors.

10.5.1.7 Construction

Dust emissions during construction can give rise to elevated dust deposition and PM_{10} concentrations. These are generally short-lived changes over a few hours or days, which occur over a limited time period of several weeks or months.

Locating activities which are a potential source of PM_{10}, such as cutting and grinding of materials and cement mixing away from boundaries, would minimise the possibility of exposure to PM_{10} at receptors adjacent to the site boundary. If this measure is implemented, then impacts on PM_{10} concentrations at local receptors are capable of being reduced to a negligible level. As there are limited properties in close proximity to the scheme, the impacts themselves will be restricted to these locations.

As noted previously, there are very few receptors in close proximity to the works area, the closest being at the tie-ins with the existing road network (north and south). Other than Blackwater Park amenity area and the River Blackwater, there no other receptors of note in proximity to the offline works area, which constitutes the majority of the construction footprint. Given the likely methods of work, scale and materials involved in the construction, it is considered that with good site practice, these works would have a slight adverse effect on amenity and a negligible effect on short-term PM_{10} concentrations at all receptors.

10.5.1.8 Track-out of Material

The construction vehicles that access the site are likely to do so from the adjacent public road network. However, over the course of the works, there would be periods when construction vehicles have to drive over unsurfaced haul ground.

Facilities for the washing of vehicles (including wheels) might provide an appropriate means of minimising the potential for material to be transferred onto the local road network. The use of washing also leads to wetting of local roads near the access and can, if not carefully managed, spread material further along the local road network. This material is termed track-out material. Regular inspection of the local roads within 200m of the site access point(s) should be undertaken and street cleaning applied as necessary.

The impact of track-out of material can be minimised by limiting the amount of material transferred onto local roads and by removal of any transferred material from the roads. The impacts associated with the track-out of material can be controlled such that it would have a negligible effect on amenity and on short-term PM_{10} concentrations at all receptors.

10.5.1.9 Summary

The conclusions of the construction dust assessment are summarised in Table 10-14. Overall, the effects of the construction phase activities are considered to be negligible and would not have a significant effect.

Table 10-14 Summary of construction phase emissions significance (with mitigation)

Source	Effects on Amenity and Property	Ecological Effects	Exposure to PM_{10} at levels that could exceed the 24-hr air quality objectives
Earthworks	Slight Adverse	Negligible	Negligible
Construction	Slight Adverse	Negligible	Negligible
Track-out	Negligible	Negligible	Negligible
Overall Significance			Not Significant

10.5.2 Operational Phase

The effect of the Proposed Road Development is likely to be three-fold:

- Some properties along the existing road network may experience a marginal improvement in air quality, due to the reassignment of a proportion of traffic;
- Some properties adjacent to junctions intersecting with the Proposed Road Development may experience some minor changes in air quality, depending on side-road realignment and traffic redistribution; and
- Some properties adjacent to the Proposed Road Development may experience a marginal deterioration in air quality, due to the reassignment of a proportion of traffic.

10.5.2.1 Index of Overall Change

As noted in Sub-Section 10.2.1, 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 (2022) at sensitive receptor locations arising from changes in road traffic as a result of the Proposed Road Development.

The Index has been based on the number of sensitive receptor locations within 50 m of the carriageway of all road links (as shown on Figure 10. 2: Affected Road Network in Volume 3) that would experience a significant change (5%) in traffic associated with the Proposed Road Development. The calculation considers the change in concentrations of NO_2 and PM_{10} under both the Do-Minimum and Do-Something scenarios, as outlined within Tables A1 and A2 included within Appendix A10-1.

A negative Index score indicates that there would be an overall reduction in exposure to pollution (i.e. a benefit); a positive Index score indicates an increase in exposure to pollution, (i.e. adverse impact).

- Overall change in exposure when comparing the Do-Minimum and Do-Something scenarios in the assumed Year of Opening (2022) for NO_x is as follows: **-71,505**
- Overall change in exposure when comparing the Do-Minimum and Do-Something scenarios in the assumed Year of Opening (2022) for PM_{10} is as follows: **-3,551**

The outcome of the calculation, as detailed above, indicates that there would be an overall reduction in exposure to pollution in the assumed Year of Opening (2022) as a result of implementing the Proposed Road Development. It is evident that a much higher number of properties would experience a decrease in exposure to PM_{10} and NO_2 throughout the affected road network than experience an increase with scheme implementation. Consequently, air quality would be improved for the majority of receptors in close proximity to the affected road network throughout Navan.

As is evident from the above, the Proposed Road Development would alter traffic flows in the locality in terms of vehicle numbers and speed, have a corresponding impact on air quality and the number of receptors that would be exposed to those impacts. Road projects are usually perceived as having only negative effects, however as demonstrated above, there would be an overall net benefit as a result of implementing the Proposed Road Development, particularly as the number of receptors in close proximity to the new route would be extremely low.

The distributor road to the west of the town would not only relieve congestion on the existing road network, but also lower emissions and subsequently reduce overall pollutant levels by helping to keep traffic flowing steadily throughout the region.

10.5.2.2 Local Air Quality Impacts

The predicted pollution concentrations at each receptor for operation of the Proposed Road Development in the Opening Year (2022), a future Design Year (2037), and the change in concentrations between the future years Do-Minimum and Do-Something scenarios are presented in Tables 10-15 – 10-18 and included within Appendix A10-2.

Table 10-15 Opening Year (2022) Do-Something Scenario annual mean pollutant concentrations

Receptor	Location	Predicted Annual Mean Concentration (µg/m^3)			Number of exceedances of 24-hour PM_{10} limit (days)
		NO_2	PM_{10}	$PM_{2.5}$	
R1	10 Windtown Crescent	8.57	10.64	6.90	0
R2	Saint Patricks, Abbeylands,	7.91	10.52	6.79	0
R3	Blackwater Park Playground	7.64	10.46	6.74	0
R4	43a Silverlawn	8.17	10.59	6.86	0
R5	15 Abbeyville	8.19	10.59	6.86	0
R6	13 Blackwater Drive	9.31	12.65	8.70	0
R7	10 Flower Hill	10.52	12.93	8.96	0
R8	1 Dean Cogan Place	11.38	11.31	7.51	0
R9	1 Blackwater Park	10.86	11.14	7.35	0
R10	6 Blackwater Park	9.27	10.84	7.08	0
R11	12 Blackwater Park	8.72	10.74	6.99	0

The predicted pollutant concentrations in the assumed year of Opening for the 2022 Do-Something scenario indicate that there would be no exceedances of pollutant limit values at any receptor. All airborne contaminants screened at the various receptor locations fall well below the Air Quality Standard Limit Values for the protection of human health. They also fall below the lower assessment thresholds for all pollutants of concern.

The receptors expected to experience the highest concentrations for all airborne pollutants remain to be those located in closest proximity to the existing routes that convey the higher volumes of traffic through the town (i.e.R6 and R7) as although traffic volume would reduce, it would still remain comparatively high, in combination with the close proximity of these receptors to the existing road.

As expected of the receptor sites selected, those that experienced lowest pollutant concentrations under the 2022 Do-Minimum Scenario would experience an increase in concentrations as a result of the Proposed Road Development, particularly with regards to Annual Mean NO_2 concentrations. This can be attributed to road elements with comparatively higher flows being introduced to an area currently devoid of proximal traffic.

As noted previously, within the study area, there is a noticeable difference in local air quality between the northern portion of the study area and the southern, with latter experiencing slightly worse conditions. Again this is reflective of the higher volumes of traffic and layout of the existing road network through this part of Navan and the convergence of the N51 National Secondary Road (Kells Road), which links Navan to the M3 Motorway, southwest of the town. With implementation of the Proposed Road Development, it is expected that those receptors to the north would experience a deterioration in air quality, whereas as those to the south would actually experience an improvement due the channelling of traffic off other parts of the proximal affected road network through an existing road corridor with few proximal receptors from the N51 Andy Connolly Roundabout through to Abbeyland South. This is reflected below in Table 10-16.

Table 10-16 Change in annual mean pollutant concentration for the Opening Year (2022) between Do-Minimum and Do-Something scenarios.

Receptor	Change in Predicted Annual Mean Concentration (µg/m^3)		
	NO_2	PM_{10}	$PM_{2.5}$
R1	0.47(s)	0.08(i)	0.072(i)
R2	0.02(i)	0(i)	0(i)
R3	0.09(i)	0.02(i)	0.018(i)
R4	-0.31(i)	-0.06(i)	-0.054(i)
R5	-0.42(s)	-0.09(i)	-0.081(i)
R6	-0.76(s)	-0.17(i)	-0.153(i)
R7	-0.18(i)	-0.04(i)	-0.036(i)
R8	-1.01(s)	-0.34(i)	-0.306(s)
R9	-2.3(s)	-0.67(s)	-0.603(s)
R10	-0.02(i)	-0.07(i)	-0.063(i)
R11	-0.08(i)	-0.04(i)	-0.036(i)

Key to magnitude of change (i) = Imperceptible, (s) = Small, (m) = Medium, (l) = Large

For the assumed Year of Opening, the magnitude of change at the majority of receptors is predicted to be either imperceptible or small, in terms of both increases and decreases in exposure to airborne pollutants. As the predicted total concentration at each receptor is predicted to be well below the Air Quality Standard Limit Values for the protection of human health, and the majority of receptors are predicted to experience an imperceptible or small change in pollutant concentration due to the Proposed Road Development, there is likely to be a negligible effect on local air quality overall.

The greatest beneficial change in concentration is predicted to occur at R9 (1 Blackwater Park).Whilst this receptor is located in close proximity to the N51 at the Kells Road Roundabout, and would be one of the closest properties in proximity to the local distributor road, the nature in which the Proposed Road Development would affect local traffic movements and the physical change of the Kells Road Roundabout to an at-grade traffic light controlled junction, in combination with the physical movement of this junction further away from this property, would result in a reduction in exposure to airborne contaminants attributable to vehicular traffic movements. The effect is less pronounced at Receptors 10 & 11, as the road network is unaffected in proximity to these properties, though the traffic movements change.

As expected of the receptor sites selected, those that experienced lowest pollutant concentrations under the 2022 Do-Minimum Scenario would experience an increase in concentrations as a result of the Proposed Road Development, particularly with regards to Annual Mean NO_2 concentrations. This can be attributed to road elements with comparatively higher flows being introduced to an area currently devoid of proximal traffic.

The greatest adverse change in concentration is predicted to occur at those properties located in the northern portion of the study area, though the changes would be imperceptible. As noted previously, this would be as a consequence of the Proposed Road Development introducing a much higher volume of traffic through this area than is currently experienced.

Table 10-17 Opening Year (2037) Do-Something Scenario annual mean pollutant concentrations

Receptor	Location	Predicted Annual Mean Concentration (µg/m³)			Number of exceedances of 24-hour PM_{10} limit (days)
		NO_2	PM_{10}	$PM_{2.5}$	
R1	10 Windtown Crescent	9.05	10.65	6.89	0
R2	Saint Patricks, Abbeylands,	7.49	10.37	6.64	0
R3	Blackwater Park Playground	7.29	10.30	6.57	0
R4	43a Silverlawn	8.51	10.61	6.85	0
R5	15 Abbeyville	8.32	10.57	6.82	0
R6	13 Blackwater Drive	9.36	12.62	8.66	0
R7	10 Flower Hill	10.91	12.97	8.97	0
R8	1 Dean Cogan Place	10.89	11.24	7.42	0
R9	1 Blackwater Park	11.31	11.22	7.40	0
R10	6 Blackwater Park	9.09	10.75	6.98	0
R11	12 Blackwater Park	8.30	10.60	6.84	0

The predicted pollutant concentrations for the 2037 Do-Something scenario indicate that there would be no exceedances of pollutant limit values at any receptor. All airborne contaminants screened at the various receptor locations fall well below the Air Quality Standard Limit Values for the protection of human health. They also fall below the lower assessment thresholds for all pollutants of concern.

Table 10-18 Change in annual mean pollutant concentration for the Opening Year (2037) between Do-Minimum and Do-Something scenarios

Receptor	Change in Predicted Annual Mean Concentration (µg/m³)		
	NO_2	PM_{10}	$PM_{2.5}$
R1	0.79(s)	0.13(i)	0.12(i)
R2	0.03(i)	0.01(i)	0.01(i)
R3	0.2(i)	0.03(i)	0.02(i)
R4	0.12(i)	0.04(i)	0.03(i)
R5	0.11(i)	0.03(i)	0.03(i)
R6	-0.97(s)	-0.25(i)	-0.22(i)
R7	-0.01(i)	-0.04(i)	-0.04(i)
R8	-1.95(s)	-0.57(s)	-0.51(s)
R9	-2.08(s)	-0.73(s)	-0.66(s)
R10	-0.04(i)	-0.08(i)	-0.07(i)
R11	-0.25(i)	-0.07(i)	-0.07(i)

Key to magnitude of change (i) = Imperceptible, (s) = Small, (m) = Medium, (l) = Large

For the Design Year, the magnitude of change at the majority of receptors is predicted to be either imperceptible or small, in terms of both increases and decreases in exposure to airborne pollutants. As the predicted total concentration at each receptor is predicted to be well below the Air Quality Standard Limit Values for the protection of human health, and the majority of receptors are predicted to experience an imperceptible or small change in pollutant concentration due to the Proposed Road Development, there is likely to be a negligible effect on local air quality overall. Those expected to experience the greatest beneficial or adverse changes in air quality are the same as those described under the opening year scenario, for the same reasons.

10.5.2.3 Regional Air Quality Impacts

The regional air quality assessment seeks to establish the total and change in emissions that would result with the Proposed Road Development, as compared with the 'Base Year' (2017) and future year 'Do-Minimum' alternative. This is used to identify the concentration of pollutants that contribute to a wider spread decline in air quality, such as acid rain deposition or an enhancement of the natural greenhouse effect. The predicted emissions from future years with the Proposed Road Development are presented in Table 10-19 and included within Appendix A10-3.

Table 10-19 Total yearly emissions for Opening Year (2022) and Design Year (2037) Do-Something scenarios

Year	C* (tonnes/year)	CO (Kg/year)	THC (Kg/year)	NOx (Kg/year)	PM_{10} (Kg/year)
2022	949	16,817	2,023	5,657	199
2037	1,315	23,479	2,804	7,642	280

**carbon bound in the emitted pollutants (carbon dioxide, carbon monoxide, hydrocarbons and particulate matter).*

The change in emissions between the current Base Year and future Do-Minimum and Do-Something scenarios are presented in Table 10-20 and Table 10-21.

Table 10-20 Change in total yearly emissions between current (2017) Base Year and Opening Year (2022) and Design Year (2037) Do-Something scenarios

Year	Change in Total Yearly Emissions against Current Base Year (tonnes/year)				
	C* (tonnes/year)	CO (Kg/year)	THC (Kg/year)	NOx (Kg/year)	PM_{10} (Kg/year)
2022	40	51	70	639	9
2037	406	6,713	851	2,623	90

**carbon bound in the emitted pollutants (carbon dioxide, carbon monoxide, hydrocarbons and particulate matter).*

When compared against the current Base Year emission rates, the Opening Year (2022) and Design Year Do-Something (2037) scenarios show an increase in emissions across all pollutants. This is a consequence of the expected traffic growth on the local road network in Navan over the assessment period. Again, this represents an absolute worst-case scenario, in that no additional measures would be implemented to decrease in emissions over the longer term, such as the accelerated deployment of 500,000 electric vehicles and the impact of greater biofuel uptake.

Table 10-21 Change in total yearly emissions for Opening Year (2022) and Design Year (2037) between Do-Minimum and Do-Something scenarios

Year	Total Yearly Emissions (tonnes/year)				
	C* (tonnes/year)	CO (Kg/year)	THC (Kg/year)	NOx (Kg/year)	PM_{10} (Kg/year)
2022	-2	-689	-56	248	-1
2037	26	-767	-52	598	6

**carbon bound in the emitted pollutants (carbon dioxide, carbon monoxide, hydrocarbons and particulate matter).*

The results for the regional assessment show that there is generally a predicted decrease in emissions in the Opening Year (2022) Do-Something scenario across all pollutants except NO_x when compared to the Opening Year (2022) Do-Minimum scenario.

Overall, the Proposed Road Development would serve not only to contribute to the attainment of a sustainable transport vision of reducing the impacts of GHG emissions, but actually demonstrates improvement. The reason for the improvements are largely associated with the favourable horizontal and vertical alignment of the road, particularly minimising any increases in distance travelled when compared to the existing route, along with associated improvements traffic conditions as a result of implementing the distributor road. By relieving congestion through the centre of Navan, vehicles would be able to achieve freer flowing conditions and attain more optimal speeds in terms of combustion emission efficiencies on the new road.

Under the Design Year Do-Something (2037) scenario, the expectant traffic growth as a consequence of sustained development is predicted to progressively offset the gains made under the Opening Year scenario in terms of reducing emissions for carbon bound in the emitted pollutants (carbon dioxide, carbon monoxide, hydrocarbons and particulate matter) and particulates, however the change is marginal. Under both Do-Something scenarios NO_x emissions are expected to increase. Again, it makes no provision for additional measures would be implemented to decrease in emissions over the longer term which would serve to contribute towards the attainment of a sustainable transport vision of reducing the impacts of GHG emissions.

Emission rates tend to increase under variable operating conditions (i.e. along the existing N51), compared with those during steady state driving (i.e. along the Proposed Road Development). The effect is implicitly considered in most speed related emission factors since the variability of speed during a trip is closely related to the average speed. Slow speed journeys in towns involve frequent speed changes in response to the traffic conditions, while higher speed trips are normally driven more smoothly.

In terms of road geometry, the emissions from a vehicle negotiating a twisting road, or from a vehicle climbing a steep slope, will be increased because of the need to use lower gears and the extra load on the engine. The vertical and horizontal geometry of the new road is very favourable in this regard with few junctions to negotiate and a gentle gradient throughout.

In relation to the actions and goals set out in the DTTAS '*Smarter Travel – A Sustainable Transport Future*' to improve air quality, the Proposed Road Development would help minimise the negative impacts of transport on the local and global environment through reducing greenhouse gas emissions.

Based on the 2018-2040 GHG Emissions Projections (kt CO_2eq), with existing measures, the transportation total is estimated to be 13,215 kt CO_2eq in 2022 and 12890.34 kt CO_2eq in 2037. With the scheme in 2022, an imperceptible reduction in CO_2 (converted from C) would be delivered with the Proposed Road Development and in 2037, an imperceptible increase in CO_2 would be delivered, equating to an 0.00074% increase to the overall projected transportation emissions.

In terms of the European Union Clean Air Policy, an imperceptible increase by 0.000384% of the Directive 2016/2284 limit within the 2020 to 2029 phase and by 0.00156% in the 2030 onwards phase would be experienced with Nitrogen oxides. THC are predicted to decrease by 0.000127% of the Directive 2016/2284 limit within the 2020 to 2029 phase and by 0.00013% in the 2030 onwards phase. This would also be imperceptible. As there is no national reporting of particulate matter levels and no Directive limits exist, no comparison of annual particulate matter emissions can be made.

10.5.2.4 Air Quality Impacts on Sensitive Ecosystems

With the use of projected traffic data to the assumed year of scheme Opening (2022), the River Boyne and River Blackwater SAC and SPA were assessed in accordance with the methodology set out in Appendix 9: Impacts upon Sensitive Ecosystems of the NRA '*Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*' (Revision 1, May 2011). The assessment procedure requires that consideration be given to the sensitivity of species, where the project contribution increases the annual mean predicted NO_x concentrations by at least 2µg/m^3 and where the total predicted concentrations are very close to, or exceed the criterion for, the protection of vegetation (30µg/m^3).

Table 10-22 summarises the predicted annual mean concentrations of NOx and road component of Nitrogen Deposition rates for the existing route under 'Do-Minimum' and 'Do-Something' conditions. The table also quantifies the annual mean change in exposure with project implementation within the River Boyne and River Blackwater SAC.

Table 10-23 summarises the predicted annual mean concentrations of NOx and road component of Nitrogen Deposition rates within the River Boyne and River Blackwater SAC for the Proposed Road Development.

Table 10-22 Annual Mean NOx Concentrations and Road Contribution to Nitrogen Deposition Rates at River Boyne and River Blackwater SAC for 'Opening Year' (2022) within 200m of the existing route

Distance from Road (m)	NOx annual mean (µg/m3)		Difference* (µg/m3)	Road Contribution to Nitrogen Deposition (N) (kg N ha-1 year-1)		Difference* (µg/m3)
	Do-Min	Do-Som		Do-Min	Do-Som	
20m	17.27	12.47	-4.8	1.124	0.861	-0.263
30m	15.13	11.45	-3.68	1.008	0.805	-0.203
40m	13.57	10.71	-2.86	0.923	0.764	-0.159
50m	12.40	10.15	-2.25	0.858	0.733	-0.125
60m	11.48	9.71	-1.77	0.807	0.708	-0.099
70m	10.76	9.37	-1.39	0.767	0.689	-0.078
80m	10.19	9.09	-1.1	0.736	0.674	-0.062
100m	9.74	8.87	-0.87	0.71	0.662	-0.048
120m	9.37	8.70	-0.67	0.69	0.652	-0.038
140m	9.09	8.57	-0.52	0.674	0.645	-0.029
160m	8.87	8.46	-0.41	0.662	0.639	-0.023
180m	8.70	8.38	-0.32	0.653	0.634	-0.019
200m	8.59	8.33	-0.26	0.646	0.631	-0.015

**Positive value indicates an increase and a Negative value indicates a decrease in exposure with scheme implementation*

Table 10-23 Annual Mean NOx Concentrations and Road Contribution to Nitrogen Deposition Rates at River Boyne and River Blackwater SAC for 'Opening Year' (2022) within 200m of the of the Proposed Road Development

Distance from Road (m)	NO_x annual mean ($\mu g/m^3$)	Road Contribution to Nitrogen Deposition (N) (kg N ha^{-1} $year^{-1}$)
20m	11.95	0.815
30m	10.82	0.752
40m	9.99	0.706
50m	9.36	0.672
60m	8.88	0.645
70m	8.50	0.624
80m	8.19	0.607
100m	7.95	0.593
120m	7.76	0.582
140m	7.61	0.574
160m	7.49	0.567
180m	7.40	0.562
200m	7.34	0.559

First and foremost, under 'Do-Minimum' and 'Do-Something' scenarios, the predicted levels of NOx (the pollutant of most concern) for all assessed designated sites would fall 'Well Below' the set EU critical load level of 30µg/m^3.

The overall lowering of Do-Minimum NO_x levels over time when compared to 'Base Year' is reflective of general trends in Ireland that NO_x concentrations emitted from road transportation are likely to reduce due to improvements in vehicle technology and combustion efficiencies.

With reference to Tables 10-22 – 10-23, it is evident that there would be an overall increase in NO_x levels in the area of the SAC affected by the Proposed Road Development. However, along the residual section of the existing route, an overall improvement would be experienced within the designated site.

Whilst the Proposed Road Development would result in a new section of the SAC being exposed to airborne contaminants associated with vehicular activity, the re-distribution of traffic to the new road would result in a notable decrease in exposure within the SAC at the existing N51 crossing of the River Blackwater. At both crossings, the exposure would be 'Well Below' the set EU critical load level of 30 $\mu g/m^3$, and the Proposed Road Development would have a beneficial effect of facilitating dispersal of contaminants over a wider area within the SAC by splitting the main traffic flows west of Navan and channelling that flow via two crossing points, as opposed to one. This would allow for greater dispersal and exposure to much smaller annual mean concentrations, particularly closer to source (where concentrations are typically highest).

10.6 Mitigation & Monitoring Measures

10.6.1 Construction Phase

Mitigation measures which would be implemented for each of the anticipated three stages of the construction phase (earthworks, construction and track-out) are detailed below.

Standard mitigation measures would be implemented onsite to control emissions of dust and PM_{10} during the earthworks. Such measures are in common use on all well-managed construction sites across Ireland and, if implemented correctly, have a proven track record of controlling emissions so that a significant effect does not occur. Such mitigation measures considered good practice include, but are not limited to:

- required works to be undertaken in a phased and controlled manner;
- the dampening down of potential dust-generating activities;
- regular inspections of works for visible signs of emissions of dust and early application of measures to minimise emissions at source;
- considerate location of temporary storage of dusty materials and material transfer operations, so that it is as far from the nearest sensitive receptors as practicable;
- agree lines of communication between local authority pollution control officer and contractor(s) prior to commencement of works and procedure for reporting dust events or complaints from local residents;
- minimise drop heights and chutes where practicable;
- during extended periods of dry weather (especially over holiday periods) plan for additional mitigation measures to avoid wind-blown dust issues, both within and outside normal working hours;
- avoid long-term stockpiles of material on-site without application of measures to stabilise the material surface, such as application of suppressants or seeding;
- re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable;
- the use of Hessian, mulches or trackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; and
- remove the cover in small areas during work and not all at once, where practicable.

Measures specific to but not limited within the construction stage include:

- placing activities which are a potential source of PM_{10}, such as cutting and grinding of materials and cement mixing, away from boundaries would minimise the possibility of exposure to PM_{10} at receptors within 30m of the site boundary;
- adoption of mobile booths for cutting and grinding operations if work cannot be undertaken away from sensitive receptors;

- the provision of dust suppression on-site to be applied during adverse meteorological conditions or as and when potential dust-generating activities are being undertaken;
- ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;
- ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and
- for smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust.

Measures specific to but not limited within the track-out stage include:

- use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary any material tracked out of the Site. This may require the sweeper being continually in use;
- avoid dry sweeping of large areas;
- ensure vehicles entering and leaving the Site are covered to prevent escape of materials during transport;
- inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable;
- record all inspections of haul routes and any subsequent actions in a site log book; and
- access gates to be located at least 10m from receptors where possible.

The following mitigation measures will be implemented during the construction phase of the development so as to minimise CO2 emissions:

- Materials required for the construction works shall be sourced locally where possible. There are operational quarries located in proximity to the Proposed Road Development. Rock crushing shall be undertaken on site where possible, to reduce the requirement to import crushed stone to site;
- a Construction TMP, as per a requirement of the CEMP shall be implemented in full. This will minimise congestion and encourage car sharing and the use of public transport;
- Materials shall be handled efficiently on site to minimise the waiting time for loading and unloading, thereby reducing potential emissions;
- Engines will be turned off when machinery is not in use;
- The regular maintenance of plant and equipment will be carried out
- Materials with a reduced environmental impact will be used where available, such as:
  - Ground Granulated Blast Furnace Slag (GGBS) and Pulverised Fly Ash (PFA) will be used as replacements for Portland cements; and
  - Recycled steel

The contractor shall be required to implement an Energy Management System for the duration of the works. This will include the following at a minimum:

- Use of thermostatic controls on all heating systems in site buildings;
- The use of insulated temporary building structures;
- The use of low energy equipment and power saving functions on all computer systems; and
- The use of low flow tap fittings and showers

It is a requirement that a CEMP (including a Dust Minimisation Plan/Air Quality Management Plan) would be prepared by the appointed contractor in due course and that this plan would implement the measures listed above. If effective mitigation measures are in place, as outlined above, significant effects on receptors are likely to be prevented or reduced.

10.6.2 Operational Phase

During the operational phase of the Proposed Road Development, no predicted exceedances of the Air Quality Standard Limit Values are expected, thus there would be no significant effects on air quality. Therefore, no specific mitigation measures are deemed necessary.

10.7 Residual Impacts

The residual impacts from the implementation of mitigation measures during the construction phase of the Proposed Road Development have been assessed.

However, in terms of residual impacts resulting from the operational phase of the scheme, mitigation measures are not considered necessary, as no significant effects on air quality are anticipated during this phase.

10.7.1 Significance of Potential Effects

The assessment of construction dust impacts as a result of the Proposed Road Development includes embedded control measures, as reported in Sub-Section 10.6. Further mitigation is likely to reduce or prevent any significant residual effects and should be included in the CEMP. The assessment of construction phase impacts predicts a slight adverse effect on amenity due to dust, and a negligible effect on health as a result of increases in PM_{10} concentrations. With the implementation of the mitigation measures, no significant residual effects are likely.

10.8 Difficulties Encountered

There were no major difficulties or data deficiencies encountered in the production of this air quality assessment or in the preparation of this section of the EIAR.

10.9 Summary

The impacts and effects as a result of changes in air pollutant concentrations have been assessed for the Proposed Road Development. The assessment has concluded that there would be no instance under any of the scenarios considered where a receptor is predicted to be exposed to annual mean concentrations higher than the National Air Quality Standard value for Nitrogen Dioxide (NO_2) and Particulate Matter (PM_{10} and $PM_{2.5}$).

The changes in concentrations of these pollutants would generally be of an imperceptible or small magnitude, in terms of exposure. The greatest beneficial change in concentration is predicted to occur at the receptors located in the southern portion of the study area, where the redistributional traffic effects of the scheme would be most keenly felt, however overall this would result in a largely negligible effect on local air quality. The greatest adverse change in concentration is predicted to occur at the receptors located in close proximity to the Proposed Road Development within the northern portion of the study area (where existing traffic volumes are lowest), however overall this would result in a largely negligible effect on local air quality. Overall there would be a reduction in receptor exposure to these pollutants as a result of implementing the proposed road development.

The results of the regional impact assessment indicate that the climatic effect on air quality would be largely beneficial but not significant. In relation to the actions and goals set out in the DTTAS '*Smarter Travel – A Sustainable Transport Future*' to improve air quality, the Proposed Road Development would help minimise the negative impacts of transport on the local and global environment through reducing greenhouse gas emissions. This also represents an absolute worst-case scenario, in that it does not consider additional measures that would be implemented to decrease in emissions over the longer term, such as the accelerated deployment of 500,000 electric vehicles and the impact of greater biofuel uptake. Furthermore, based on the 2018-2040 GHG Emissions Projections, with existing measures, an imperceptible reduction in CO_2 would be delivered with the proposed road development and the scheme would not hinder the achievement of targets under the European Union Clean Air Policy.

In terms of designated ecological sites, the assessment indicates Oxides of Nitrogen (NO_x) levels would increase in close proximity to the proposed road development. However, as estimated levels would fall 'Well Below' the EU critical load levels, the significance of effect in all cases would be negligible. Whilst decreases in NO_x levels would be experienced within the designated ecological site away from the Proposed Road Development (i.e. in the vicinity of the N51), the significance of effect would also be negligible. The Proposed Road Development would have a beneficial effect of facilitating dispersal of contaminants over a wider area within the SAC by splitting the main traffic flows through Navan and channelling that flow via two crossing points, as opposed to one. This would allow for greater dispersal and exposure to much smaller annual mean concentrations, particularly closer to source (where concentrations are typically highest).

The likely effects on amenity and local air quality resulting from construction works has also been considered at nearby residential receptors due to potential changes in dust deposition rates and airborne concentrations of particulate matter. The closest receptors to any construction-related activity would be at the tie-ins with the existing road network (north and south). Other than Blackwater Park amenity area and the River Blackwater, there no other receptors of note in proximity to the offline works area, which constitutes the majority of the construction footprint. Given the likely methods of work, scale and materials involved in the construction, it is considered that with good site practice, these works would have a slight adverse effect on amenity and a negligible effect on short-term PM_{10} concentrations at all receptors. Overall, adverse effects on amenity and local air quality due to fugitive emissions of dust and Particulate Matter during construction are not considered to be significant and would only be local in terms of effect.

The effects of emissions from construction-related traffic movements are also not likely to be greater than those estimated for the assumed Opening Year (2022), thus are not likely to be significant in terms of localised increases in airborne pollutants.

10.10 References

- AECOM. (2018). *Local Distributor Road 4 Abbeyland Navan, Route Selection Report*, Doc. Ref. 60546769-REP-20-0000-CH-0002 050974.
- DTTAS. (2009). Smarter Travel – A Sustainable Transport Future (A New Transport Policy for Ireland 2009 – 2020), Department of Transport, Tourism and Sport.
- EPA. (2013). *Ireland's Greenhouse Gas Emission Projections 2012-2030,* Environmental Protection Agency, Wexford, Ireland.
- EPA. (2016). *Ireland's Environment – An Assessment 2016,* Environmental Protection Agency, Wexford, Ireland.
- EPA. (2017). *National Ambient Air Quality Monitoring Programme 2017-2022*, Environmental Protection Agency, Wexford, Ireland.
- EPA. (2019). *GHG Emissions Projections Report,* Environmental Protection Agency, Wexford, Ireland.
- EPA. (2019). *Air Quality in Ireland 2017*, Environmental Protection Agency, Wexford, Ireland.
- EU. (2008). Directive 2008/50/EC of the European Parliament and of the Council of 21 May 2008 on ambient air quality and cleaner air for Europe, European Union.
- Defra. (2011). *Local Air Quality Management Technical Guidance (TG16)*, Department for Environment, Food and Rural Affairs.
- DECLG. (2014). *National Policy Statement on Climate Change,* Department for Environment, Communities and Local Government
- Government of Ireland. (2018). The European Union (National Emission Ceilings) Regulations 2018 (S.I. No. 232/2018).
- HA. (2013). Interim Advice Note (IAN) 170/12 v3 ('Updated air quality advice on the assessment of future NO_x and NO_2 projections for users of DMRB Volume 11, Section 3, Part 1 'Air Quality'), Highways Agency.
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, Meath, Ireland.
- NRA. (2008). Environmental Impact Assessment of National Road Schemes – A Practical Guide, National Roads Authority, Dublin, Ireland.
- NRA. (2011). *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*, National Roads Authority, Dublin, Ireland.

Chapter 11: Noise and Vibration

11

11. Noise and Vibration

11.1 Introduction

This chapter provides an assessment of the potential noise and vibration impacts of the Proposed Road Development as described in Chapter 4 (Description of the Proposed Road Development) on sensitive receptors, in accordance with the requirements of the relevant EIA legislation and guidance on preparation and content of EIAR. This chapter should be read in conjunction with Chapter 4 and the site layout plans.

11.2 Methodology

This noise and vibration assessment has been prepared in accordance with the EPA '*Guidelines on the Information to be contained in Environmental Impact Statements*' (2002), '*Advice Notes on Current Practice (in preparation of Environmental Impact Statements'* (2003), the "*Guidelines on the information to be contained in Environmental Impact Assessment Reports*" (EPA DRAFT August 2017), the EPA's '*Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)'* (2016) and the NRA's '*Guidelines for the Treatment of Noise and Vibration in National Road Schemes*' (2004).

The methodology used to assess noise and vibration impacts arising from the construction and operational phases of the Proposed Road Development is as follows:

- A review of the area surrounding the Proposed Road Development was undertaken, which considered the topography of the surrounding area and sensitive receptors;
- A baseline noise survey was conducted in accordance with the
  - NRA'S document '*Guidelines for the Treatment of Noise and Vibration in National Road Schemes*' 2004 (subsequently referred to NRA's 2004 Guidelines),
  - NRA's document '*Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*' 2014, and
  - the shortened measurement procedure set out in U.K.'s Department of Transport (Welsh Office) Document '*Calculation of Road Traffic Noise'* (CRTN) (1988);
- Construction noise and vibration impacts have been calculated using the prediction methods specified within BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise' (BSI, 2014a) and 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration (BSI, 2014b)';
- Predictions of road traffic noise levels at properties affected by the operation of the Proposed Road Development were undertaken using the proprietary computer-based modelling package SoundPLAN v8.0. This package implements the road traffic noise prediction methodology in CRTN 1988 which describes road traffic noise level in L_{A10} (18 hour) index. Method B conversion methodology, as specified within NRA's 2004 Guidelines, has been used to derive L_{den} levels from the L_{A10} (18 hour) predictions output from the SoundPLAN model.

  The need for operational noise mitigation measures was assessed against the design criteria set out in paragraph 11.2.1.2 below. Where the design criteria were met or exceeded, practicable mitigation measures have been proposed with the aim of reducing noise levels below the criteria. Information relating to the Proposed Road Development was obtained primarily from the design team.

11.2.1 Noise Significance Criteria

11.2.1.1 Construction Noise Criteria

In Ireland, there are no statutory guidelines relating to noise limits for construction and demolition activities. These are generally controlled by local authorities and commonly refer to limiting working hours to prevent a noise nuisance. NRA's 2004 Guidelines have outlined recommended noise levels for construction noise during road works.

Although the recommendations in the NRA's 2004 Guidelines refer to road projects, they have been developed in line with typical construction noise limits on construction projects used previously in Ireland. The limits outlined represent a reasonable compromise between the practical limitations during a construction project and the need to ensure an acceptable ambient noise level for local residents. As a result, these limits have become the most acceptable standard for construction noise limits for EIA in Ireland to date.

However, the NRA 2004 guidelines do note that where pre-existing noise levels are particularly low, more stringent levels maybe more appropriate. Table 11-1 details these recommended limits.

Table 11-1 NRA Maximum Permissible Noise Levels at the Facade of Dwellings during Construction

Day & Times	Noise Levels dB(A)	
	L_{Aeq} 1 hour	L_{Amax}
Monday to Friday 07:00 to 19:00 hrs	70	80
Monday to Friday 19:00 to 22:00 hrs	60	65
Saturday 08:00 to 16:30 hrs	65	75
Sundays and Bank Holidays 08:00 to 16:30 hrs	60	65

11.2.1.2 Operational Noise Criteria

The NRA 2004 Guidelines has set a recommended target criterion for road traffic noise from all national road schemes of 60dB L_{den} (free field). The criterion applies to existing noise receptors in both the opening and design year (15 years after opening of the Proposed Road Development). The guidelines requires road noise traffic levels impacts to be assessed in terms of the L_{den} indicator, which is that used for the assessment and management of environmental noise in accordance with the Environmental Noise Directive, 2002/49/EC. L_{den} is the 24 hour average noise level with a 10 dB penalty added to the night-time levels between 2200 and 0700 hours and a 5 dB penalty added to the evening levels between 1900 and 2200 hours to reflect people's extra sensitivity to noise during the night and the evening.

The NRA 2004 Guidelines recognise that it is not always possible to achieve the target criterion of 60dB L_{den}. In such circumstances, it recommends that a structured approach should be taken in order to ameliorate as far as practicable road traffic noise through the consideration of measures such as alignment changes, barrier type (e.g. earth mounds) and low noise road surfaces. Mitigation measures are only deemed necessary when the following three conditions are satisfied at sensitive receptors in either opening or future years:

a. the combined expected maximum traffic noise level, i.e. the relevant noise level, from the Proposed Road Development together with other traffic in the vicinity is greater than the design goal;

b. the relevant noise level is at least 1dB more than the expected traffic noise level without the Proposed Road Development in place;

c. the contribution to the increase in the relevant noise level from the Proposed Road Development is at least 1dB.

The NRA 2004 Guidelines are not directly applicable to the assessment of road traffic noise associated with the Proposed Road Development, given that it does not include the construction of a new section of National Primary Road. However, the principles have been followed for the purpose of this assessment and are considered to be appropriate.

11.2.1.3 Rating of Noise Impacts

The impact level that can be attached to changes in noise levels can be described as set out in Table 11-2. It should be noted that these changes are subjective and will vary among individuals.

Table 11-2 Impact Scale for Changes in Noise Levels (Perceptible to Human Beings)

Changes in Noise Level	Impact Rating	EPA Glossary of Impacts/Effects	Subjective reaction	Subjective change	% Change in Loudness
0	No change	n/a	n/a	No change	0
<3 dB(A)	Not significant	Neutral/Imperceptible or slight effect	Barely perceptible	Negligible	10
3-5 dB(A)	Minor		Perceptible	Noticeable	30
6-10 dB(A)	Moderate	Significant effect: Positive or Negative	Up to a doubling of loudness	Clearly Noticeable	70
11-15 dB(A)	Major		Over a doubling of loudness	Substantial	100
>15 dB(A)	Severe	Profound effect: negative only	Very substantial	Very substantial	>100

11.2.2 Vibration Significance Criteria

Vibration may be defined as regularly repeated movement of a physical object about a fixed point. The magnitude of vibration is expressed in terms of Peak Particle Velocity (PPV) expressed in millimetres per second (mm/s).

There are various vibration guidelines to protect individuals and properties during the operational and construction phases of a development. Common practice in Ireland has been to use guidance from internationally recognised standards which address vibration impacts in two ways: those dealing with human comfort and those dealing with cosmetic or structural damage to buildings. These include:

Vibration that would likely to lead to complaints:

- BS 6472:1992 Guide to Evaluation of Human Exposure to Vibration in Buildings

Vibration levels that would likely to lead to structural damage:

- BS 7385: Part 2 1990: Evaluation and Measurement for Vibration in Buildings – Guide to Damage Levels from Ground-Borne Vibration, and
- Building Research Establishment (BRE) Digest 353 (July 1990): Damage to structures from ground-borne vibration.

These and other international guidance documents are considered by the NRA in the Irish context in the NRA's 2004 Guidelines. This document is used in this assessment as the principal source of guidance in relation to vibration impacts from roads scheme in Ireland.

11.2.2.1 Construction Vibration Criteria

Vibration is normally perceptible at around 0.5mm/s and may become disturbing or annoying to receptors in the case of nominally continuous source of vibration such as road traffic. Typically, higher levels of vibration are tolerated by receptors for single events, or events of short duration, at levels not normally acceptable for continuous sources.

With regard to the potential for vibration damage during construction and demolition, the NRA recommends that vibration from road construction activities be limited to the values set out in Table 11-3. These values have been derived through consideration of the various standards described above.

These should be adhered to at all times during the construction phase of the Proposed Road Development.

Table 11-3 Typical Allowable Vibration during Road Construction in Order to Minimise the Risk of Building Damage

Frequency:	Less than 10 Hz	10 to 50 Hz	50 to 100 Hz and above
Allowable vibration velocity (Peak Particle Velocity) at the closest part of any sensitive property to the source of vibration:	8 mm/s	12.5 mm/s	20 mm/s

11.2.2.2 Operational Vibration Criteria

The NRA 2004 Guidelines note 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. As a result, these Guidelines do not consider it necessary to set limits for vibration during the operational phase of a road scheme.

11.3 Description of the Existing Environment

The Proposed Road Development site predominantly occurs within an open Greenfield area with some areas of woodland and hedgerows. Residential areas are located to the north of the Proposed Road Development site while Blackwater Park is located to the east of the Proposed Road Development. The River Blackwater is located within the southern section of the Proposed Road Development site. Continuing to the south the scheme meets the N51/R147 Kells Road, which is lined by both residential and commercial properties. The principal noise sources at residential areas close to the Proposed Road Development are currently from existing road traffic.

11.3.1 Baseline Survey

Baseline noise surveys were undertaken at representative locations around the Proposed Road Development site on 1st October 2018 and between 9th and 10th October 2018. On 1st October, attended monitoring was carried out at 6 locations. All attended noise surveys were carried out in accordance with the shortened measurement procedure in CRTN 1988. 24 hour unattended monitoring was undertaken on 9th and 10th October 2018.

Noise measurements at all attended surveys were undertaken using 01dB DUO Class 1 noise meter. A B&K 2250 Class 1 noise meter was used at the unattended monitoring location. Weather conditions were observed during all measurement periods as dry and calm.

11.3.1.1 Measurement parameters

The noise parameters recorded at all measurement survey locations included:

L_{Aeq} Is the A-weighted equivalent continuous steady sound level during the measurement period and effectively represents an average ambient noise value.

L_{A10} Is the A-weighted sound level that is exceeded for 10% of the measurement period and is used to quantify road traffic noise.

L_{A90} Is the A-weighted sound level that is exceeded for 90% of the measurement period and is used to quantify background noise level

A-weighting is the process by which noise levels are corrected to account for the non-linearity of human hearing.

11.3.1.2 Measurement Locations

Noise monitoring locations included six attended measurements (N1-N6) and one unattended measurement (N7). These are described further in Table 11-4 and Figure 11.1 contained in Volume 3.

Table 11-4 Noise Monitoring Locations

Noise Monitoring Location	Development Address
N 1	Dean Cogan Place – kerbside outside No.11 and 12
N 2	St Patrick's Classical School – grass verge adjacent to N51
N 3	Blackwater Park - grass area in front of No. 10
N 4	Ratholdron Road – grass verge to rear of Windtown Crescent
N 5	Ratholdron Road – paved area adjacent to Blackwater Park entrance
N 6	Clonmagaddan – grassed area opposite entrance to Windtown Road
N 7	Kells Road – grassed area to north east of Kells Road (N51/R147) junction with Blackwater Park

11.3.1.3 Survey Results

Table 11-5 and Table 11-6 summarise the noise levels recorded during the attended and unattended measurement surveys respectively.

Table 11-5 Attended measurement survey results with derived L_{A10} 18 hour and Lden values for locations N1 to N6

Location	Measurement Period	L_{Aeq}	L_{A10}	L_{A90}	Calculated L_{A10} 18hr	Calculated L_{den}
N1	10:10 - 10:15	67	66	55	65	66
	11:00 - 11:15	62	65	54		
	12:00 - 12:15	63	66	55		
N2	10:20 - 10:35	70	73	59	72	72
	11:20 - 11:35	70	74	60		
	12:20 - 12:35	70	74	62		
N3	10:40 - 10:55	58	61	50	60	61
	11:40 - 11:55	58	62	50		
	12:40 - 12:55	58	61	51		
N4	14:00 - 14:15	63	66	45	65	66
	15:00 - 15:15	61	62	44		
	16:00 - 16:15	64	68	48		
N5	14:20 - 14:35	67	72	49	71	71
	15:20 - 15:35	68	72	48		
	16:20 - 16:35	68	73	53		
N6	14:40 - 14:55	62	66	48	66	67
	15:40 - 15:55	62	66	48		
	16:40 - 16:55	63	68	50		

Table 11-6 Calculated L_{den} value for unattended monitoring at location N7

Date	Time	L_{Aeq}	L_{A10}	L_{A90}
10/10/2018	07:00:00	56.2	58.0	52.6
10/10/2018	08:00:00	56.0	57.9	53.1
10/10/2018	09:00:00	56.0	58.2	52.7
10/10/2018	10:00:36	55.4	57.5	52.1
09/10/2018	11:00:00	59.9	62.2	56.1
09/10/2018	12:00:00	60.1	62.6	56.2
09/10/2018	13:00:00	59.9	62.4	56.5
09/10/2018	14:00:00	60.9	62.5	56.2
09/10/2018	15:00:00	60.0	62.1	56.7
09/10/2018	16:00:00	58.7	60.9	55.7
09/10/2018	17:00:00	59.3	60.5	56.3
09/10/2018	18:00:00	57.6	58.9	54.7
09/10/2018	19:00:00	56.2	57.7	53.1
09/10/2018	20:00:00	54.9	56.8	50.9
09/10/2018	21:00:00	54.2	55.2	48.5
09/10/2018	22:00:00	50.4	53.4	44.5
09/10/2018	23:00:00	47.2	51.0	36.6
10/10/2018	00:00:00	45.2	48.7	34.8
10/10/2018	01:00:00	43.9	47.6	32.2
10/10/2018	02:00:00	43.7	46.9	30.6
10/10/2018	03:00:00	44.9	47.5	30.1
10/10/2018	04:00:00	46.0	48.9	32.0
10/10/2018	05:00:00	50.9	54.3	39.7
10/10/2018	06:00:00	53.8	56.1	49.2
	Calculated L_{den}			59.0

The baseline levels in Table 11-5 and Table 11-6 above are considered representative of the baseline noise climate in the study area and exhibit the characteristics that would be expected for a semi-urban setting.

11.4 Assessment of Impacts

11.4.1 Construction Phase

11.4.1.1 Noise Impacts

Due to the nature of the activities undertaken on a linear construction site such as the Proposed Road Development, there is the potential for the generation of noise and vibration levels above those currently experienced in the surrounding environment. Higher noise levels are generally accepted during the construction phase than the operational phase, as construction works are temporary and transitory in nature.

Whilst there is no published statutory limits relating to maximum permissible levels that may be experienced at sensitive receptors during the construction and demolition works, the criteria set out in Table 11-1 above are proposed as an appropriate target criteria for this assessment. Local authorities also typically control construction activities by imposing limits on the hours of operation.

Although detailed construction information is not available for the Proposed Road Development, a quantitative assessment of construction impacts has been undertaken. This quantitative assessment has assumed activities typically associated with road construction will be undertaken and these are described in Table 11-7, together with the types of plant typically used in such activities. The noise exposures estimated to be experienced at increasing distances from these activities are reported in Table 11-8.

Table 11-7 Typical construction activities and plant associated with road schemes

Construction Activity	Typical Plant used for activity	BS 5228 Table and Item number
Earthworks	30T 360deg Excavator	C 2.16
	20T 360deg Excavator	C 2.21
	Vibrating Roller Medium	D 3.116
	D6 Dozer 28T	C 2.11
	25T Dumper	C 5.16
	Lorry (4-axel)	C 2.34
Drainage	20T 360deg Excavator	C 2.21
	15T 360deg Excavator	C 2.25
	9T Dumper	C 4.4
	Vibrating Roller Medium	D 3.116
	Circular Saw	C 5.36
	Compressor	D 7.9
	Water Pump (6-inch)	C 2.45
	Cement Deliveries	C 4.20
	Lorry (4-axel)	C 2.34
Bridge construction	15T 360deg Excavator	C 2.25
	400tn Crawler Crane	C 4.50
	Compressor	D 7.9
	5T Dumper	C 4.7
	Circular Saw	C 5.36
Piling	CFA Piling Rig	C 12.42
	15T 360deg Excavator	C 2.25
	Air Compressor	D 7.8
	Scissor Lift	C 4.57
	Poker Vibrator	C 4.33
	Water Pump 6 inch	C 2.45
	Cement Deliveries	C 4.20
Surfacing	Paver (concrete)	D 8.26
	Road Planer	C 5.7
	Vibrating Roller Medium	D 3.116
	Vibratory Plate (petrol)	C 2.41
	Lorry Delivery	C 6.21/C 6.23

Table 11-8 Construction noise impacts at varying distances from typical construction activities associated with road construction ($L_{Aeq,1hr}$)

Receptor Distance	10m	20m	50m	100m	200m	300m
Construction activity						
Earthworks	88	82	74	68	62	59
Piling	86	80	72	66	60	56
Bridge construction	86	80	72	66	60	56
Drainage	90	84	76	70	64	60
Surfacing	88	82	74	68	62	59
Maximum unscreened noise level	90	84	76	70	64	60
Maximum screened noise level*	80	74	66	60	54	50

Construction noise calculations assume plant is placed on site boundary and hence representing closest distance between noise source and receiver.

**Screening assumed to provide reduction of 10dB(A) from unscreened value as per BS 5228 Pt 1 Annex E.4.*

It should be noted that the predicted construction noise levels shown in Table 11-8 assumes all plant associated with each activity is operating at the same time and located at the site boundary closest to the receptor. This is unlikely to materialise on site and hence the predictions are representative of worst-case.

The potentially worst affected receptors from construction noise are residential properties situated to close to the extents of the new link road. This means that any property within 50 m of the scheme may experience levels in excess of 65 dB during construction works. These include:

- Residential properties along Blackwater Park and Dean Cogan Place
- Residential properties on Windtown Road, directly to east of new link road, and Windtown Crescent.

The construction activities likely to adversely impact noise levels at these residential properties include earthworks, drainage installation and surfacing. The bridge construction over the River Blackwater, and any associated piling, will also adversely impact noise levels experienced at those residential properties on Blackwater Park which are located closest to the new link road. Given that the many of these properties, particularly those on Blackwater Park, are between 20-50 m from the construction activities at their closest point, these adverse impacts have the potential to result in significant adverse, not greater than moderate, effects.

However, the exact significance of any adverse noise impact resulting from the construction works will be highly dependent upon the methods, timing and duration of the works required. For instance, earthworks, drainage installation and surfacing will be transitory, with high noise levels only experienced at nearby noise sensitive receptors for a limited amount of time. However, other activities, such the bridge construction and any associated piling, will be confined to specific locations for long periods and hence impacts of these activities on nearby receptors are likely to be greater due to the noise exposure.

Exact plant types, mitigation techniques, durations and timings of the construction and demolition activities described in Table 11-7 are not available at this stage. However, further consideration of the potential effects and identification of appropriate measures to minimise effects as far as practicable will be reviewed as detailed information relating to construction plant, timings and programme become available.

There is the possibility due to site conditions that construction works may need to be undertaken during the evening and night-time, such as surfacing works where the proposed link road meets with existing roads. Normal working hours shall be as per the NRA guidelines with works outside normal working hours, other than required in respect of emergency works, shall only take place with the express written agreement from the relevant local authority.

In addition to direct impacts for the construction works, there is also the potential for additional impacts to occur at residential properties and other sensitive receptors as a result of construction traffic using the existing road network. The potential for such impacts, and hence significant adverse effects, is dependent on the volume and route of construction traffic. Although the volume of construction traffic and its routing is not available, it is considered that significant adverse effects due to construction traffic are unlikely to occur. Construction traffic levels are expected to be below 10% of current AM/PM peak traffic levels and will be managed via a construction stage traffic management plan.

11.4.1.2 Vibration Impacts

There is potential for ground vibration due to the construction phase works which will mainly result from the use of vibratory rollers to compact earthworks and road surfacing. In order to ensure that there is no potential for vibration damage during construction, the NRA recommends that vibration from road construction activities be limited to the values set out in Table 11-3. These values have been derived through consideration of the various international standards; compliance with this guidance should ensure that there is minimal risk of even cosmetic damage to buildings.

Residential properties on Windtown Road, directly to east of new link road, and Windtown Crescent have the potential to be worst affected by vibration, should vibratory rollers be used for surfacing compaction activities. However, although these residential properties are approximately 10m from these activities at their closest point, it is unlikely that the thresholds in Table 11-3 will be met and hence the likelihood of damage to buildings as a result of the use of vibratory rollers is considered to be negligible. As a result, significant adverse effects due to vibration during construction are unlikely to occur.

11.4.2 Operation Phase

11.4.2.1 Prediction methodology

As stated in Section 11.2, road traffic noise calculations were undertaken using the acoustic noise modelling package SoundPLAN v8.0. The L_{A10} values derived from SoundPLAN were converted to L_{den} by applying the following conversion as set out in NRA guidance:

$$L_{den} = L_{10}*0.86+9.86 \text{ dB(A)}$$

Road traffic noise calculations were undertaken for the ‘Do Minimum’ (without the Proposed Road Development in place) and ‘Do Something’ (with Proposed Road Development) scenarios for both the opening year (2022) and future year (2037) at all residential properties and other noise sensitive receivers within 300m from both the Proposed Road Development and the roads bypassed by the Proposed Road Development. The difference in noise level between the ‘do minimum’ and ‘do something’ scenarios in both 2022 and 2037 were derived.

11.4.2.2 Input parameters

In order to assess the road traffic noise levels in all assessment years and scenarios, traffic data for 2022 and 2037 were input into the noise model from the traffic modelling carried out as described in Chapter 5 (Traffic Analysis) for the Proposed Road Development. The traffic flows for these years were provided as 24hr AADT and the speeds as morning (AM) and evening (PM) peak. Following discussion with traffic specialists, the 24hr AADT values were considered equivalent to 18hr Annual Average Weekday Traffic (18hr AAWT) required for CRTN calculations. In addition, these discussions also concluded that the maximum of the peak speeds was considered representative of the annual average speed required for CRTN calculations.

Ground height information used in the assessment for areas outside of the Proposed Road Development boundary was derived from Ordnance Survey (OS) Digital Terrain Model (5

m grid) processed into 1m contours. Lidar data and the proposed 3D scheme design have been utilised to define the existing and proposed ground heights within the Proposed Road Development boundary.

Building height data were not available in provided building datasets. Hence, floor number of buildings were identified with a desktop exercise using publicly available satellite and street imagery to be able to assign appropriate height information. Building heights were assigned according to the assumptions given below:

- 1 floor building = 4 m height
- 2 floors building = 7 m height
- 3 floors building = 10 m height
- 4 floors building = 13 m height
- All buildings with footprint area less than 25 m^2 = 3 m height

Building use information was not available in provided building datasets. Hence, these were identified with a desktop exercise using publicly available satellite and street imagery.

The effect of the ground type on noise predictions was also considered, with the following ground absorption values set in the model:

- A ground absorption value of G=0.5 (representing an average of soft and hard grounds) has been assigned to built-up areas.
- Remaining areas set to G=1.0 (corresponding to 100% soft ground).

Road surfaces on all roads in both the ‘do minimum’ and ‘do something’ scenarios in both 2022 and 2037 were assumed to be Hot Rolled Asphalt. As speeds on all links were below 75kph, a correction of -1 dB was applied in the model to account for the effect on noise levels of this surface.

11.4.2.3 Model validation

To validate the outputs from the modelling of the scenarios described earlier, a noise model was created for the base year (2017). L_{den} values for this year were calculated from the model and compared to L_{den} values derived from measured LA10 data obtained during the baseline survey.

As a general rule, a difference of +/- 3dB(A) between measured levels and predicted values is considered to indicate good agreement. Difference between 4-6dB(A) are considered to indicate moderate agreement. Differences above 6dB(A) are considered to indicate bad agreement.

Table 11-9 Summary of results for model verification

Location	Baseline Derived L_{den}	Model Derived L_{den}	Difference L_{den}	Comments	Notes on baseline noise
N1	66	67	1	Good agreement	Dominant noise source - road traffic.
N2	72	68	-4	Moderate agreement	Dominant noise source - road traffic.
N3	61	61	0	Good agreement	Dominant noise source - road traffic.
N4	66	63	-3	Moderate agreement	Dominant noise source - road traffic.
N5	71	66	-5	Moderate agreement	Dominant noise source - road traffic.
N6	67	60	-7	Bad agreement	Dominant noise source - road traffic. However, other nearby sources include external plant at leisure centre
N7	59	61	2	Good agreement	Dominant noise source – road traffic

Of the seven locations, three are of ‘good’ and three are of ‘moderate’ agreement. For the one that is considered as ‘bad’ agreement, this was subject to other extraneous noise sources noted in the baseline monitoring that cannot be catered for in the model, including external plant from the nearby leisure centre.

11.4.2.4 Modelling Output

The results of the noise modelling for the Do Minimum and Do Something scenarios for the Proposed Road Development in the opening year and design year are addressed below and are shown on Figure 11.4-11.7 contained in Volume 3. Noise predictions were undertaken for approximately 3600 individual residential and noise sensitive receptors located within 300 m of the Proposed Road Development and existing roads bypassed by the Proposed Road Development.

The changes in road traffic noise levels likely to be experienced at these properties as a result of the Proposed Road Development in the opening year and design year are shown on Figure 11.8-11.10 contained in Volume 3. In summary, road traffic noise levels at a majority of receptors close to the following sections of road are expected to decrease as a result of the Proposed Road Development due to the diversion of traffic onto the new link road:

- Proudstown Road between Clonmagadden Road and N51;
- N51 between Proudstown Road and Kells Road;
- Abbeyland/Windtown Road between N51 and Windtown Crescent, and

- Kells Road between N51 and Proposed Road Development.

The Proposed Road Development also results in increases in road traffic noise levels at receptors immediately to the north and south of the Proposed Road Development. Two of these receptors exceed the predicted noise levels and increases set out in paragraph 11.2.1.2 and these are listed in Table 11-10 and Table 11-11 below.

Table 11-10 Predicted noise levels at receptors identified as meeting design criteria - opening year

Building name	Building ID	Floor	Facade	Do minimum (L_{den})	Do Something (L_{den})	Do Something without road (L_{den})	Difference: Do Something – Do Minimum	Contribution to increase in relevant noise level
1 Blackwater Park	269528	First	North	54.0	61.2	55.5	7.2	5.7
	269529	Ground	East	59.7	62.6	59.1	2.9	3.5
	269528	First	South	62.8	64.2	62.8	1.4	1.4
	269528	First	East	60.8	64.3	61.1	3.5	3.2

Table 11-11 Predicted noise levels at receptors as meeting design criteria design year

Building name	Building ID	Floor	Facade	Do minimum (L_{den})	Do Something (L_{den})	Do Something without road (L_{den})	Difference: Do Something – Do Minimum	Contribution to increase in relevant noise level
1 Blackwater Park	269528	First	N	54.5	62.1	55.8	7.6	6.3
	269529	Ground	N	54.7	60.7	53.6	6.0	7.1
	269528	First	E	51	60.3	51.2	9.3	9.1
	269529	Ground	S	61.5	62.7	61.1	1.2	1.6
	269528	First	N	52.5	60.9	54.2	8.4	6.7
	269529	Ground	E	60.2	63.4	59.4	3.2	4.0
	269528	First	S	63.3	64.6	63.1	1.3	1.5
	269528	First	E	61.3	65.1	61.4	3.8	3.7
St Patrick's	208936	Ground	NW	61.2	62.9	61.6	1.7	1.3

11.5 Mitigation and Monitoring Measures

11.5.1 Construction Phase

The construction phase of the Proposed Road Development will involve activities typically involved with road construction including earthworks and earthworks haulage, drainage, ground breaking, surfacing works, construction of a bridge and movement of machinery and materials to and from the construction compound[48] and local roads. A variety of plant will be used during these construction works, all of which have the potential to generate noise and vibration. These include machinery shown in Table 11-7 above. Construction is anticipated to be carried out in one phase and in line with the construction phasing information outlined in Section 4.11 of Chapter 4 (Description of the Proposed Road Development).

Working hours will be restricted to those outlined below. However, beams for the construction of the bridge may have to be transported to the site at night time due to traffic. Any out of hours working will be agreed in advance with the County Council.

[48] A construction compound will be required along or in the vicinity of the Proposed Road Development. It was proposed that the primary construction compound would be located in the land located to the south-west of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. An alternative and secondary compound is proposed to the north of the existing N51/R147 roundabout on the land currently occupied by a commercial building to be demolished.

With regard to construction activities, all plant items used during the construction phase will comply with standards outlined in '*European Communities (Construction Plant and Equipment) (Permissible Noise Levels) Regulations*,' (1998). Reference should be made to 'BS5228: *Noise control on construction and open sites'*, which offers detailed guidance on the control of noise from construction activities.

The following practices will be adopted during construction, including:

- Limiting the hours during which noisy site activities are permitted by MCC to 07.00 – 19.00 Monday – Friday and 07.00 - 13.00 Saturday. Work outside of normal hours shall only take place where written permissions have been sought and received from MCC;
- Appointing a site representative responsible for matters relating to noise; and
- Establishing channels of communication between the contractor/applicant and residents.

Furthermore, it is envisaged that a variety of practicable noise control measures will be employed. These include:

- Selection of construction plant with low inherent potential for generation of noise and/or vibration and use of quiet working methods to be implemented where practicable;
- Mufflers or silencers should be used where practicable and in line with manufacturers guidelines, all machines and equipment should be shut down when not in use;
- Erection of temporary barriers around items such as construction generators or high duty compressors. For maximum effectiveness, a barrier would be positioned as close as possible to either the noise source or receiver. The barrier would be constructed of material with a mass of > 7 kg/m_2 and should have no gaps or joints in the barrier material. As a rough guide, the length of a barrier would be five times greater than its height. A shorter barrier would be bent around the noise source, to ensure no part of the noise source is visible from the receiving location;
- Siting of noisy construction plant as far away from sensitive properties as permitted by site constraints;
- Plant and Machinery used on site should comply with the EC (Construction Plant and Equipment) Permissible, Noise Level Regulations, 1988 (S.I. No. 320 of 1988) or the most recent regulations available at the time of construction;
- All noise producing equipment should comply with S.I. No. 632 of 2001 European Communities (Noise Emission by Equipment for use Outdoors) Regulations 2001 or the most recent regulations available at the time of construction;
- Should construction noise levels raise above NRA guidance levels mitigation measures should be implemented to reduce noise levels.

The use of vibratory rollers will be monitored to ensure acceptable levels of vibration are maintained at sensitive receptors and measures will be undertaken to minimise levels when necessary.

11.5.2 Operation Phase

As described in Section 11.4.2.4, the design goals set out in Section 11.2.1.2 have been exceeded at 1 Blackwater Park and St Patricks. As a result, a number of mitigation measures have been identified as being required in order for the design goals to be met at these locations. These are summarised below and shown on Figure 11.3 contained in Volume 3.

A LNRS is proposed along all sections of the link road, as well as on the tie in points along the existing road network. A 1.5 m high noise barrier is also proposed along the new link road, extending 39.5 m along the northbound carriageway in the vicinity of 1 Blackwater Park. A 1.5 m high bund, extending 225 m along the southbound carriageway, is also proposed.

The results of the noise modelling for the Do Minimum and Do Something scenarios for the Proposed Road Development in the opening year and design year with mitigations are shown on Figure 11.11-11.12 contained in Volume 3. The changes in road traffic noise levels likely to be experienced at these properties as a result of the Proposed Road Development in the opening year and design year with mitigations are shown on Figure 11.13-11.14 contained in Volume 3.

11.6 Cumulative Impacts

Based on the information available at the time of this assessment, cumulative significant adverse noise and vibration effects arising from construction and operation of this scheme in combination with others is unlikely.

11.7 Residual Impacts

The construction phase of the Proposed Road Development is predicted to adversely impact noise and vibration levels at a number of residential properties which will be in close proximity to earthworks, drainage installation and surfacing operations. The bridge construction over the River Blackwater, and any associated piling, will also adversely impact noise levels experienced at those residential properties on Blackwater Park which are located closest to the new link road. These impacts are based on assumed activities typically associated with road construction, together with the types of plant typically used in such activities. A further review of these impacts would be required once construction details, including plant and programme, are available.

Subject to the installation of low noise road surfacing materials and the installation of a noise barrier, all residential receptors will comply with the NRA design criteria.

11.8 Difficulties Encountered

No detailed construction information, such as plant types, mitigation techniques, durations and timings of the construction activities were available for the Proposed Road Development. Thus, the quantitative assessment which has been undertaken and reported in this chapter has assumed activities typically associated with road construction, together with the types of plant typically used in such activities.

11.9 Summary

The potential noise and vibration impacts have been considered for both the construction and operational phases of the Proposed Road Development in the opening year (2022) and design year (2037).

Monitoring comprised of an unattended survey at one location and attended surveys at 6 locations.

The construction of the Proposed Road Development is predicted to adversely impact residential properties and other noise sensitive receptors. However the application of measures such as restricted working hours, the use of quiet plant, positioning construction works at a distance from noise sensitive receptors will reduce the noise and vibration impacts due to the construction of the scheme.

The operation of the Proposed Road Development is predicted to reduce road traffic noise levels at a majority of receptors close to the following sections of roads due to the diversion of traffic onto the new link road:

- Proudstown Road between Clonmagadden Road and N51;
- N51 between Proudstown Road and Kells Road;
- Abbeyland/Windtown Road between N51 and Windtown Crescent, and
- Kells Road between N51 and Proposed Road Development

The operation of the Proposed Road Development is predicted to increase road traffic noise levels at receptors in the vicinity of Clonmagadden, R147 and N51 junction. The predicted increase at majority of these receptors is identified to be not significant.

Two residential properties were predicted to exceed the NRA's design criteria, if no mitigation measures were proposed. However, the use of low noise road surfacing materials and the installation of a noise barrier, as mitigation measures, will result in these residential receptors complying with the aforementioned criteria.

11.10 References

- EPA. (2003). *EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements*, Environmental Protection Agency, Wexford, Ireland.
- EPA. (2016). *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*, Environmental Protection Agency, Wexford, Ireland.

- EPA. (2017). *EPA Guidelines on the information to be contained in Environmental Assessment Reports, Draft, August 2017*, Environmental Protection Agency, Wexford, Ireland.
- Department of Transport, Whelsh Office. (1988). *Calculation of Road Traffic Noise.*
- NRA. (2004). *Guidelines for the Treatment of Noise and Vibration in National Road Schemes,* National Roads Authority, Dublin, Ireland.
- NRA. (2014). *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*, National Roads Authority, Dublin, Ireland.
- BRE. (1990). *Damage to structures from ground-borne vibration*, Building Research Establishment Digest 353.
- BSI. (1990). BS 7385: Part 2 1990: Evaluation and Measurement for Vibration in Buildings – Guide to Damage Levels from Ground-Borne Vibration.
- BSI. (2012). BS 6472:1992 Guide to Evaluation of Human Exposure to Vibration in Buildings
- BSI. (2014a). BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 1: Noise'.
- BSI. (2014b). BS 5228-2:2009+A1:2014 'Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration'.

Chapter 12: Landscape and Visual Impact Assessment

12

12. Landscape and Visual Impact Assessment

12.1 Introduction

This chapter describes the landscape and visual effects arising from the Proposed Road Development, Abbeyland, Navan from locations accessible by the general public in accordance with the relevant EPA Guidelines, general national and European best practice guidelines in relation to the preparation of Landscape and Visual Impact Assessments (LVIA).

The following technical drawings and appendices are supporting the landscape and visual impact assessment and are included in Volume 3 (Figures) and Volume 4 (Appendices).

Volume 3 – Figures

- Figure 12.1 – Landscape Character Areas;
- Figure 12.2 – Landscape Character Units;
- Figure 12.3 – Landscape Value;
- Figure 12.4 – Landscape Designations;
- Figure 12.5 – Landscape Mitigation Sheet 1 of 3;
- Figure 12.6 – Landscape Mitigation Sheet 2 of 3;
- Figure 12.7 – Landscape Mitigation Sheet 3 of 3;
- Figure 12.8 – Typical Landscape Softworks Details 1;
- Figure 12.9 – Typical Landscape Softworks Details 2; and
- Figure 12.10 – Typical Landscape Softworks Details 3.

Volume 4 – Appendices

- Appendix A12-1 – Booklet of Photomontages (Photomontages 1-6) including Photomontage Location Sheet; and
- Appendix A12-2 – Outline Softworks Specification.

12.2 Methodology

12.2.1 Assessment Guidelines, Planning Legislation and other information sources

The following guidelines, planning legislation and information sources were used in the assessment:

- EPA '*Guidelines on the Information to be contained in Environmental Impact Statements'*, 2002;
- EPA EIS Manual '*Advice Notes on Current Practice (in the preparation of Environmental Impact Statements)'*, 2003;
- EPA Draft '*Revised Guidelines on the Information to be contained in Environmental Impact Statements*', September 2015, where appropriate;
- EPA Draft '*Advice Notes for Preparing Environmental Impact Statements'*, 2015, where appropriate;
- 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;
- NRA 2008: '*Environmental Impact Assessment of National Road Schemes - A Practical Guide*, Revision 1.
- NRA 2006: '*A Guide to Landscape Treatments for National Road Schemes in Ireland'*.

- NRA 2006*: 'Guidelines for Protection and Preservation of Trees, Hedgerows and Scrub Prior to, during and Post Construction of National Road Schemes'*.
- NRA 2013: '*Design Manual for Roads and Bridges*.
- TII 2019: '*Landscape Character Assessment (LCA) and landscape and visual impact assessment (LVIA) of proposed national roads: Standards Document, PE-ENV-01105',* January 2019, Draft for Consultation.
- LI: '*Photography and Photomontage in Landscape and Visual Impact Assessment'*, Advice Note 01/2011;
- NDP 2009 - 2015;
- MCDP 2013 - 2019;
- Irishtrails, http://www.irishtrails.ie;
- OSI, 1:50,000 Discovery Mapping; and
- DTTAS and DHPLG: DMURS (2019).

12.2.1.1 European

The European Landscape Convention provides guidelines for managing landscapes/townscapes. The Convention is not an EU Directive. Countries that sign and ratify the Convention make a commitment to upholding the principles it contains within the context of their own domestic legal and policy frameworks. The convention was ratified by Ireland in March 2002 and came into effects in Ireland in 2004. The European Landscape Convention requires "*landscape to be integrated into regional and town planning policies and in cultural, environmental, agricultural, social and economic policies, as well as any other policies with possible direct or indirect impacts on Landscape*".

12.2.1.2 National

The National Landscape Strategy (NLS) for Ireland 2015-2025 was launched in May 2015 and is to be implemented by the Government in the future. The NLS promotes the sustainable protection, management and planning for the landscape/townscape. The NLS states that the "*National Landscape Strategy will be used to ensure compliance with the European Landscape Convention and to establish principles for protecting and enhancing the landscape (townscape) while positively managing its change. It will provide a high-level policy framework to achieve balance between the protection, management and planning of the landscape by way of supporting actions." It also states that "The Strategy sets out Ireland's high-level objectives and actions with regard to landscape (townscape). It also positions landscape in the context of existing Irish and European strategies, policies and objectives, and outlines methods of ensuring co-operation at a sectoral and at a European level by the State*."

12.2.1.3 TII

The draft TII Standards Document on the preparation of Landscape Character Assessments (LCA) and LVIA of proposed national roads has been available as a consultation draft since January 2019. At the time of this assessment, these standards have not been finalised. Therefore, best practice guidance, such as the "Guidelines for Landscape and Visual Impact Assessment, 3rd Edition, 2013, Landscape Institute (LI) (UK) & IEMA" which provide specific guidelines for landscape and visual impact assessments have also been used to prepare this assessment. As a result, a combination of the draft TII guidelines and the LI guidelines and professional experience has informed the methodology for the assessment herein. The LI guidelines require the assessment to identify, predict and evaluate the significance of potential effects to landscape / townscape characteristics and established views. The assessment is based on an evaluation of the sensitivity to change and the magnitude of change for each landscape / townscape or visual receptor. For clarity, and in accordance with best practice, the assessment of potential effects on landscape / townscape character and visual amenity, although closely related, are undertaken separately.

12.2.2 Assessment Methodology

The significance of an effect or impact is determined by two distinct considerations:

- The **Nature** of the receptor likely to be affected, namely:
  - The value of the receptor;
  - The susceptibility of the receptor to the type of change arising from the proposed developments; and
  - The sensitivity to change is related to the value attached to the receptor.

More details and definitions relating to landscape and visual susceptibility and sensitivity are provided in Sections 12.2.3 (Landscape) and 12.2.4 (Visual)

- The **Magnitude** of the effect likely to occur, namely:
  - The size and scale of the landscape and visual effect (for example, whether there is a complete or minor loss of a particular landscape element);
  - The geographical extent of the areas that will be affected;
  - The duration of the effect and its reversibility; and
  - The quality of the effect – whether it is neutral, positive or negative.

The table below provides the definition of the duration of both landscape and visual effects.

Table 12-1 Definition of Duration of Effects

Duration	Description
Temporary	Effects lasting one year or less
Short Term	Effects lasting one to seven years
Medium Term	Effects lasting seven to fifteen years
Long Term	Effects lasting fifteen to sixty years
Permanent	Effects lasting over sixty years

The quality of both landscape and visual effects is defined in the table below.

Table 12-2 Definition of Quality of Effects

Quality of Effects	Description
Neutral	This will neither enhance nor detract from the landscape character or view
Positive (Beneficial)	This will improve or enhance the landscape character or view
Negative (Adverse)	This will reduce the quality of the existing landscape character or view

12.2.3 Landscape Effects

Landscape effects describe the impact on the fabric or structure of a landscape or landscape character.

12.2.3.1 Landscape Receptors

The assessment of landscape effects firstly requires the identification of the components of the landscape. 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 different from another.

The assessment identifies 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.

12.2.3.2 Landscape Susceptibility

Landscape susceptibility relates to the ability of a particular landscape to accommodate the Proposed Road Development. Landscape susceptibility is appraised through consideration of the baseline characteristics of the landscape, and in particular, the scale or complexity of a given landscape.

The evaluation of landscape susceptibility is undertaken with reference to a three-point scale, as outlined in Table 12-13.

Table 12-3 Landscape Susceptibility Criteria

Landscape Susceptibility	Classification Criteria
High	Small scale, intimate or complex landscape considered to be intolerant of even minor change
Medium	Medium scale, more open or less complex landscape considered tolerant to some degree of change
Low	Large scale, simple landscape considered tolerant of a large degree of change

12.2.3.3 Landscape Sensitivity

Landscape sensitivity to change is determined by employing professional judgment to combine and analyse the identified value, quality and susceptibility and is defined with reference to the scale outlined in the table below.

Table 12-4 Landscape Sensitivity to Change Criteria

Landscape Susceptibility	Classification Criteria
High	• Landscape characteristics or features with little or no capacity to absorb change without fundamentally altering their present character • Landscape designated for its international or national landscape value or with highly valued features • Outstanding example in the area of well cared for landscape or set of features that combine to give a particularly distinctive sense of place Few detracting or incongruous elements
Medium-high	• Landscape characteristics or features with a low capacity to absorb change without fundamentally altering their present character • Landscape designated for regional or county-wide landscape value where the characteristics or qualities that provided the basis for their designation are apparent or a landscape with highly valued features locally Good example in the area of a well-cared for landscape or set of features that combine to give a clearly defined sense of place
Medium	• Landscape characteristics or features with moderate capacity to absorb change without fundamentally altering their present character • Landscape designated for its local landscape value or a regional designated landscape where the characteristics and qualities that led to the designation of the area are less apparent or are partially eroded or an undesignated landscape which may be valued locally – for example an important open space An example of a landscape or a set of features which is relatively coherent, with a good but not exceptional sense of place - occasional buildings and spaces may lack quality and cohesion
Medium-Low	• Landscape characteristics or features which are reasonably tolerant of change without detriment to their present character • No designation present or of little local value An example of an un-stimulating landscape or set of features; with some areas lacking a sense of place and identity
Low	• Landscape characteristics or features which are tolerant of change without determent to their present character • An area with a weak sense of place and/or poorly defined character /identity • No designation present or of low local value or in poor condition An example of monotonous unattractive visually conflicting or degraded landscape or set of features

12.2.3.4 Magnitude of Landscape Change

Magnitude of change is an expression of the size or scale of change in the landscape, the geographical extent of the area influenced and its duration and reversibility. The variables involved are described below:

- The extent of existing landscape elements that will be lost, the proportion of the total extent that this represents and the contribution of that element to the character of the landscape;
- The extent to which aesthetic or perceptual aspects of the landscape are altered either by removal of existing components of the landscape or by addition of new ones;
- Whether the effect changes the key characteristics of the landscape, which are integral to its distinctive character;

- The geographic area over which the landscape effects will be felt (within the Proposed Road Development boundary; the immediate setting of the site; at the scale of the landscape type or character area; on a larger scale influencing several landscape types or character areas); and
- The duration of the effects (temporary, short term, medium term, long term, permanent). Duration is related to the reversibility of the effect and some effects may be fully or partially reversible.

Changes to landscape characteristics can be both direct and indirect. Direct change occurs where the Proposed Road Development will result in a physical change to the landscape within or adjacent to the Proposed Road Development site. Indirect changes are a consequence of the direct changes resulting from the Proposed Road Development. They occur often away from the Proposed Road Development site (for example, traffic volumes on adjacent roads) and may be a result of a sequence of interrelationships or a complex pathway (for example, a new road or footpath construction may increase public access and associated problems e.g. littering). They may be separated by distance or temporally from the source of the effects.

The magnitude of change affecting the baseline landscape resource is based on an interpretation of a combination of the criteria set out in Table 12-5.

Table 12-5 Magnitude of Landscape Change Criteria (Landscape Effects)

Magnitude	Classification Criteria
None	No change
Negligible	Little perceptible change
Low	Minor change, affecting some characteristics and the experience of the landscape to an extent; and Introduction of elements that is not uncharacteristic
Medium	Noticeable change, affecting some key characteristics and the experience of the landscape; and Introduction of some uncharacteristic elements.
High	Noticeable change, affecting many key characteristics and the experience of the landscape; and Introduction of many incongruous developments
Very High	Highly noticeable change, affecting most key characteristics and dominating the experience of the landscape; and Introduction of highly incongruous development

12.2.4 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.

12.2.4.1 Visual 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 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);
- Nature of visual receptors (type, potential number and sensitivity of viewers who may be affected); and
- Impact of ancillary developments.

12.2.4.2 Visual Susceptibility

The GLVIA guidelines identify that the susceptibility of visual receptors to changes in views and visual amenity is a function of:

- The occupation or activity of people experiencing the view at a particular location; and
- The extent to which their attention or interest may therefore be focused on the views and visual amenity they experience at particular locations.

For example, residents in their home, walkers whose interest is likely to be focused on the landscape or a particular view, or visitors at an attraction where views are an important part of the experience often indicate a higher level of susceptibility. Whereas receptors occupied in outdoor sport where views are not important or at their place of work are often considered less susceptible to change. Visual susceptibility is determined with reference to the three-point scale which is outlined in Table 12-6.

Table 12-6 Visual Susceptibility

Susceptibility	Classification Criteria
High	Receptors for which the view is of primary importance and are likely to notice even minor change
Medium	Receptors for which the view is important but not the primary focus and are tolerant of some change
Low	Receptors for which the view is incidental or unimportant and is tolerant of a high degree of change

12.2.4.3 Visual Sensitivity

Sensitivity to change considers the nature of the receptor, for example a person occupying a residential dwelling is generally more sensitive to change than someone working in a factory unit. The importance of the view experienced by the receptor also contributes to an understanding of the susceptibility of the visual receptor to change as well as the value attached to the view.

A judgement is also made on the value attached to the views experienced. This takes account of:

- Recognition of the value attached to particular views, for example in relation to heritage assets, or through planning designations;
- Indicators of the value attached to views by visitors, for example through appearance in guidebooks or on tourist maps, provision of facilities for their enjoyment (sign boards, interpretive material) and references to them in literature or art; and
- It is important to note that the absence of view recognition does not preclude local value, as a view may be important as a resource in the local or immediate environment due to its relative rarity or local importance.

The visual sensitivity to change is based on interpretation of a combination of all or some of the criteria outlined in Table 12-7.

Table 12-7 Visual Sensitivity to Change Criteria

Visual Sensitivity	Classification Criteria
High	Users of outdoor recreational facilities, on recognised national cycling or walking routes or in nationally designated landscapes Residential buildings
Medium-high	Users of outdoor recreational facilities, in highly valued landscapes or locally designated landscapes or on local recreational routes that are well publicised in guide books Road and rail users in nationally designated landscapes or on recognised scenic routes, likely to be travelling to enjoy the view
Medium	Users of outdoor recreational facilities including public open space in moderately valued Landscapes Users of primary transport road network, orientated towards the Proposed Road Development, likely to be travelling for other purposes than just the view
Medium-low	People engaged in active outdoor sports or recreation and less likely to focus on the view Primary transport road network and rail users likely to be travelling to work with oblique views of the project or users of minor road network
Low	People engaged in work activities indoors, with limited opportunity for views of the Proposed Road Development

12.2.4.4 Magnitude of Visual Change

Visual effects are direct effects as the magnitude of change within an existing view will be determined by the extent of visibility of the Proposed Road Development. The magnitude of the visual effect resulting from the development at any particular viewpoint or receptor is based on the size or scale of change in the view, the geographical extent of the area influenced and its duration and reversibility. The variables involved include:

- The scale of the change in the view with respect to the loss or addition of features in the view and changes in its composition, including the proportion of the view occupied by the development;
- The degree of contrast or integration of any new features or changes in the landscape form, scale, mass, line, height, skylining, back-grounding, visual clues, focal points, colour and texture;
- The nature of the view of the development, in relation to the amount of time over which it will be experienced and whether views will be full, partial or glimpses.
- The angle of view in relation to the main activity of the receptor, distance of the viewpoint from the development and the extent of the area over which the changes will be visible; and
- The duration of the effects (short term, medium term or long term) and the reversibility of the effect (whether it is permanent, temporary or partially reversible).

The magnitude of visual effect resulting from the Proposed Road Development at any particular viewpoint or receptor is based on the interpretation of the above range of factors and is set out in Table 12-8 enclosed overleaf.

Table 12-8 Magnitude of Visual Change Criteria (Visual effects)

Magnitude	Classification Criteria
None	No change in the existing view
Negligible	The development will cause a barely discernible change in the existing view
Low	The development will cause very minor changes to the view over a wide area or minor changes over a limited area
Medium	The development will cause modest changes to the existing view over a wide area or noticeable change over a limited area
High	The development will cause a considerable change in the existing view over a wide area or a significant change over a limited area
Very High	The development will cause significant changes in the existing view over a wide area or a change which will dominate over a limited area

12.2.5 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 taking into account mitigation measures and the change over time.

The significance of effects is assessed by considering the sensitivity of the receptor and the predicted magnitude of effect in relation to the baseline conditions. In order to provide a level of consistency and transparency to the assessment and allow comparisons to be made between the various landscape and visual receptors subject to assessment, the assessment of significance is informed by pre-defined criteria as outlined in the table below. 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 significance of the effects can be adverse (negative) or beneficial (positive) according to the definitions set out in Table 12-9:

Table 12-9 Categories of Significance of Landscape and Visual Effects

Significance Category	Description 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.

The significance of the effect is determined by considering the magnitude of the effect and the quality of the baseline environment affected by the Proposed Road Development. The basis for consideration of the significance of effects is included overleaf.

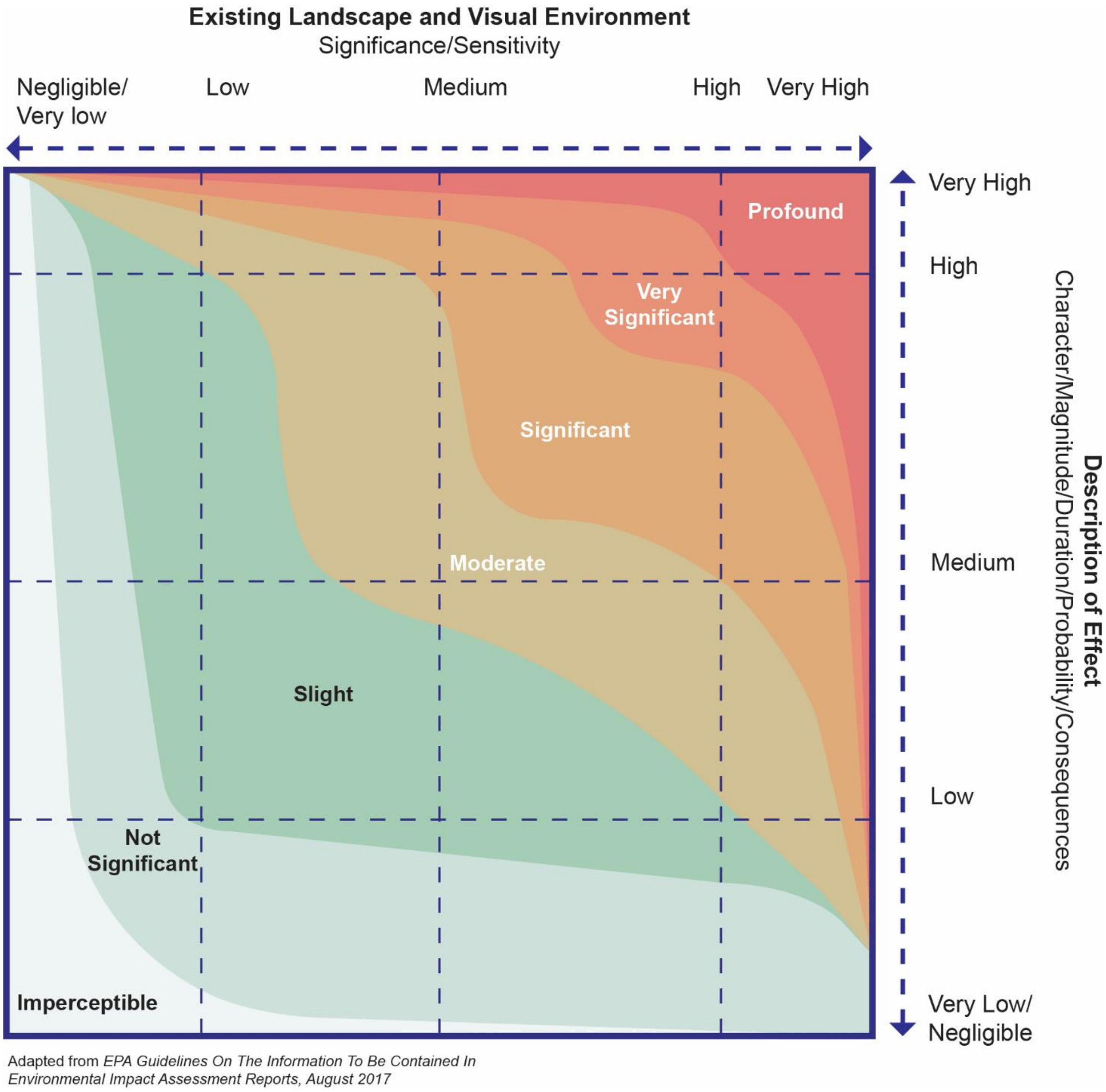


Figure 12-1 Basis for consideration of significance of effects

Effects will be assessed for all phases of the development. Construction effects are considered to be temporary, short term effects which occur during the construction 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. Each effect is assessed to be 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.

12.2.6 Fieldwork

A site survey of the 1.5km study area to either side of the Proposed Road Development was carried out on 21st August 2018, identifying the potential visibility of the Proposed Road Development, key viewpoints within the local and wider landscape and the potential for mitigation measures to integrate the proposals into its surroundings. Photomontages showing the existing view and the superimposed development have been produced from 6 representative viewpoints located within the study area. Photomontages 1-6 are included in Appendix A12-1 in Volume 4.

12.2.7 Selection of Viewpoints

Viewpoint selection has been carried out according to the current best practice standards and the following industry guidelines:

- 'Photography and Photomontage in Landscape and Visual Impact Assessment', Landscape Institute Advice Note 01/2011.
- 'Photography and Photomontage in Landscape and Visual Impact Assessment', Landscape Institute, Technical Guidance Note, public consultation Draft 2018-06-01.

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 are informed by desktop and site surveys.
- There is 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.

12.2.8 Photomontages

Photomontages are photorealistic visualisations produced using specialist software. 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 on site, where visualisations can be compared to the 'real life' view, and the full impact of the Proposed Road Development can be understood.

The landscape and visual impact assessment on site 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.

Viewpoints / Photomontages 1 - 6 (Appendix A12-1 in Volume 4) show the Proposed Road Development including the following information for each:

Page 1

- Existing View - Showing the baseline image; and
- Photomontage - Showing the Proposed Road Development including all visible components prior to the implementation of landscape mitigation measures.

Page 2

- Photomontage - Showing the Proposed Road Development including all visible components including landscape mitigation measures after 7 years; and
- Wireline Image indicating visible and non-visible elements of the Proposed Road Development from the viewpoint.

Photomontage images have been produced with reference to best practice and the following industry guidelines:

- 'Photography and Photomontage in Landscape and Visual Impact Assessment', Landscape Institute Advice Note 01/2011, 2011;

- 'Photography and Photomontage in Landscape and Visual Impact Assessment', Landscape Institute, Technical Guidance Note, public consultation Draft 2018-06-01.
- 'Guidelines for Landscape and Visual Impact Assessment (GLVIA)', Third Edition, Landscape Institute and Institute of Environmental Management and Assessment, IEMA, 2013; and
- 'Visual Representation of Wind Farms', Version 2.2, Scottish Natural Heritage, February 2017 (in relation to viewpoint selection, technical equipment, function and limitations of visualisations).

12.2.9 Zone of Theoretical Visibility

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 mainly gently undulating nature and the considerable amount of buildings and vegetation within the study area, the production of a ZTV would not be useful for the identification of viewpoints within the study area. The assessment relied therefore on comprehensive site surveys to establish the nature of visibility within the study area and to identify key viewpoint locations.

12.3 Description of the Existing Environment

Navan is a historic town located at the meeting of the Rivers Boyne and Blackwater, which flow directly through the town. Navan is located approximately 45km north west of Dublin City Centre and is the largest urban centre in County Meath. The vestiges of Navan's history are clearly evident on the landscape with monuments such as Kilcarn Bridge, Athlumney Castle and parts of the Town Walls are clearly visible. Rivers Boyne and Blackwater are of particularly high amenity landscape value.

Navan has a significant number of protected structures and archaeological sites. A portion of Navan town centre is also an identified Architectural Conservation Area (ACA).

Navan enjoys a relatively compact urban structure though it has expanded to a considerable degree in line with the major population growth. The town straddles both sides of the River Boyne and River Blackwater, with development generally well balanced on all sides. In recent years, the south eastern portion of the town, particularly around Athlumney/Johnstown, has experienced the most notable amount of new development. The scale of the built environment is generally low, predominantly single and two storey structures, though certain landmark buildings such as Navan Credit Union and the Academy Square apartments have raised the height profile in certain areas. More recent developments in the town such as the Solstice Arts Centre have resulted in the introduction of modern architectural urban elements into the built landscape, which complements the established charm and character of the town. Other notable new structures constructed in recent years include developments in the IDA Business Park, Navan Leisure Centre, extensions to Navan Shopping Centre, the redeveloped Dunnes Stores at Kennedy Place, office developments on Abbey Road and the major retail parks on the Kells and Athboy roads.

The location of Navan set in the Boyne Valley at the confluence of the River Boyne & Blackwater. It is located in close proximity to the historical site of 'The Hill of Tara' and to Slane Hill and Slane Castle. It is also strategically located in the centre of tourist attractions in the County such as Newgrange, Boyne Valley Drive, Knowth and Dowth, Trim Castle, Bective Abbey, Kells and Slieve na Calliagh.

12.3.1 Landscape Character

The current MCDP Plan 2013-2019 contains a LCA which describes landscape character areas and strategies for the protection of specific landscape features.

The Meath LCA divides the County into four Landscape Character Types which are further sub-divided into twenty Landscape Character Areas. The Proposed Road Development is located in River Corridors and Estuaries Landscape Character Type and Blackwater Valley Landscape Character Area. The wider study area extends to Lowland Landscapes Landscape Character Type and the following Landscape Character Areas - North Navan

Lowlands to the north-east, West Navan Lowlands to the south and Boyne Valley to the east. Each of the Landscape Character Areas had been assigned a specific rating under the following categories within the Meath Landscape Character Assessment: Landscape Value, Landscape Sensitivity, Landscape Importance and Landscape Capacity.

The ratings from the LCA are summarised in the tables below.

Table 12-10 Landscape Value

Landscape Character Area	Landscape Value	Description
Blackwater Valley (Majority of Proposed Road Development Location)	Very High	Areas which have particularly high value by nature of their dramatic scenic quality, unspoilt beauty, conservation interests, historic, cultural or other associations that influence landscape value. These areas may be of national or regional importance.
North Navan Lowlands (Small section of Proposed Road Development Location)	Moderate	Areas which retain a positive character and a sense of place or are of local interest or importance.
West Navan Lowlands – wider study area	Moderate	Areas which retain a positive character and a sense of place or are of local interest or importance.
Boyne Valley – wider study area	Exceptional	Areas which are of outstanding value by nature of their dramatic scenic quality, unspoilt beauty, conservation interests, historic, cultural or other associations that influence landscape value. These areas may be of national or international importance.

Table 12-11 Landscape Sensitivity

Landscape Character Area	Landscape Sensitivity	Description
Blackwater Valley - Proposed Development Location)	High	A vulnerable landscape likely to be fragile and susceptible to change. Frequency and sensitivity of users is likely to be high. The introduction of a change is likely to significantly alter the character to the extent that it would be difficult or impossible to restore.
North Navan Lowlands – wider study area	Medium	A landscape that can accommodate a certain amount of change without affecting the overall character. There are unlikely to be large numbers of people using or viewing this landscape.
West Navan Lowlands – wider study area	Medium	A landscape that can accommodate a certain amount of change without affecting the overall character. There are unlikely to be large numbers of people using or viewing this landscape.
Boyne Valley – wider study area	High	A vulnerable landscape likely to be fragile and susceptible to change. Frequency and sensitivity of users is likely to be high. The introduction of a change is likely to significantly alter the character to the extent that it would be difficult or impossible to restore.

Table 12-12 Landscape Importance

Landscape Character Area	Landscape Importance	Description
Blackwater Valley- Proposed Road Development Location)	Regional	The landscape is afforded importance by a regionally recognised element or elements within it. These may relate to history, culture, geology or other associations. Such elements may be designated within the MCDP or may comprise smaller elements which are not designated but together form an important characteristic of an area, which is recognisable or distinct within the County or Province.
North Navan Lowlands – wider study area	Regional	The landscape is afforded importance by a regionally recognised element or elements within it. These may relate to history, culture, geology or other associations. Such elements may be designated within the MCDP or may comprise smaller elements which are not designated but together form an important characteristic of an area, which is recognisable or distinct within the County or Province.
West Navan Lowlands – wider study area	Local	The landscape is afforded importance by a locally recognised element or elements within it. These may relate to history, culture, geology or other associations. These elements are unlikely to be designated but will individually or collectively form an important characteristic of an area, which is locally recognisable.
Boyne Valley – wider study area	International	The landscape is afforded importance by an internationally recognised element or elements within it. For example, these may relate to history, culture, geology or other associations. These landscapes are usually internationally known and may attract visitors from all over the world.

Table 12-13 Landscape Capacity

Landscape Character Area	Landscape Capacity	Description
Blackwater Valley - Proposed Road Development Location)	Medium Potential Capacity: The Landscape has medium sensitivity to the type of development proposed. Any change caused by the Proposed Road Development would be unlikely to have a significant adverse effect on landscape character or value that could not be mitigated against.	Medium potential capacity to accommodate road and rail infrastructure development provided that the potential loss of boundary walls, planting and damage to historic features and their settings is mitigated against.
North Navan Lowlands – wider study area	High Potential Capacity: The landscape will have low sensitivity to this type of development and few constraints imposed by landscape elements. Development of the type proposed is very unlikely to have an adverse effect on landscape character or value.	High potential capacity to accommodate new transport infrastructure with potential associated opportunities to improve the condition of degraded field boundaries and enhance passenger rail network by utilising disused lines.
West Navan Lowlands – wider study area	Medium Potential Capacity: The landscape has medium sensitivity to the type of development proposed. Any change caused by the Proposed Road Development would be unlikely to have a significant adverse effect on landscape character or value that could not be mitigated against.	Medium to low potential capacity to accommodate new transport infrastructure. In parts of this Landscape Character Area that have a strong landscape structure such development could be located in visually non-prominent areas. Elsewhere, particularly in the degraded area around Navan, such development would have a detrimental impact on a landscape that is already in poor condition.
Boyne Valley – wider study area	Low Potential Capacity: The landscape has high sensitivity to the type of development proposed which could have a detrimental effect on landscape character or value.	Low potential capacity to accommodate new transport routes due to the exceptional landscape value and high sensitivity of this Landscape Character Area. The future upgrading of existing roads would also need to be carefully planned to

Landscape Character Area	Landscape Capacity	Description
		avoid the loss of landscape features that screen existing road and rail corridors.

To summarise, the Proposed Road Development lies within the 'Blackwater Valley' Landscape Character Area, which is considered to have medium potential capacity to accommodate road infrastructure; it is an area of very high landscape value, high landscape sensitivity and regional importance according to the Meath CDP.

Within the study area, the landscape character includes:

- The historic urban compact townscape of Navan which includes historic buildings and streetscape, Blackwater River Valley, Boyne River Valley, railway infrastructure and amenity recreation areas such as Blackwater Park. The compact form of the central town begins to disperse as one travels along roads leading out of the town with a loss of homogenous characteristics and varying quality of landscape character and ribbon development.
- Late 20th century/early 21st century sub-urban residential and industrial landscape; these areas stretch primarily northwards, southwards and eastwards from the town centre and are generally laid out to prioritise vehicular movement rather than accommodate "as the crow flies" pedestrian or cycle routes. These areas define the urban edge character experienced around the periphery of Navan Town. The Tara Mines site is located outside the study area, to the north west of the town centre.
- Edge of town agricultural landscape of field, hedgerow and dispersed housing and farm buildings as well as national and regional roads and a network of local roads and lanes. There is no clear defining boundary between the end of the town and the start of the countryside.

12.3.2 Landscape Designations

Landscape Designations are presented in Figures 12.1 – 12.4 included within Volume 3 of this EIAR.

12.3.2.1 Sensitivity of Landscape Character Areas

Sections of the study area are characterised by the high-quality landscapes of the Blackwater and Boyne River Valleys. The Blackwater Valley Landscape Character Area, which contains the majority of the Proposed Road Development, is designated as an area of 'High Sensitivity' in the County Meath Landscape Character Assessment. The remaining parts of the development are located within an area of Moderate Sensitivity as shown in Figure 12.1 included in Volume 3.

12.3.2.2 Areas of High Landscape Value

Meath LCA classifies also areas into various Landscape Values. The majority of the Proposed Road Development is located within an area identified as 'Very High Value'; the remainder is located within an area of 'Moderate Value' as shown in Figure 12.3 included in Volume 3. The value rating is due to the importance of river valleys located within or in the vicinity of Navan town. Meath LCA describes these river valleys of Very High Value (River Blackwater) and Exceptionally High Value (River Boyne). The LCA acknowledges that shelter vegetation exists along some stretches of the valley with the presence of natural and native woodland and that this vegetation has a shielding and absorbing quality in landscape terms. It can provide a natural visual barrier as well as add to the complexity of a vista, breaking it up to provide scale and containment for built forms.

12.3.2.3 Tree Protection

Stands of Trees and individual trees to be preserved are indicated at various locations through the town on Map 2 of the NDP 2009 - 2015, as indicated in Figure 12.4 included in Volume 3. Individual protected trees indicated on the map and located in close proximity to the proposed route alignment, particularly along the eastern side of N51 and the western side of the school playground of St. Patrick's Classical School will be retained and protected during construction works as indicated in Section 12.5 Mitigation.

12.3.2.4 Views and Prospects to be preserved

The MCDP 2013-2019 and NDP 2009-2015 identify a number of protected views and prospects within the study area, none of which will be impacted upon as a result of the Proposed Road Development.

12.3.2.5 Walking and Driving Routes

Navan Slí na Sláinte is located approximately 750 m east of the Proposed Road Development and is indicated in Figure 12.4 included in Volume 3. The Proposed Road Development will have no effects on this walking route.

A number of Amenity Walkways are indicated on Map 2 – Development Objectives, included in NDP 2009 – 2015, within the Blackwater Park and east of it. None of the indicated Amenity Walks will be impacted upon as a result of the Proposed Road Development as they are located away from the Proposed Road Development.

Boyne Valley Driving Route runs via R147 at the southern end of the proposed route alignment allowing for views of the Proposed Road Development, in particular at the junction of the N51 / R147 Kells Road.

12.3.2.6 Sites designated for ecological reasons

While Special Areas of Conservation (SAC) and Special Protection Areas (SPA) are ecological designations, they warrant inclusion in this chapter as they often represent intact landscapes which are of amenity value. Two designated sites will be traversed by the Proposed Road Development, these are:

- River Boyne and River Blackwater SAC (Site Code 002299)
- River Boyne and River Blackwater SPA (Site Code 002299)

Effects on landscape character and visual amenity in the area in which both sites are located arise from the proposed new road bridge across the River Blackwater and associated structures. Landscape effects are described in Section 12.4.3 in this report. Visual effects are described in Section 12.4.4. Photomontage 4 illustrates a view from a location within the SAC boundaries.

For further details on effects on these designated ecological sites, please refer to Chapter 7 (Biodiversity).

12.3.2.7 Cultural Heritage Sites

Chapter 13 (Cultural Heritage) provides details on any relevant national monuments and heritage features.

12.3.3 Evolution of the Baseline Environment without the Proposed Road Development (Do Nothing Scenario)

All components of the environment are constantly changing due to a combination of natural and human processes. When predicting likely direct and indirect effects it is important to remember that there are two available for comparison: the existing environment and the environment as it will be in the future if no development of any kind were to take place – the 'do-nothing' impact.

In landscape terms, if the development did not go ahead, the Proposed Road Development site will remain as a varied edge of town landscape, characterised by agricultural fields enclosed by hedgerows. It is likely that the adverse impacts of heavy traffic traversing Navan Town will increase further, aggravating the impact within the historic core of Navan.

12.4 Assessment of Impacts

12.4.1 Vegetation Removal

Vegetation will be required to be removed to facilitate the construction of the new road development. See also Chapter 7 (Biodiversity) for details of significance of vegetation removal. The key areas of vegetation to be removed include the following:

- Ch. 0+000 (north of alignment) - sections of the existing hedgerow along the road will be removed but most of the existing hedgerow will be retained.
- Ch. 0+050 - 0+200 (north of alignment) - all vegetation in this location will be removed.
- Ch. 0+450 – existing hedgerow vegetation will be removed.
- Ch. 0+500 – 0+850 - sections of existing hedgerow and tree vegetation will be removed in this area to accommodate the development, including attenuation pond, areas where construction fencing is to be located and the construction of pedestrian/cycle links to Blackwater Park.
- Ch. 0+900 (south of alignment) - vegetation in this location will be removed.

- Ch. 1+000 – 1+100 (south of alignment) - vegetation to be removed from this area to include hedgerows and mature tree planting located within the existing OPW building grounds.

All vegetation being retained will be protected in accordance with the recommendations of *NRA/TII: Guidelines for Protection and Preservation of Trees, Hedgerows and Scrub Prior to, during and Post Construction of National Road Schemes*.

12.4.2 General description of potential for landscape change along the proposed route

This section describes the potential for landscape change along the proposed route using chainage as a reference.

12.4.2.1 Chainage 0+000 to 0+200

This section includes works at the junction of L3409 Ratholdron Road and L34094-1 Clonmagadden Road. The addition of the LDR4 corridor, new pedestrian footpath and realigned access track along the southern section of Ratholdron Road will alter the existing character experienced due the intensification of roadway infrastructure and associated vehicular traffic. Further south within this section of the development, the Proposed Road Development level rises as the corridor runs in a southwest orientation through areas of established vegetation, which includes mature trees. The Proposed Road Development will introduce a new character to this area of landscape due to the addition of carriageway, footpath, cycle lanes and roadside embankments.

12.4.2.2 Chainage 0+200 to 0+450

This part of the road remains elevated, passing through an open field to the west of Blackwater Park. The most significant change in this location will arise from the introduction of the road and associated elements such as embankments within the currently agricultural setting. A section of hedgerow to the south of this area will be removed.

12.4.2.3 Chainage 0+450 to 0+600

This part of the route is primarily located in a small parcel of land containing an agricultural field to the west of Blackwater Park. The addition of the road in this area will include the provision of a pedestrian and cycle link into Blackwater Park, with a pedestrian crossing at the carriageway.

12.4.2.4 Chainage 0+600 to 0+850

This section of the road traverses within and along the western boundary of Blackwater Park and provides for pedestrian and cyclist connectivity with the existing park and new road. The location of a proposed attenuation pond further south, will form a new depression in the landscape, with access road and perimeter fencing. The road level starts to increase following Ch. 0+800, as the route moves south towards the Blackwater River, with roadside embankments becoming a new feature in the landscape.

12.4.2.5 Chainage 0+850 to 1+000

Along this part of the road, the embankment height continues to increase as it travels south to cross the Blackwater River via the proposed bridge. The most significant change here is the introduction of bridge infrastructure and landform associated with the roadside embankments.

12.4.2.6 Chainage 1+000 to 1+100

This part of the route travels south towards the existing roundabout between the R147 Kells Road and the N51. The proposed embankment height decreases on approach to the existing carriageway. The existing commercial building located on the N51 will be removed to facilitate the Proposed Road Development.

12.4.3 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 will continue the trend of development around the periphery of the historic centre of Navan. However, this Arterial Link (as defined in the DMURS) will introduce new road traffic and higher traffic speeds than occur at present in some parts of the nearby landscape. The existing L34094-1 and R147 provide a precedent for similar scale road infrastructure in some parts of the study area.

The majority of the Proposed Road Development is located within an area of High Sensitivity and Very High Value. The location of the new road will impact significantly and adversely on these designations and 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. In conjunction with the change in landscape character within existing agricultural fields, areas where the road connects with the existing road network to the north and south as well as the point at which it crosses the River Blackwater will experience further landscape character changes. Good design, landscape mitigation and maintenance of connections and frontage to the new road will minimise these adverse landscape effects and help to integrate the Proposed Road Development into the landscape over time.

The creation of a tunnel effect or severance of landscape connections will be avoided where possible, and opportunities for integrating the new road into the Boyne Valley to Lakelands County Greenway along the L3409 have been taken. With good mitigation by way of road edge design and pedestrian crossings, the development will bring landscape cohesion to the emerging suburban and industrial areas west and northwest of Navan Town. The new road will create a direct link between north and south Navan, providing an alternative route into the town while also relieving traffic congestion on the existing road network. However, the requirement for noise mitigation due to the close proximity of the development to residential receptors to the south of the road alignment, will introduce a new structure in the landscape measuring 1.5m in height. Native woodland screen planting has been proposed to soften the effect of this noise mitigation measure.

Potentially sensitive landscape receptors include parts of the landscape recognised by designation, parts of the landscape used for amenity, and the setting of heritage features, as well as general aspects of landscape character such as landform and vegetation. 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 and existing circulation patterns as well as removal of vegetation on the site and the construction of a noise mitigation barrier of 1.5 m high. There are also positive landscape effects arising from the new proposed planting.

A potential positive landscape effects is the reduction of traffic through the historic core of Navan.

A summary of landscape effects is enclosed in Table 12-14.

Table 12-14 Summary of Landscape Effects

Receptor	Susceptibility to change	Sensitivity to change	Magnitude of Landscape Change	Direct/Indirect Effects	Level of Significance
Landscape Character Area - Blackwater Valley (Proposed Road Development located within this Landscape Character Area)	High	High	Medium-High	Direct & Indirect	Significant Adverse (localised effects)
Landscape Character Area – Blackwater Valley (within the wider study area)	Medium	Low	Negligible-Low	Indirect	Not Significant Adverse
River Blackwater	High	High	High	Direct	Very Significant Adverse (localised effects)
Area of High Landscape Sensitivity as recognised in the Co. Development Plan	High	High	Medium	Direct	Significant Adverse (localised effects)
Area of Moderate Landscape Sensitivity as recognised in the Co. Development Plan	Medium	Medium	Medium	Direct	Moderate Adverse (localised effects)
Area of Exceptionally High Landscape Value as recognised in the Co. Development Plan – River Boyne	High	High	None	None	None
Area of Moderate Landscape Value as recognised in the Co.	Medium	Medium	Medium	Direct & Indirect	Moderate Adverse

Receptor	Susceptibility to change	Sensitivity to change	Magnitude of Landscape Change	Direct/Indirect Effects	Level of Significance
Development Plan – River Blackwater					(localised effects)
Area of Very High Landscape Value as recognised in the Co. Development Plan – River Blackwater	High	High	Medium	Direct & Indirect	Moderate to Significant Adverse (localised effects)
Effect on existing vegetation	Medium	Medium	Medium	Direct	Moderate Adverse (before mitigation)
Historic Townscape	High	Medium-High	None	n/a	None
Effect on landform	Medium	Low-Medium	Medium	Direct	Slight-Moderate Adverse
Protected Trees	High	High	None	None	None
Open Green Space (Blackwater Park)	High	High	Medium-Low	Direct	Moderate Adverse

12.4.4 Visual Effects

The Proposed Road Development is located in a generally gently undulating landscape and therefore even relatively low vegetation or intervening buildings will provide screening to receptors. The main receptor groups are local residents, pedestrians and visitors to Blackwater Park as well as vehicle drivers along adjacent roads. The sensitivity of residents and pedestrians is considered High. The sensitivity of vehicle drivers is considered Medium to Low. The susceptibility to change is highest for residents and pedestrians 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 driver 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.

Six photomontages have been prepared which illustrate the nature of visibility of the proposals at key locations recognised for their heritage and landscape value. Larger versions of the images below are included in Appendix A12-1 in Volume 4 of this EIAR. A detailed description of each viewpoint is enclosed overleaf.

Photomontage 1 is located on Clonmagadden Road looking south west.

Figure 12-2 Photomontage 1 from Clonmagadden Road looking south west – Existing view

Figure 12-3 Photomontage 1 from Clonmagadden Road looking south west – Proposed view (prior to mitigation)

Photomontage 1 shows the change in view from Clonmagadden Road which is located to the north of the Proposed Road Development. The main receptor groups are residents, pedestrians and vehicle drivers. Their sensitivity and susceptibility are considered Medium to High. The magnitude of visual change is Medium-High. The significance of visual effects is therefore considered Moderate-Significant Adverse. The most noticeable aspects of the development will be the removal of sections of mature vegetation in the middle distance and a new road corridor with associated lighting columns extending into the distance. Vehicle traffic will be visible in a location where it has not been present prior to the development, however, this new road will form a continuation to the existing road corridor and given the surrounding streetscape context and pattern of development, the Proposed Road Development will not be uncharacteristic to the area and will integrate into the existing visual character of the area.

Photomontage 2 is located on the amenity looped walk within Blackwater Park looking south.

Figure 12-4 Photomontage 2 looking south from path in Blackwater Park – Existing view

Figure 12-5 Photomontage 2 looking south from path in Blackwater Park – Proposed view (prior to mitigation)

Photomontage 2 illustrates the change in view from the looped pathway in Blackwater Park. The main receptor groups are pedestrians and recreational users of Blackwater Park. Their sensitivity and susceptibility are considered High. The magnitude of visual change is Low-Medium and the resulting significance is considered Slight – Moderate Adverse due to the limited visibility of the development which is primarily comprised of the addition of lighting columns which will become an integrated element within the existing view. However, the Proposed Road Development will light up previously unlit areas during hours of darkness resulting in adverse visual effects.

Photomontage 3 is located within Blackwater Park looking south west.

Figure 12-6 Photomontage 3 looking south west from Blackwater Park – Existing view

Figure 12-7 Photomontage 3 looking south west from Blackwater Park – Proposed view (prior to mitigation)

Photomontage 3 shows the change in view from the looped pathway in Blackwater Park. Noticeable components of the development include several lighting columns, and a section of the southern road corridor including the proposed bridge crossing the River Blackwater. The main receptor groups are pedestrians and recreational users of Blackwater Park. Their sensitivity and susceptibility are considered High. The Proposed Road Development will light up previously unlit areas during hours of darkness. The magnitude of visual change is Low-Medium, and the resulting significance is Slight-Moderate Adverse.

Photomontage 4 is located within Blackwater Park looking south west.

Figure 12-8 Photomontage 4 from Blackwater Park looking south west – Existing view

Figure 12-9 Photomontage 4 from Blackwater Park looking south west – Proposed view (prior to mitigation)

Photomontage 4 shows the change in view from the southern boundary of Blackwater Park close the River Blackwater and within SAC River Boyne and River Blackwater. Areas of the embankment along the eastern boundary of the road along with the proposed bridge, parapets and other associated elements will be clearly noticeable in this view. The elevated carriageway will partially screen areas of vegetation and development in the distance. The new road will create a prominent change in the existing view, altering the existing character which is predominantly focused on the parkland area enclosed by mature vegetation. The main receptor groups are pedestrians and recreational users of Blackwater Park. Their sensitivity and susceptibility are considered High. The Proposed Road Development will also light up previously unlit areas during hours of darkness resulting in adverse visual effects. The magnitude of visual change is High, and the resulting significance is Significant Adverse.

Photomontage 5 is located within the private rear garden of a residential property to the south of River Blackwater. The view is oriented north east.

Figure 12-10 Photomontage 5 from private residential property looking north east – Existing view

Figure 12-11 Photomontage 5 from private residential property looking north east – Proposed view (prior to mitigation)

Photomontage 5 shows the change in view as experienced from the rear of adjacent private residential properties located to the immediate south of the River Blackwater. The elevated carriageway, areas of embankment and new bridge structure will create a prominent change in the existing view, which is further compounded by the removal of mature and semi-mature vegetation. The development will alter the existing landscape rural character in this view, introducing a new type of development. The main receptor group is local residents. Their sensitivity and susceptibility are considered High. The Proposed Road Development will also light up previously unlit areas during hours of darkness resulting in adverse visual effects. The magnitude of visual change is High, and the resulting significance is Significant Adverse.

Photomontage 6 is located on the N51 looking north east towards the existing roundabout.

Figure 12-12 Photomontage 6 from N51 looking north east – Existing view

Figure 12-13 Photomontage 6 from N51 looking north east – Proposed view (prior to mitigation)

Photomontage 6 shows the change in view that will be experienced from the N51. The main receptor groups are pedestrians and vehicle drivers. Their sensitivity and susceptibility is considered Medium as the use of this area of the study is not primarily focused on the view during commuting through this area. The most noticeable changes relate to the improvement and upgrade of the existing carriageway to include realigned cycle lanes and new lighting columns. The removal of the existing roundabout, existing vegetation (which has been screening the commercial building to be demolished) and addition of roadway infrastructure to the north will be noticeable in the middle distance along this channelled view. The magnitude of visual change is considered Medium and the significance is considered Slight-Moderate Neutral.

A summary of visual effects for each viewpoint / photomontage is enclosed in the Table 12-15 overleaf.

Table 12-15 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	Viewpoints / Photomontages
Viewpoint 1	Residents, Pedestrians, Vehicle drivers	Medium	Medium-High	Medium-High	Moderate-Significant Adverse	Viewpoint 1
Viewpoint 2	Pedestrians and recreational users of Blackwater Park	High	High	Low-Medium	Slight – Moderate Adverse	Viewpoint 2
Viewpoint 3	Pedestrians and recreational users of Blackwater Park	High	High	Low-Medium	Slight – Moderate Adverse	Viewpoint 3
Viewpoint 4	Pedestrians and recreational users of Blackwater Park	High	High	High	Significant Adverse	Viewpoint 4
Viewpoint 5	Residents	High	High	High	Significant Adverse	Viewpoint 5
Viewpoint 6	Pedestrians, Vehicle drivers	Medium	Medium	Medium	Slight-Moderate Neutral	Viewpoint 6

12.4.5 Effects on designated Driving Routes

The impact on the Boyne Valley Driving Route will be localised and concentrate on the junction with the N51 / R147 Kells Road located within the urban outskirts of Navan town. Considering that the Proposed Road Development will not alter the route of the existing driving route and the new junction layout will remain at the existing level, the visual change is considered low and the significance of visual effects is considered not significant.

12.4.6 Effects at Construction

Chapter 4 (Description of the Proposed Road Development) of this EIAR contains a schedule of proposed construction works for the project. The construction stage for the new road 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 following describes the most likely significant landscape and visual effects arising at construction stage:

12.4.6.1 Vegetation Removal

The visual significance of the removal of hedgerows, areas of scrub and woodland and clusters of semi-mature and mature trees will range from moderate to significant adverse. Landscape effects and their significance will range from moderate to very significant adverse on a localised scale considering the requirement for vegetation removal to construct the Proposed Road Development. The highest significant effects arising from vegetation removal will occur in the areas where larger vegetation will be removed including at chainage:

- Ch. 0+000 (north of alignment) – roadside vegetation will be removed
- Ch. 0+050 (north of alignment) – all vegetation in this location will be removed
- Ch. 0+100 – 0+200 (north of alignment) – all vegetation will be removed
- Ch. 0+400 – 0+500 – all vegetation in this area will be removed
- Ch. 0+850 – 1+050 – Almost all vegetation in this location will be removed

The significance of landscape and visual effects on the wider landscape arising from vegetation removal to construct the proposed project will be moderate and adverse in the short term, reducing to slight and neutral as new planting establishes.

12.4.6.2 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 a moderate adverse to significant adverse visual effects and moderate to very significant adverse landscape effects, on a localised scale, 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 also have an effect upon the local landscape and views towards the construction site. However, effects will be temporary and will have no long-term landscape or visual effects.

12.4.6.3 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.

The area proposed for disposal of unacceptable material will also experience landscape effects arising from earthworks on a localised scale. Again, the significance of effects will be temporary, and the landscape restoration proposed will reduce the long-term significance of landscape effects to moderate.

12.4.6.4 Construction of new bridge over River Blackwater

The main activities during the construction stage of the River Blackwater Bridge with the potential for visual effects include:

10. Installation of sediment control measures, e.g. silt fences and straw bales, sediment lagoons, settlement trenches;
11. Diversion of necessary utilities;
12. Excavation, as required, for all bridge supports;
13. Construction of reinforced concrete abutments;
14. Construction of approach embankments;
15. Construction of the wing walls;
16. Completion of waterproofing and the additional protective layer and installation of parapets and finishes.

12.5 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.

12.5.1 Avoidance Measures

- A Constraints Study and the Route Selection process were carried out to assess a number of potential sites for this development. During this process, which culminated in a publication of a route selection report, three route options, a do nothing and a do minimum were considered as part of the Stage 1 assessment. The route selection process was undertaken in line with the NRA National Roads Project Management Guidelines 2010 under the following criteria: Economy; Safety, Environment; Accessibility & Social Inclusion; and Integration. The examination of the above concluded that the development of Route Option B1 will have least adverse impact whilst maintaining an optimal standard of geometric design. This route now forms the basis for the current proposal.
- Minimising the earthworks and change in levels
- Maximising the span of the new bridge over the River Blackwater

12.5.2 Reduction Measures

- Disturbance of existing vegetation will be minimised where possible and proposed planting will help integrate the proposed new road 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;
- Provision of sufficient protection for trees to be retained in areas close to construction works (as described in BS 5837:2005); and
- Noise mitigation will take the form of bunds rather than barriers where space allows.

12.5.3 Remediation Measures

- Appropriate native screen planting will be provided where the road will have an adverse visual effect on adjacent properties or views, and avenue or parkland planting will be provided where the design aim is to integrate the new road and path into the urban landscape.
- Wildflower mixes derived from native seed stock (Irish provenance) will be used on verges to maximise biodiversity;
- Within the boundary of the SAC to the south, vegetative turves will be reused and reinstated where possible to retain native seed mix and to encourage rapid colonisation of vegetation;
- Construction compounds[49] 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; and
- Noise bunds will be planted to integrate them into the overall landscape plan.

12.5.4 Mitigation Measures: Operational Stage

The proposed mitigation plan is contained on Figures 12.5-12.7 included in Volume 3 of this EIAR. Further information regarding these measures are detailed within Appendix A12-2 in Volume 4 of this EIAR. The landscape mitigation plan shows an approach which screens where necessary, softens the effect of the new road construction in other areas and provides a basis for the emergence of streetscape frontage for new developments as they emerge in the future.

A number of boundary treatments are proposed to best suit the context of the Proposed Road Development as follows:

- **Ch. 0+100 – 0+000**
  Grass verges and hedgerows will be established and reinstated as appropriate along L34094-1 Clonmagadden Road and L3409 Ratholdron Road.
- **Ch. 0+000 – 0+400**
  Native woodland planting along roadside embankments and adjacent areas aligned with the new road corridor will provide screening of the LDR4 road corridor from surrounding areas, contributing to the reduction of road noise and light glare.
- **Ch. 0+400 – 0+500**
  Existing bunds to the east of the road alignment will be retained. A proposed pedestrian entrance to Blackwater Park will be reinforced via an area of meadow grass with informal clusters of trees that will lead pedestrians into the existing parkland. Meadow grass is further planted along this access route along with a mixed native hedgerow that will tie in with the established park path network.
- **Ch. 0+500 – 0+750**

[49] A construction compound will be required along or in the vicinity of the Proposed Road Development. It was proposed that the primary construction compound would be located in the land located to the south-west of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. An alternative and secondary compound is proposed to the north of the existing N51/R147 roundabout on the land currently occupied by a commercial building to be demolished.

Roadside boundary treatments will comprise a woodland planted bund along the eastern section of the road, together with native meadow, clusters of feature trees and hedgerow planting to the west. Existing retained mature tree vegetation along the western section of the alignment will provide screening of the road corridor.

- **Ch. 0+750 – 0+900**
The boundary treatment continues as above with the exception of a further pedestrian entrance to Blackwater Park along the eastern section of the road. The linearity of the roadside planting is broken here, as per the northern pedestrian park entrance, with and area of native meadow grass and clusters of feature trees to signify the threshold of the existing park along the road. The most southern area of this section of road enters a Special Area of Conservation (SAC) as the road embankment increase in elevation to cross the River Blackwater. Within the SAC boundary, vegetative turves will be reused and reinstated where possible to retain native seed mix and to encourage rapid colonisation of vegetation.

- **Ch. 0+900 – 1+100**
The road alignment crosses the River Blackwater, a designated SPA where the landscape mitigation approach is to create minimal intervention through maximising the reinstatement of existing grassland that will be disturbed during construction. South of this, woodland planting provides screening from the nearby residential receptors on approach to the proposed junction with the R147 / N51.

- **Ch. 1+100 – 0+200**
Woodland screen planting terminates and grass verges with informal clusters of feature trees are located along the northern side of the proposed road junction with the R147 / N51. To the south of the junction, existing trees, along the boundary of St. Patrick's School are retained, and the road edge is grass seeded with feature tree planting located along the western side of the road alignment. Grass seeded verges and additional feature tree planting is proposed along the upgraded sections of the existing R147 / N51 alignment to tie the development into the surrounding road network and setting.

12.6 Cumulative Impacts

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.

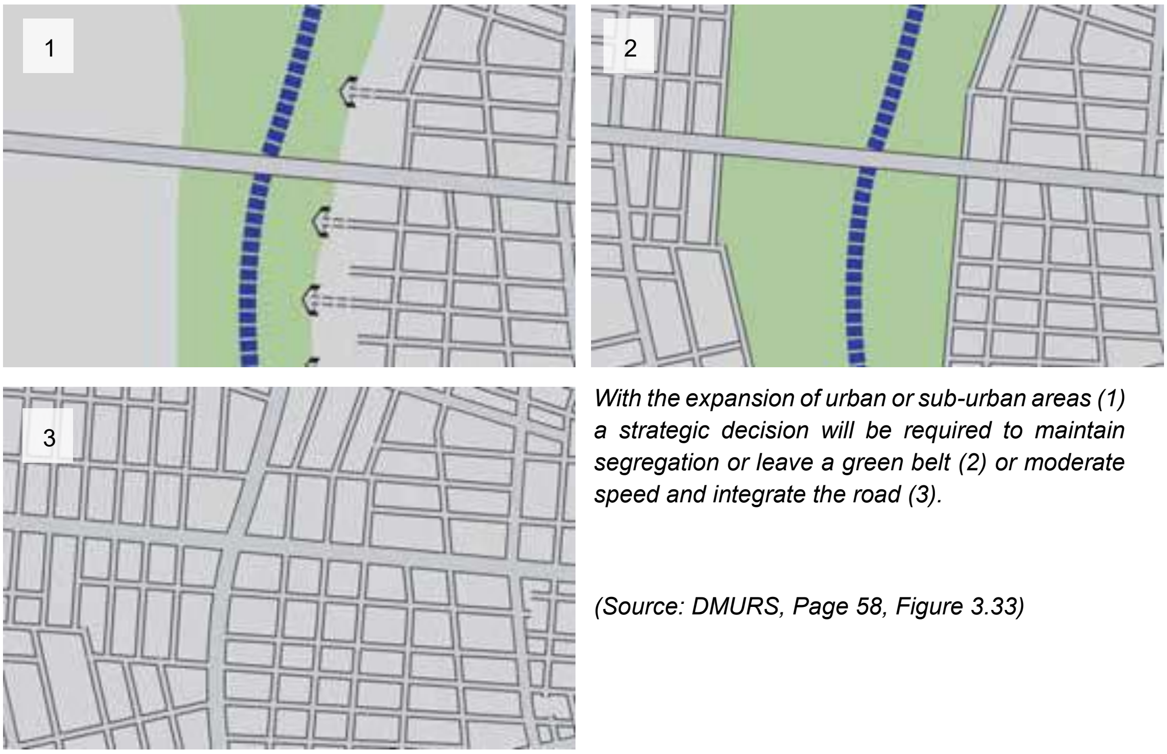
The cumulative assessment evaluates the additional change resulting from the Proposed Road Development in relation to the theoretical baseline scenario and follows a similar methodology to that used for the landscape and visual assessments. Table 12-16 states definitions which are used to determine cumulative effects.

Table 12-16 Definition of Types of Cumulative Effects

Types of Cumulative Effects	Classification Criteria	Types of Cumulative Effects
In combination	Where two or more features are seen together at the same time from the same place, in the same (arc of) view where their visual effects are combined.	In combination
In Succession	Where two or more features are present in views from the same place (viewpoint) but cannot be seen at the same time, together because they are not in the same arc view - the observer has to turn to see new sectors of view whereupon the other features unfold in succession.	In Succession
In sequence	Where two or more features are not present in views from the same place (viewpoint) and cannot, therefore, ever be seen at the same time, even if the observer moved around the arc of view, the observer has to move to another viewpoint to see the second or more of them, so they will then appear in sequence.	In sequence

The Proposed Road Development will continue the emerging trend of development around the periphery of Navan Town in line with the Town Development Plan. The new road will introduce traffic and higher traffic speeds than those that occur at present in some parts of the landscape. The existing L34094-1 and R147 provide a precedent for similar scale road infrastructure in some parts of the study area. Cumulatively, the existing built environment within the study area and Proposed Road Development will intensify the edge of the town-landscape characteristic. The areas which retain elements of rural character will most experience this cumulative change to landscape character. Visually, these effects will be experienced in combination, in succession and in sequence. The future landscape character will depend on the strategic planning approach taken to new development along the Proposed Road Development which will either retain a green belt either side or reduce the road to moderate speeds and integrate it into a new streetscape.

Therefore, the master-planning approach to new developments adjacent to the road will have the potential to incrementally generate effective urban cohesion and permeability, or to increase the potential for severance. *The Design Manual for Urban Roads and Streets* sets out a number of scenarios which summarise the potential cumulative effect of an Arterial link road into the future. The type of scenario arising depends on planning decisions into the future beyond the scope of this project.



With the expansion of urban or sub-urban areas (1) a strategic decision will be required to maintain segregation or leave a green belt (2) or moderate speed and integrate the road (3).

(Source: DMURS, Page 58, Figure 3.33)

Permitted developments with the potential to contribute to cumulative development include:

- 3 storey mixed use development within Balmoral Industrial Estate approximately 50 m from the proposed alignment (planning ref: NA141115).
- Clonmagadden SDZ approximately 1 km from the proposed alignment.
- Beaufort Place, Navan, County Meath. Residential development approximately 1km from the proposed alignment (planning ref: NA170485).
- Moathill, Navan, County Meath. Residential development consisting of 74 no. apartment units in 2 no. 5 storey blocks (planning ref: NA151301).

The above permitted developments will not result in significant cumulative effects.

12.6.1 Lighting Effects

Lighting effects will arise from both the lighting columns proposed to light the road and the glare of cars using the road at night and in low light conditions, which will increase the district brightness in the hours of darkness in the vicinity of the Proposed road. The sensitivity of receptors, which will mainly include local residents, vehicle drivers along nearby roads and pedestrians within the Blackwater Park is considered Medium-High. The magnitude of visual change is considered Moderate to High and the significance is considered Significant Adverse.

Mitigation measures include lighting that 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 and dimmable technologies. Planting and noise barriers along the road will reduce the amount of glare from traffic where this has the potential to impact on residences.

12.7 Residual Impacts

12.7.1 Landscape Effects

The location of the new road 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. In conjunction with the change in landscape character within existing agricultural fields, areas where the road connects with the existing road network to the north and south as well as the point at which it crosses the River Blackwater will experience further landscape character changes.

Moderate to Significant Adverse effects on the local landscape character of the River Blackwater and its setting will be experienced due to the introduction of roadway infrastructure, bridge and associated components along with the introduction of vehicle movements in a location where there haven't been any previously. Higher effects have been avoided from mitigation by the approach to design of the new bridge and the proposed replanting.

The landscape effect on the Blackwater Valley landscape character along with areas of high landscape value will range widely from Very Significant Adverse to None depending on the distance to the Proposed Road Development. The proposed noise barrier at a height of 1.5 m high will introduce structures associated with large scale road infrastructure into the landscape adjacent to existing residential receptors where there is currently mature tree vegetation. In general, the highest residual landscape effects will arise from changes to landform and existing circulation patterns, introduction of high levels of traffic into relatively quiet areas as well as removal of vegetation on the site and the potentially positive effect of increasing urban permeability. The road will also become a new pedestrian and cycle link at the edge of Navan Town, with direct links established with Blackwater Park amounting to a residual positive addition to the pedestrian connectivity and walking/cycle infrastructure of town.

An indirect positive effect on the landscape/townscape character is the reduction of traffic through the historic core of Navan. The residual effect on the historic townscape of central Navan is therefore Moderate Positive.

12.7.2 Visual Effects

Adherence to the proposed landscape mitigation measure, their successful implementation and maintenance will result in a reduction of visual effects over time as the proposed screening vegetation matures. The highest residual visual effects will arise due to the visibility of landform changes, vehicles, the new vehicular bridge and noise barrier. Locations which will experience the highest significance of visual effects (Moderate Adverse) following the implementation of landscape mitigation including

- Residences to the immediate south of the new bridge location; and
- Views from the southern part of Blackwater Park.

Table 12-17 summarises the residual visual effects in the 6 photomontages described in detail in Section 12.4.4 above.

Table 12-17 Summary of Residual Visual Effects for each Viewpoint / Photomontage

Viewpoints / Photomontages	Receptor Group	Susceptibility to change	Sensitivity to change	Magnitude of Landscape Change	Level of Significance	Viewpoints / Photomontages
Viewpoint 1	Residents, Pedestrians, Vehicle drivers	Medium	Medium-High	Medium	Moderate Adverse	Viewpoint 1
Viewpoint 2	Pedestrians and recreational users of Blackwater Park	High	High	Low	Slight Neutral	Viewpoint 2
Viewpoint 3	Pedestrians and recreational users of Blackwater Park	High	High	Low	Slight Neutral	Viewpoint 3
Viewpoint 4	Pedestrians and recreational users of Blackwater Park	High	High	Medium	Moderate Adverse	Viewpoint 4
Viewpoint 5	Residents	High	High	Low	Slight Neutral	Viewpoint 5

Viewpoints / Photomontages	Receptor Group	Susceptibility to change	Sensitivity to change	Magnitude of Landscape Change	Level of Significance	Viewpoints / Photomontages
Viewpoint 6	Pedestrians, Vehicle drivers	Medium	Medium	Medium	Slight-Moderate Neutral	Viewpoint 6

12.8 Difficulties Encountered

The information available combined with on-site surveys have allowed for the preparation of a comprehensive and robust townscape / landscape and visual impact assessment.

There were no difficulties encountered during the preparation of this landscape and visual impact assessment regarding the Proposed Road Development.

12.9 Summary

The majority but not all of the identified likely adverse landscape and visual effects will be able to be mitigated. The new road will intensify the edge of town character of this part of Navan. The Proposed Road Development will provide a new access route from north to south and improve access and permeability outside of the town centre and to planned and zoned development lands to the north. Whether or not the road eventually becomes an integrated part of the town's urban fabric will depend on future strategic masterplanning of new developments alongside the road and approaches to road speeds. New pedestrian infrastructure through the study area will be a positive landscape effect as it will formalise existing often semi-official pedestrian crossings and provide a safe access between communities.

Proposed planting will mitigate the majority but not all of the likely adverse visual effects. Vehicles and elevated parts of the road alignment including the new bridge will remain visible from a number of viewing locations particularly from residential properties to the immediate south of the River Blackwater and from open areas within Blackwater Park. Following mitigation planting and the replanting of riverside vegetation, close distance visibility of the new bridge will be limited to a relatively short stretch along the River Blackwater and limited areas within Blackwater Park.

12.10 References

- DTTAS and DHPLG. (2019). *Design Manual for Urban Roads and Streets*, Department for Transport, Tourism and Sport and the Department of Housing, Planning and Local Government.
- EPA. (2002). *Guidelines on the information to be contained in Environmental Impact Statements*, EPA, Wexford, Ireland.
- EPA. (2003). *Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.* Environmental Protection Agency, Wexford, Ireland.
- EPA. (2014). *Construction & Demolition Waste Statistics for Ireland*, Environmental Protection Agency, Wexford, Ireland.
- EPA. (2017). *Guidelines on the information to be contained in Environmental Assessment Reports*, Environmental Protection Agency, Wexford, Ireland.
- Irishtrails. (2019). [online]. Available at: http://www.irishtrails.ie/
- LI. (2011). *Photography and Photomontage in Landscape and Visual Impact Assessment*, Landscape Institute Advice Note 01/2011.
- LI & IEMA. (2013). *Guidelines for Landscape and Visual Impact Assessment (GLVIA)*, 3rd Edition, Landscape Institute and Institute of Environmental Management and Assessment, UK.
- NRA. (2008). *Environmental Impact Assessment of National Road Schemes - A Practical Guide*, National Roads Authority, Dublin, Ireland.

- NRA. (2006a). *A Guide to Landscape Treatments for National Road Schemes in Ireland,* National Roads Authority, Dublin, Ireland.
- NRA. (2006b). *Guidelines for Protection and Preservation of Trees, Hedgerows and Scrub Prior to, during and Post Construction of National Road Schemes*. National Roads Authority, Dublin, Ireland.
- NRA. (2013). *Design Manual for Roads and Bridges*, National Roads Authority, Dublin, Ireland.
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, Meath, Ireland.
- MCC. (2013). *Meath County Development Plan (2013-2019)*. Meath County Council, Meath, Ireland.
- TII. (2019). Landscape Character Assessment (LCA) and landscape and visual impact assessment (LVIA) of proposed national roads: Standards Document, PE-ENV-01105, January 219, Draft for Consultation, Transport Infrastructure Ireland, Dublin, Ireland.

Chapter 13: Cultural Heritage

13

13. Cultural Heritage

13.1 Introduction

This chapter of the EIAR assesses the potential impacts and resultant effects of the Proposed Road Development upon the archaeological and architectural heritage assets.

This chapter is supported by:

- Figures 13.1 and 13.2 provided in Volume 3 of the EIAR.
- A gazetteer of the archaeological and architectural heritage assets is presented in Appendix A13-1 provided in Volume 4 of the EIAR.
- Investigation of Lands at the Local Distributor Road 4 (LDR4) Abbeyland & Moathill, Navan, County Meath Archaeological Geophysical Survey Detection Licence No. 19R0127 (Earthsound Geophysics, 2019) presented in Appendix A13-2 provided in Volume 4 of the EIAR.
- An archaeological review of the preferred route was prepared in August 2019 (Roycroft, 2019) presented in Appendix A13-3 provided in Volume 4 of the EIAR.

13.2 Methodology

13.2.1 Scope

A baseline assessment has been produced to inform the chapter. The baseline assessment has identified all archaeological assets, architectural heritage and designed landscapes such as gardens and demesnes, within a defined study area. The baseline also considers the setting of these heritage assets, which can be described as the surroundings in which the heritage assets are experienced and appreciated.

The main objectives of the baseline assessment are:

- to identify cultural heritage assets within the site and study area;
- to assess the baseline information and offer an analysis of the potential for currently unrecorded archaeological assets within the site;
- to assess the importance of the cultural heritage assets;
- to assess the potential impact of the Proposed Road Development on cultural heritage assets and their setting within the site and study area; and
- to inform an archaeological mitigation strategy if required.

13.2.2 Consultation

Throughout the preparation of this assessment, consultation has been undertaken with the relevant statutory consultees. The results of this consultation are presented in Table 13-1.

Table 13-1 Consultation Results

NAME AND ORGANISATION	DATE	METHOD	OUTCOME
Development Advice Unit, Department of Culture, Heritage and the Gaeltacht	29/08/18	AECOM request for consultation and comment on the proposed development via Email	Response noted the proximity of the development to the Zone of Archaeological Potential established around the town of Navan. Recommended that full account is taken of the archaeological potential of the selected route and the potential impacts on previously unidentified archaeological remains. Specific advice should be sought concerning the archaeological potential of the location where the roadway crosses the River Blackwater. Bridge design should be analysed to identify potential impacts on both river bank and sub-aqua environments.

NAME AND ORGANISATION	DATE	METHOD	OUTCOME
Alison Harvey, The Heritage Council	29/08/18	AECOM request for consultation and comment on the proposed development via Email	No response
Ian Lumley, An Taisce	29/08/18	AECOM request for consultation and comment on the proposed development via Email	No response.
Loreto Guinan, Heritage Officer / Robert Miles Architectural Conservation Officer Meath County Council	29/08/18	AECOM request for consultation and comment on the proposed development via Email	Response notes that there is no objection to the removal of Old Commissioners of Public Works Building. Extensive Archaeology around the Blackwater Park will necessitate the need for an Archaeological Impact Assessment, Test trenching and subsequent monitoring on site if planning is approved. National Monuments Service will need to be furnished with these reports for agreement to proceed to construction

13.2.3 Sources

The preparation of the baseline was informed by material gathered and collated from various sources, including:

- National Monuments Service (NMS) and Archaeological Survey of Ireland (ASI);
- National Inventory of Architectural Heritage (NIAH);
- NDP 2009-2015, Record of Protected Structures;
- Geological Survey of Ireland:
- Navan Abbeylands Preliminary Assessment Summary Niall Roycroft 15th February 2012. Archaeological assessment prepared on behalf of Meath County Council;
- Local Distributor Road 4, Abbeyland, Navan Co Meath Archaeological Review ITM: 686018, 768357 Vicinity of 12E0103 (figure-of-eight shaped enclosure, field system and burials) Niall Roycroft December 2018;
- Local Distributor Road 4, Abbeyland, Navan Co Meath Archaeological Review of Preferred Route ITM: 686018, 768357 Vicinity of 12E0103 (figure-of-eight shaped enclosure, field system and burials) Niall Roycroft 29th August 2019; and
- Earthsound Geophysics (2019) Investigation of Lands at the Local Distributor Road 4 (LDR4) Abbeyland & Moathill, Navan, County Meath Archaeological Geophysical Survey Detection Licence No. 19R0127.

Online sources were also consulted, including OSI historic mapping.

In addition to the gathering of comprehensive baseline information, a site visit was undertaken on the 24th August 2018 in order to identify any previously unidentified cultural heritage assets that might exist within the site, and to assess the current ground conditions and the extent of previous ground disturbance. The visit also assessed the potential impact of the Proposed Road Development on the setting of designated cultural heritage assets in the study area.

13.2.4 Asset Selection & Study Area

A study area of 1km from the 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 13.1 and has been utilised to produce a figure illustrating the surrounding cultural heritage assets. Heritage data from all sources has been identified within this 1km 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.

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, and ACAs within the 1 km study area.

13.2.5 Legislative and Policy Framework

This 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;
- National Heritage Plan (2002);
- Planning and Development Acts 2000 – 2019;
- MCDP 2013- 2019; and
- NDP 2009 – 2015.

13.2.6 Local and National Policy Framework

13.2.6.1 Meath County Development Plan 2013 - 2019

The MCDP 2013 – 2019 was published in 2013 and aims to establish a framework for the sustainable development of County Meath. As part of this framework, specific sections and policies governing development in relation to Cultural Assets were produced and included. The policies within the County Meath Development Plan reflect the overarching aims of legislation and planning policy including the Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022.

Strategic Policy CSA SP1 deals specifically with the heritage of the county. The policy has been created 'to ensure that the unique cultural heritage of Meath is protected, conserved and sensitively integrated into the sustainable development of the county for the benefit of present and future generations.' In consideration of the archaeological heritage of County Meath, the council have established a number of policies to govern proposed developments in the area and to further promote the archaeological heritage. These policies are:

- CH POL 6 – To promote awareness of, and access to, the archaeological inheritance of County Meath;
- CH POL 7 – To ensure that development in the immediate vicinity of a recorded monument is sensitively sited and designed so that it does not significantly detract from the monument. Where upstanding remains exist, a visual impact assessment may be required;
- CH POL 8 – To retain surviving medieval plots and street patterns in the villages and towns of Meath, where practicable, and in the course of development to record evidence of ancient boundaries, layout etc.;
- CH POL 9 – To inform and seek guidance from the National Museum of Ireland if an unrecorded archaeological object is discovered, or the National Monuments Service of the Service of the Departments of Arts, Heritage and the Gaeltacht in the case of the discovery of an unrecorded archaeological site, in accordance with National Monuments legislation.

These policies are supplemented with a number of objectives to help to achieve the aims of the policies above. These objectives are a material consideration in the planning process. The objectives state:

- CH OBJ 7 – To protect archaeological sites and monuments, underwater archaeology and archaeological objects, which are listed in the Record of Monuments and Places, and to seek their preservation in situ (or at a minimum, preservation by record) through the planning process;
- CH OBJ 8 – To seek to protect important archaeological landscapes from inappropriate development;
- CH OBJ 9 – To make the Record of Monuments and Places (RMP) available to the public;
- CH OBJ 11 – To encourage and promote the appropriate management and maintenance of the County's archaeological heritage, including historical burial grounds in accordance with conservation principles and best practise guidance.

The architectural heritage, or historic built environment, is considered in a series of policies designed to preserve those structures identified on the Record of Protected Structures. The policies state:

- CH POL 10 – to conserve and protect the architectural heritage of Meath;

- CH POL 11 – to require that all planning applications relating to Protected Structures contains the appropriate accompanying documentation…to enable the proper assessment of the proposed works;
- CH POL 12 – to encourage the retention, sympathetic reuse and rehabilitation of Protected Structures.

There are in addition, a number of objectives set by the council with regards to the architectural heritage. These relevant objectives

- CH OBJ 13 – to protect all structures (or, where appropriate, parts of structures) within the county which are of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest and which are included in the Record of Protected Structures;
- CH OBJ 15 – to identify and retain good examples of historic street furniture e.g. cast-iron post boxes, water pumps, signage, street lighting and kerbing.

In addition to the protection given through the development plan to Protected Structures, the industrial heritage of County Meath is also protected through a specific policy. The policy is:

- CH POL 16 – to protect the industrial heritage of Meath, including the Royal Canal and Boyne Navigation, historic bridges, roadside features and street furniture.

ACA are places, areas of groups of structures of a townscape which is of special interest and can also comprise areas which are of significance to Protected Structures. They provide a mechanism to protect buildings which are of interest, but which do not meet the criteria of a Protected Structure, or perhaps buildings which individually do not merit placement on the Record, but together form a coherent or important example of their type. The policies within the development plan state:

- CH POL 17 – to identify places of special architectural, historical, archaeological, artistic, cultural scientific, social or technical interest and where appropriate define them as ACAs;
- CH POL 18 – to require that all development proposals within an ACA should be appropriate to the character of the area, inclusive of its general scale and materials, and are appropriately sited and sensitively designed having regard to the advice given in the Statements of Character for each area.

The objectives relating to this are:

- CH OBJ 21 – to ensure that any new development within or contiguous to an ACA is sympathetic to the character of the area and that the design is appropriate in terms of scale, height, plot density, layout, materials and finishes.

Designed landscapes, historic parks, gardens and demesnes are identified by the NIAH and placed on the inventory. They are not statutorily designated but are recognised by MCC as important heritage assets and provision has been made in the development plan for their protection. The policy states:

- CH OBJ 19 – to encourage the protection, promotion and enhancement of heritage gardens and parks in the county and support public awareness, enjoyment of and access to these sites.

This policy is supported by an objective, as detailed below:

- CH OBJ 22 – to discourage development that would lead to a loss of, or cause damage to, the character, the principle components of, or the setting of historic parks, gardens and demesnes of heritage significance;

13.2.6.2 Navan Development Plan 2009 - 2015

The NDP 2009-2015 contains the following specific sections and policies governing development in relation to Cultural Assets which are pertinent to the scheme, as detailed below.

Effects on entries to the Record of Monuments and Places and other archaeological heritage.

In terms of Architectural Archaeological Heritage, the relevant policy of MCC and Navan Town Council is:

HER POL 10:

- To protect (in-situ where practicable or as a minimum, preservation by record) all monuments included in the Record of Monuments and Places (including those newly discovered).

- To seek to protect, where practicable, the setting of and access to sites. In securing such protection the planning authorities will have regard to the advice and recommendations of the Department of Arts, Heritage and the Gaeltacht the Environment, Heritage and Local Government.
- To require that all applications for development within the zone of archaeological potential are accompanied by a professional archaeological impact assessment.
- Where remnants of burgage plots do remain intact, development proposals on such plots should reflect this character within the design and layout of proposals. In order to promote the renewal of such areas, design guidance will be provided, if necessary, for such sites at preplanning stage.

Effects on entries to the Records of Protected Structures, Architectural Conservation Areas and other architectural heritage

In terms of Architectural Archaeological Heritage, the relevant objectives of MCC & Navan Town Council:

- HER OBJ 5: When considering development in the vicinity of archaeological monuments, the planning authorities shall aim to achieve a satisfactory buffer area between the development and the monument in order to ensure the preservation and enhancement of the amenity associated with the monument. This shall be achieved in consultation with the Department of Arts, Heritage and the Gaeltacht the Environment, Heritage and Local Government. Buffer areas shall not be included within the required open space area of any development but should be in addition to such requirements.
- HER POL 1: To preserve, protect and enhance the architectural heritage of Navan and to ensure that new development makes a positive contribution to the historic character of Navan.
- HER POL 3: To encourage the development of compact urban forms by consolidating existing development boundaries and utilising brownfield sites in preference to expanding urban areas into the countryside and adjoining settlements.
- HER OBJ 1: To preserve the character of the Navan Historic Core Architectural Conservation Area.
- HER OBJ 2: To achieve the preservation of the special character of places, areas, groups of structures and townscapes within the town and environs by: Encouraging local initiatives which promote the preservation of the special character of Architectural Conservation Areas.
- HER POL 6: To encourage the retention and protection of all structures which contributes in a positive manner to the character of the ACA.
- HER POL 8: To encourage the retention of all architectural and townscape elements which contribute to the character of the ACA.
- HER OBJ 3: It is the intention of the planning authorities by the designation of the Navan Historic Core Architectural Conservation Area:
  - To protect and enhance the architectural heritage of Navan for future generations.
  - To preserve the historic street pattern within the core of the town.
  - To require that all new developments shall observe the existing scale of the town.
  - To protect the character of the existing streetscape by giving consideration to the suitability of style, construction materials, colour and decoration to be used in any proposals for development taking place within this area.
  - To encourage appropriate new uses for empty and under-utilised buildings.
  - To avoid the destruction of minor historic elements whose cumulative loss would severely erode the cultural significance of the town.
- HER POL 9: The following shall be the policy of the planning authorities with regard to protected structures in the Navan Development Plan area:
  - To refuse permission, either in whole or in part, for the demolition of protected structures, save in exceptional circumstances.
  - To resist removal or modification of features of architectural importance.
  - To resist interventions which would negatively affect the character of a structure, either externally or internally.

- To resist development that would adversely affect the setting of a protected structure.
- To require that all planning applications relating to protected structures shall be accompanied by drawings and documents sufficient to describe the impact of the proposed development on the character of the structure.
- To encourage the retention of all features of architectural heritage importance;
- To encourage works of renovation and renewal which maintain and enhance the character of a protected structure, either externally or internally;
- To encourage development which has a positive impact on the setting of a protected structure.

Occurrence of adverse visual impacts

- HER POL 29: To maintain and enhance the diverse and high quality landscape in Navan and its environs. The following views are located within the vicinity of the development:
  - VP14 Of the Blackwater River and Weir from Blackwater Bridge looking east;
  - VP15 Towards Spicer's Mill from the proposed Town Park; and
  - VP16 Towards the Blackwater Railway Bridge from the northern bank of the Blackwater, west of the proposed Town Park.

13.2.6.3 National Policy on Town Defences Environment and Local Government (2008)

This publication sets out the national policy for the protection, preservation and conservation of the defences of towns and cities. The policy document defines town defences as including all walls, gates, towers, earthen banks and fosses, bastions, outworks and other features. Town defences are considered to be monuments for the purposes of the National Monuments Act, 1930-2004, and are duly protected under that legislation.

13.2.7 Assessment Methodology

Criteria for Assessing Importance of Heritage Assets

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 13-2). This table has been derived from the following guidance, with reference to relevant legislation and policy, and using professional judgement:

- Department of Arts, Heritage and the Gaeltacht, 2013, NIAH Handbook;
- Environmental Protection Agency, 2017, Guidelines on Information to be Contained in Environmental Impact Assessment Reports;
- Code of Practice between the National Roads Authority (NRA) and the Minister for Arts, Heritage and the Gaeltacht, June 2000;
- National Roads Authority, Guidelines for the Assessment of Archaeological Heritage Impacts (particularly Appendix 2, Significance Criteria); and
- National Roads Authority, Guidelines for the Assessment of Architectural Heritage Impacts (particularly Table 8).

Table 13-2 Factors Determining the Importance of Heritage Assets

IMPORTANCE	CRITERIA
International/Very High	World Heritage Sites. Protected Structures deemed to be of very high importance using legislation, EPA guidance, NIAH rating criteria and professional judgement. Structures and Designed Landscapes recorded by the NIAH. Building and Garden Survey with an International Rating.

IMPORTANCE	CRITERIA
National/High	National Monuments. Recorded Monuments deemed to be of high importance using legislation, EPA guidance, NRA 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, NRA Significance Criteria and professional judgement.
Regional /Medium	Recorded Monuments deemed to be of medium importance using legislation, EPA guidance, NRA 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, NRA 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, NRA Significance Criteria and professional judgement. Townland Boundary Features. Parks/Gardens/Demesnes recorded by the NIAH Garden Survey which have poor historic legibility. Undesignated architectural heritage assets. Undesignated archaeological features which are particularly common or in poor condition.

Criteria for Assessing the Magnitude of Effects

Having identified the importance of the heritage asset, the magnitude of the effect from the Proposed Road 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 level and degree of effects takes into account mitigation measures which have been embedded within the Proposed Road Development as part of the design development process. The assessment of the magnitude of effects uses guidance published by the EPA (EPA 2017) which categorises effects in terms of quality, extent, context, probability, significance and duration. The effect upon the setting of an asset is also taken into account.

The quality of an effect 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 significance of an effect can be judged on a seven point scale:

- Imperceptible effect – a change capable of measurements but without significant consequences;
- Not significant – an effect which causes noticeable changes in the character of the asset but without significant consequences;
- Slight effect – an effect which causes a noticeable change without affecting the special interests or qualities of the asset to any particular degree;
- Moderate effect – 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 effect – 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 effect – an effect which obliterates the special interest or qualities of an asset.

The extent and context of effects 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 of effects can be described by the following two points:

- Likely effects – these are effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented; and
- Unlikely effects – 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 of an effect can be defined by the following criteria:

- Momentary effect – effect lasting from seconds to minutes;
- Brief effect – effect lasting for a day or less;
- Temporary effect – effect lasting for one year or less;
- Short-term effect – effect lasting one to seven years;
- Medium-term effect – effect lasting seven to fifteen years;
- Long-term effect – effect lasting fifteen to sixty years.

Effects can also be identified as permanent effect, i.e. an effect lasting over sixty years and reversible effect, i.e. can be reversed through remediation or restoration. Another consideration is the frequency of the effect, i.e. how often will the effect occur; once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually.

These effects have been derived from the EPA Guidelines for the Information to be contained in an EIAR (2017). The impact 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 13-3).

Table 13-3 Factors Determining the Magnitude of Effect

MAGNITUDE OF EFFECT	DESCRIPTION
Very 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
High	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
Medium	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
Low	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

The level of effect takes into account mitigation measures, which have been embedded within the Proposed Road Development as part of the design development process.

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, adverse of beneficial.

Table 13-4 Significance of Effect Matrix

MAGNITUDE OF EFFECT	IMPORTANCE OF CULTURAL HERITAGE ASSET			
	Local	Regional	National	International
Very High	Significant	Significant	Profound	Profound
High	Moderate	Significant	Significant	Profound
Medium	Slight	Moderate	Significant	Significant
Low	Imperceptible	Slight	Slight	Moderate

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. Reassessing the significance of the effect after applying additional mitigation allows the level of residual effect to be assessed.

13.3 Characteristics of the Proposed Road Development

13.3.1 Proposed Scheme

The scheme consists of a 1.15 km local distributor road on a predominantly greenfield site in the north-west of Navan, Co. Meath. The Proposed Road Development comprises of an Urban Arterial Street, incorporating both footpath and cycle path provisions, connecting the N51/R147 Kells Road to the L3409 Ratholdron Road through Abbeyland.

It runs in a north-south direction across the River Blackwater between the L3409 Ratholdron Road and the N51/R147 Kells Road. The location is characterized by open green fields with some wooded areas in the section north of the River Blackwater, which runs to the west of the recently developed Blackwater Park. The southern section of the study area contains the River Blackwater and continuing to the south the scheme crosses the OPW building to meet the N51/R147 Kells Road, which is lined by both residential and commercial properties. A new bridge crossing over the River Blackwater in the south is also proposed, which will improve access to lands to the north of the town.

13.4 Description of the Existing Environment

13.4.1 Overview

A 1 km study area from the Proposed Road Development site boundary was used to identify Protected Structures, Recorded Monuments, National Monuments, Monuments in State Care, Monuments with Preservation Orders, Zones of Archaeological Potential and ACAs.

The 1 km study area was also used to identify structures and designed landscapes listed on the NIAH, which have not been put forward as Protected Structures.

Initial desk-based assessment and professional judgement was used to identify five assets, which would potentially experience an impact from the Proposed Road Development (some assets are designated as Recorded Monuments or Protected Structures and for the purposes of enumeration, these assets were counted under whichever designation was deemed most appropriate, using professional judgement). The five identified assets were then used as the basis for the site visit where the identified heritage assets' current context and setting were assessed. These assets are the ACA associated with Navan's Historic Core, the weir (NT025-105), railway bridge (NT025-173), Spicer's Blackwater Mills (NT025-106) and the motte (ME025-023001).

13.4.2 Geology and Topography

The geology varies along the footprint of the scheme. To the south, the underlying bedrock geology consists of Carboniferous dark grey argillaceous and cherty limestone and shale. This is overlain by gravels laid down by the adjacent River Blackwater.

The underlying bedrock within the mid-area of the footprint of the scheme consists of rhyolite, rhyolitic tuff and slate laid down during the Middle – Upper Ordorian period of the Paleozoic. This bedrock is exposed towards the north bank of the River Blackwater but is overlain by till derived from Lower Paleozoic sandstone and shales further to the north. This till continues into the north extent of the footprint of the scheme where the underlying bedrock consists of microgranite and porphyry formed during the Silurian – Devonian period of the Paleozoic.

The topography of the area consists of higher ground to the south which slopes downhill to the River Blackwater before rising uphill from the north bank of the river through Blackwater Park. The terrain levels out on the summit of the ridge with the Ratholdron Road and urban development beyond.

13.4.3 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 the Arts, Heritage, Regional, Rural and Gaeltacht Affairs, within the site or in the 1 km study area.

13.4.4 Record of Monuments and Places (RMP)

The baseline assessment identified 28 assets recorded on the RMP within the study area, and two further assets located just outside of the study area (Figure 13.1). None of the assets are located within the footprint of the scheme. These assets represent a range of site types and periods. Two of the recorded assets can be linked to the prehistoric period. The first is a fulacht fiadh (ME025-044015) which is located on the north bank of the River Blackwater adjacent to the bridge carrying the Navan Inner Relief Road 2A over the river approximately 800 m to the east of the site boundary. This type of site is associated with wetland environments and was used to heat water for cooking or other purposes. The second prehistoric site is located approximately 1.1 km to the southwest of the scheme. It consisted of a food vessel and urn (ME025-043002) containing the cremated remains of at least two individuals. Both this asset and the fulacht fiadh date to the Bronze Age (c.2500-600BC).

Three of the assets are associated with the Early Christian period (c. AD450-1150). This period is the most prolific in terms of surviving archaeological sites with the best known being raths or ringforts. These sites consist of a circular or oval area enclosed by a bank and ditch or, in some cases, multiple banks and ditches and are highly visible on historic mapping. Many of the sites shown on historic mapping have since been removed through agricultural activity or development. As their provenance cannot now be vouched, they are simply known as enclosures. One such site (ME025-051) is located approximately 900 m east of the scheme lying under the modern development, Chestnut Grove.

An Early Christian occupation site (ME025-043001) is located approximately 1.1 km to the southwest of the scheme. This site consisted of three ditches surrounded by a small rectangular area which contained a paved area. The site has been dated to the late first millennium or early second millennium AD. A related souterrain (ME025-004) was also uncovered during this excavation. This feature was located approximately 160 m to the northeast of the occupation site (ME025-043001) and consisted of the basal courses of a short passage and a beehive chamber. The pit burial (ME025-043002) was uncovered during this excavation showing the Early Christian occupation site was located on a Bronze Age burial site.

The Abbey of St. Navan (ME025-024) may also date to the Early Christian period as it appeared to have been well established prior to the Anglo-Norman settlement of Meath. However, there are no visible remains associated with the abbey.

Navan is situated at a strategic location on an elevated ridge at the junction of the Rivers Boyne and Blackwater. The Anglo-Normans recognised this strategic importance and constructed a motte (ME025-023001) on top of a high ridge approximately 245 m to the southwest of the scheme. This asset which dates to the Early Medieval period is evidence of the Anglo-Norman settlement of the area and consists of an overgrown, flat-topped and scrub covered earthen mound measuring 4.5 m high at the north, 6.8 m high at the south and 37 m in diameter at the base. The mound is defined by a ditch to the north measuring 10m wide at top with external diameter 1.5 m while the remains of a small lunate bailey measuring 7 m north to south and 20 m east to west is also extant. Archaeological testing was carried out in 1997 approximately 70 m to the northwest of the motte under licence (97E0101). This uncovered the remains of two inhumations in a disturbed condition at the summit of the ridge. These inhumations consisted of a male aged between 18 and 23 and a female aged between 31 and 45.

Navan was one of the first boroughs established by the English in the palatinate of Meath appearing to have arisen under the patronage of the Nangle family who were barons of Navan (Lewis, 1837). The Nangles founded an abbey for the Canons Regular of the Order of St. Augustine in 1189. This abbey (ME025-024) was originally located approximately 765m east of the scheme and replaced the earlier monastic settlement. It was sacked in 1539 by the Ulster Irish then continued as the parish church until around 1693 when it was described as being in ruins after being sacked during the 1641 rebellion. It was still surrounded by a stone wall which later led to it being replaced by a cavalry barracks with the military destroying the abbey graveyard (ME025-024003). There are no visible traces of the abbey, although its former location is known and part of its built fabric in the form of dressed stones (ME025-044020) are located in a rockery at St. Mary’s Roman Catholic Church. Other associated elements including a tomb (ME025-024001), a stone sculpture (ME025-024002) and a font (ME025-024004) were removed from the abbey and are now located elsewhere. The stone sculpture is in the National Museum of Ireland (NMI) and the font is in St. Mary’s Church in Navan.

The historic town of Navan (ME025-044) continued to develop during the medieval period and King Edward IV granted the town its first Charter of Incorporation in 1469. Further charters with added privileges were added in 1494, 1623, 1661 and 1689. The town was defended by walls (ME025-044003) which enclosed an area of approximately 13 acres. A section of wall and tower survive at the point where the wall turned east towards the River Boyne just short of Barrack Street, while a section of uncoursed rubble walling nap rendered at street level (NT025-077) is located at the Town Hall on Watergate Street and is recorded as being part of the town walls which were rebuilt in April 1796.

Other features from the medieval period from within the town include the late 16th century stone cross (ME025-044002) which was originally located within the Market Square and which is now housed in the NMI in Dublin, and a fragment of a late medieval cross shaft (ME025-044010) which is now within the graveyard of St. Mary’s Church of Ireland. A wayside cross (ME025-044067) dating to the late 16th century originally stood beside an old road to Ratholdron Castle but is now on display in Meath County Library (ME025-013). Excavations at the original location of this cross in 1977 revealed a plinth of two steps made from cut limestone blocks. The remains of eight infants and young children were also recovered from the general area of the cross confirming local traditions that the site was a Children’s Burial Ground (ME025-059).

Navan increased in importance as a commercial and market centre from the 17th century onwards. There is one asset relating to this period noted within the study area. This is a limestone grave slab (ME025-023003) which is kept in St. Patrick’s Classical School approximately 260 m to the southwest of the scheme. The grave slab is in three pieces with an inscription reading ‘’HERE UN../ISE/FETH AVE…’’.

The opening of the Boyne Navigation Canal in 1790 and the construction of the railway lines during the 1840s further helped the commercial and industrial expansion of Navan. By the end of the 18th century there were eight corn mills in operation with the largest associated with distilleries. Other industries within the town produced paper, linen, sacking, leather, bacon, soap, candles, nails and agricultural machinery. Agricultural produce and livestock from the rural hinterlands were sold at the Market Place. The Market Place was originally recorded as an asset on the RMP. However, this class is no longer in use by the ASI it is now a redundant record (ME025-044001). Another asset relating to agricultural activity is a lime kiln (ME025-044018) which was uncovered during archaeological investigations along the line of the Navan relief road to the east of the scheme.

13.4.5 Zones of Archaeological Potential

Two Zones of Archaeological Potential are located within the study area (Figure 13.1). The first of these is associated with the River Blackwater and incorporates the line of the river. The scheme crosses this Zone of Archaeological Potential with a new bridge providing access across the river. The second Zone of Archaeological Potential is associated with the historic core of Navan. The western extent of this zone is located approximately 500 m to the east of the scheme boundary and will not be impacted.

13.4.6 Record of Protected Structures (RPS)

The baseline assessment identified 80 assets on the County Meath Record of Protected Structures within the 1 km study area (Figure 13.2). None are located within the Proposed Road Development site and details are included in Appendix A13-1. These assets are also noted on the NIAH and two are also RMP sites. Those noted on the RMP are Navan Motte (NT025-166) and the town wall (NT025-077). Sixty-six of the Protected Structures are located within the ACA associated with the historic core of Navan and will be discussed in relation to this designated asset.

The closest of the remaining Protected Structures within the immediate vicinity of the scheme are all industrial features. A weir (NT025-105) is located approximately 90 m east of the scheme on the River Blackwater. This weir dates to 1790 and was associated with the industrial complex located immediately adjacent on the south bank of the river.

A railway bridge (NT025-173) is located approximately 361 m west of the scheme and carried the railway line to Kingscourt north over the River Blackwater. This asset consists of a single-span single track railway bridge with rusticated limestone abutments, iron trestle beams and iron handrail dating from 1870. The remaining two Recorded Structures within the immediate vicinity of the scheme are located approximately 412 m to the east. The first of these is Spicers Blackwater Mills (NT025-106) which is a detached eleven-bay six-storey water mill built in 1783 with the remains of the cast-iron water wheel. To the north of Spicers Mill is an associated limestone and concrete mill weir and sluice (NT025-107) which dates to 1780.

The remaining Protected Structures, within the study area but outside the ACA, consist of a range of structures dating from the 19th and 20th centuries including institutional buildings such as the former fever hospital (NT025-169) and workhouse (NT025-167) to private dwellings such as Aylesbury Lodge (NT025-171) and a post box (NT025-168).

13.4.7 Architectural Conservation Areas

There is one ACA located within the study area. This is the Navan Historic Core ACA which covers the area of the historic town core of Trimgate Street, Market Square, Watergate Street, Ludlow Street, Bridge Street, Church Hill, the Fair Green and Railway Street between Trimgate Street and Circular Road (Figure 13.2).

Navan’s town core is a distinctive area with a street pattern which survives from the medieval period when the town was walled, and many of the current street names, such as Trimgate Street, Watergate Street, Abbey Street and Canon Row, reflect activity during this period. The historic streetscapes of Navan are largely composed of town houses and shops dating from the 18th to 20th centuries interspersed with a number of religious, institutional and commercial buildings. These represent the majority of the Navan’s protected structures and reflect how the town developed during the 18th and 19th centuries. It is recognised that they have acquired economic and aesthetic values and contribute to the town’s distinctive character (MCC, 2009).

13.4.8 National Inventory of Architectural Heritage Structures

A total of 87 buildings and structures listed on the NIAH are located within 1 km of the scheme. None of these assets are located within the footprint of the scheme. Eighty assets are also Protected Structures and have been assessed under this higher statutory designation. The majority of the remaining seven assets are located within the Navan Historic Core ACA. These consist of former domestic properties which are now commercial properties such as Tara Cleaners (NIAH Reg. No. 14009489) and Navan Safety & Workwear Ltd (NIAH Reg. No. 14009505), a domestic property (NIAH Reg. No. 14009521) and a length of limestone kerbstones (NIAH Reg. No. 14009570) dating to 1870.

The remaining three assets are located outside the ACA with the closest St. Patrick's (NIAH Reg. No. 14008009) located approximately 100 m southeast of the scheme on Kells Road. This property is a detached three-bay, two-storey Edwardian style house built around 1915 with gabled end bays flanking dormer roofed veranda. It is accessed via a gateway consisting of low quadrant walls and wrought-iron railings and pair of gates.

The last two assets are located on the Navan Relief Road approximately 700 m east of the scheme and are associated with the former barracks. The main building (NIAH Reg. No. 14006026) is a five bay, two storey building dating from 1785 which was refurbished in 1990 with a garage extension to left hand side and gabled enclosed porch. The second building is a four-bay, two-storey extension to the former barracks in 1885 with single-storey extension to front added in 1990. The two buildings are currently used as dwellings.

13.4.9 National Inventory of Architectural Heritage Designed Landscapes

One designed landscape was identified within the 1 km study area (Figure 13.2). Nevinstown House Planned Landscape (ME-43-N-855685) is located approximately 600 m to the west of the scheme and is associated with the former Nevinstown House which is shown on the 1st edition OS map sheet. Features included an entrance driveway and parkland. The house and entrance no longer exist, although the site footprint and boundary wall are still visible.

13.4.10 Archaeological Investigations

A number of archaeological investigations have taken place within the vicinity of the scheme. Several of these are noted on the RMP and have been discussed in relation to this. Further investigations within the area include:

- Abbey Road where the remains of the town wall and ditches dating to the early medieval period were excavated under licence 02E1456;
- Canon Row/Kennedy Road where medieval pits and a ditch were uncovered and excavated under licence 05E0754;
- River Blackwater, Abbeylands South where a survey took place of a 210m stretch of the riverbank / riverbed prior to the redevelopment of the Navan Carpet factory site. Survey included visual inspection and magnetometry by hand-held detection of the river bed and south river bank under licence 05D075, 05R058. Nothing of archaeological significance was noted.
- Former Navan Carpets factory site, Abbeylands South where archaeological monitoring of the redevelopment of the site took place under licence 05E0454. Nothing of archaeological significance was noted.
- Navan Inner Relief Road - Site 1 excavation of early medieval settlement which was enclosed by a ditch. This was excavated under licence 06E0274; and
- Navan Inner Relief Road – Sites 1 and 2 which were excavated under licence 06E0024. Site 1 was a medieval ditched enclosure while Site 2 consisted of a prehistoric ring ditch and associated cremation burials.

The most pertinent archaeological investigations took place between March and June 2012 in relation to the Blackwater Park development immediately adjacent to the eastern boundary of the scheme (12E0103) which revealed two distinct areas of archaeological activity (Farrimond MacManus, 2012).

Area 1 contained two small ring ditches dating to the Bronze Age. The remains of a large un-decorated urn and small flecks of burnt bone were recovered from the ditch fill of one of the ring ditches; however no in-situ cremations were recovered. This was likely due to disturbance through agricultural activity.

The remains of six graves were also uncovered 55 m to the northeast of the ring ditches. These graves consisted of simple pits with three containing the partially preserved remains of three individuals. No remains of coffins or grave goods were recovered.

Area 2 contained a complex array of ditched enclosures and smaller land divisions along with three subsoil cut kiln pits. These enclosures extended beyond the limit of excavation associated with the development and have been interpreted as the remains of intense but short-lived activity. No evidence for domestic activity was uncovered within the enclosures which suggested they may have been used for agricultural or industrial purposes. The presence of the three kilns substantiates an industrial use though no evidence for slag or pottery waste was recovered.

More recently, the Applicant commissioned a geophysical survey over five pre-selected sites along the LDR 4. This took place in July 2019 using Magnetic Gradiometer under detection licence no. 19R0127 (Earthsound, 2019). The purpose of the survey was to identify any geophysical anomalies of possible archaeological origin within the five specified survey areas and to recommend for consideration further investigatory measures to be undertaken with justifications based on the findings of the geophysical survey. The full report is included as Appendix A13-2 contained in Volume 4 of this EIAR.

Area 1 was located within the north of the scheme with the terrain consisting of mostly flat grassland covered in short grass. Three anomalies were noted within Area 1:

- Anomaly 1: Weakly magnetic linear anomaly interpreted as a possible ditch or relict field boundary running in a northwest to southeast direction for 45m. The anomaly was recommended for test excavation.
- Anomaly 2: Highly magnetic isolated anomaly interpreted as a possible large pit or cluster of pits and area of burning measuring 7.4m in diameter. The area may be related to the historic road which is visible on historic OS maps including the Historic 6” (1837-1842). The anomaly was recommended for test excavation.
- Areas of very high magnetism noted in southern half of Area 1. This consists of a large area of very high magnetism spreading across most of the southern half of Area 1. It was surmised that the interference could be caused by rubble from the historic road which passed through this part of the field or debris and dumped materials possibly from nearby demolished houses. It was also surmised that large areas of burning, modern ferrous deposits or interference from overhead electricity lines and poles may have caused the high magnetic anomaly.

Area 2 was located towards the middle of the scheme directly to the west of the Blackwater Park development where archaeology was uncovered under licence (12E0103). It consists of mostly flat grassland. Evidence of modern disturbance was uncovered while only one anomaly of archaeological potential was uncovered within this area:

- Anomaly 3: Linear magnetic anomaly which has been interpreted as s possible former field boundary ditch measuring 99m and orientated north to south. The anomaly was recommended for test excavation.

Area 3 was located within the middle of the scheme directly to the southwest of the Blackwater Park development. The terrain consisted of parkland and uneven ground on a gentle south facing slope. covered in high grass and weeds. The majority had been freshly mown although the south part of the survey area was not cut and could not be surveyed. Seven anomalies of archaeological potential were noted within this area:

- Anomaly 4: Two conjoining linear magnetic anomalies consisting of two perpendicular possible ditches or field drains. One is orientated north to south measuring 95 m and running into a former field boundary (Anomaly 8) at south. The second extends east for 16m and likely continues beyond the survey area. The anomalies may be associated with Anomaly 9 at south. The anomaly was recommended for test excavation.
- Anomaly 5: A curvilinear magnetic anomaly possibly representing a curving ditch measuring 29m northwest to southeast with an extending element 7.8m long towards the south. It may be related to Anomaly 6 and is possibly archaeological in nature. It has been recommended for test excavation.
- Anomaly 6: A curvilinear magnetic anomaly possibly representing a curving possible ditch measuring 24.7m southwest to northeast. This anomaly may be archaeological in nature and has been recommended for test excavation.
- Anomaly 7: Three sub-circular / oval anomalies located in close proximity to one another. The smallest is sub-circular measuring 6.9m by 7.7m. The second anomaly is located 2.5 m to the north of the first and measures 8m by 9.3m. The last is located 2m to the east of the second anomaly and Anomaly 6 appears to run into it from the north. The two anomalies cover an area measuring 19.5 m by 9.5 m and may be archaeological in nature probably associated with a dug feature or deposit. All three anomalies are recommended for test excavation.
- Anomaly 8: Linear magnetic anomaly formed by a relict field boundary which is shown on historic OS maps. Anomaly 4 runs into this field boundary. Anomaly 8 has been recommended for test excavation.
- Anomaly 9: Two linear magnetic anomalies interpreted as two perpendicular possible ditches (28m north to south, 13m east to west). The longer segment may be related to Anomaly 4. These anomalies may be agricultural in nature. They have been recommended for test excavation.
- Multiple isolated linear trends consisting of five possible shallow ditches, gullies or furrows located throughout the survey area. These anomalies have been recommended for test excavation.

Area 4 was located to the immediate south of the river within the grounds of the former council offices. The terrain consisted of a flat garden covered by short grass and surrounded by a metal fence. The garden contains a number of electricity and lamp posts, shrubs and evidence of services. One anomaly was noted within this area; however, the entire area is covered in high magnetic interference likely associated with the deposit of modern soils. It is noted that these modern soils could mask any potential archaeological features underneath. The anomaly is:

- Anomaly 10: Two linear magnetic anomalies interpreted as two possible ditches roughly east to west. These anomalies may be cut through or have been caused by the high magnetism within the survey area. They have been recommended for test excavation.

Area 5 was located at the south extent of the scheme at Moathill. The motte (ME025-023001) is located to the immediate south. The terrain consists of uneven ground on a slight northwest facing slope covered in high grass which has been cut and left on the ground. The edges of the area were heavily overgrown and were excluded from the survey. Evidence of agricultural activity and modern disturbance was detected as well as three anomalies with archaeological potential. These anomalies are:

- Anomaly 11: Multiple isolated magnetic responses which have been interpreted as four possible pits or postholes in the north section of the field. They have been recommended for test excavation.
- Anomaly 12: Two parallel linear anomalies which have been interpreted as two parallel possible ditches which may have formed a field boundary. They have been recommended for test excavation.
- Anomaly 13: Multiple isolated magnetic responses which have been interpreted as four possible pits or postholes in the southwestern section of the field. They have been recommended for test excavation.

An archaeological review of the preferred route was prepared in August 2019 (Roycroft, 2019). This report is a summary of the Navan LDR4 Preferred Route for Archaeological and Cultural Heritage. The review has taken note of the findings of the adjacent excavation (12E0103) at Blackwater Park and the recent geophysical survey as well as a study of standing earthworks (banks, ditches and roads) within the line of the scheme. Pertinent details of these are outlined in Table 13-5 below while the full report is included as Appendix A13-3 contained in Volume 4 of this EIAR.

Table 13-5 Archaeology and Standing Earthworks within Navan LDR4 Preferred Route

Item	Description
1.1	Unnamed road. Southern side of this road is townland boundary [1.3]. Road form is (N side) large ditch in hedge, grassed verge, then road surface, then 'embanked verge' (up to 0.50m high - with hedge +/or trees), then a very large, water filled ditch (S side - townland boundary [1.3]). Road is on 1837 OS and seems to be the same sort of build as Roads [2.3], [2.4], [2.5]. Road [1.1] runs outside and along Abbeyland townland boundary [1.3] and may have originally run around all the way to connect to the precursor to the R162 Kingscourt Road. Road [1.1] may be medieval in origin but its present form is influenced by c. 18th – 19th C redesign/upgrade caused by adjacent Navan-Kingscourt Railway to W and later upgrades.
1.2	Farm plot. 1837 OS shows a building oriented N-S on the E side. 1915 shows no buildings and 1939 Cassini shows a shed / stable. This shed is now demolished but the S wall is retained as the S boundary to the plot [1.2] (rest of boundary to road [1.1] is a hedge unless it is a modern blockwork wall.
1.3	Abbeyland-Windtown townland boundary. This line is shown on the 1650 Down Survey and presumably follows the line of the boundary to the lands of medieval St Mary's Abbey. The main form is a very large (4m wide x 2m deep approx), water-containing ditch that has been reconstructed as it approaches the Ratholdron Road. The ditch water perhaps passes underneath the Ratholdron Road in a small culvert? There is no obvious planting on the S side of Ditch [1.3] nor a bank and it is likely any such features were removed.
1.4	Ratholdron Road. This road is built around 1800 as it does not feature on the 1777-85 Taylor & Skinner but is shown on the 1812 Larkin Map.
1.7	Very large ditch-drainage channel. Shown on 1915 OS but probably in existence before this.
2.1	Ditch on 2019 Geophysical Survey. Lines up with a ditch W of ditch [1.7] and is probably a field boundary in existence before 1837.
2.2	Original Ratholdron/Donaghpatrick/Kells Road - erased in mid-20th C to create a large field. Visible as a cropmark on Google aerial 31/7/2008. Geophysical survey anomaly 2 seems to be associated with this road. Form is road with lateral drainage ditches between two banks and survives fairly well as Road [2.5].
2.3	Marked as a drainage ditch-Boundary on 1915 OS. This boundary seems to be associated with a road or field track as well as drainage ditches. To S of Road [2.5] it is certainly a track/Road [2.4] leading to Farm [3.5]. The ditches all acted as drains and it is possible that the ditches were designed to overflow onto the road surface, but this larger flow was contained between the associated outer banks. There is a stream marked roughly along this line on the 1812 Larkin map. To the E of Boundary [2.3] is a fairly recent Field Gate of two masonry piers that is now blocked off and overgrown. LRD4 impacts on c.130m of this erased feature. LDR4 does not significantly effect this feature (LDR4 fenceline is adjacent to the surviving section – including the field gate).

2.4	Road leading S from Road [2.2]/[2.5]to Farm [3.5]. Form is ditch-bank-ditch-road surface-ditch-bank-ditch and it is around 10-15m wide. This is the same form as Road [2.5] except the road surface on Road [2.5] is above the adjacent land surface. Road surface of 'Road' [2.4] seems to be below the adjacent land surface and therefore perhaps the original intention was to include more of a drainage function. The ditches all acted as drains and it is possible that the ditches were designed to overflow onto the road surface, but this larger flow was contained between the associated outer banks. There is a stream marked roughly along this line on the 1812 Larkin map. LDR4 impacts on c. 70m of this feature.
2.5	Original Ratholdron/Donaghpatrick/Kells Road hidden in well vegetated boundary. The road survives well as a ditch-bank-ditch-road surface-ditch-bank ditch form and it is around 10-15m wide (very overgrown). Road surface is above adjacent ground level. If the surrounding vegetation were tidied up, this road would make a nice feature of Blackwater Park since it is a rare survival of a 18th C or earlier 'Main Road'. Road [2.5] continues in a less well preserved form to the E of the Blackwater Park footpath that cuts through it. LDR4 does not significantly effect this feature (LDR4 fenceline is adjacent to the surviving section).
3.6	Large boundary of the wide, central area flanked by lateral ditches between two banks. 1915 OS mapping and crop marks show this to have been a field track that also acted as a drainage channel. Mostly erased by 1915 but part of the same presumably post-medieval landscape organisation as tracks [2.3], [2.4], [2.5]. A side track [4.7] from Track [3.6] leads to quarry [4.6]. Track [3.6] has been erased during works for bank [3.1] and all the area to the W of this, so only survives below ground within the lands proposed for LDR4. Approx. 30m of boundary [3.6] crosses LDR4.
3.7	Geophysical anomalies probably representing field ditches and cultivation ridges.
4.1	Large, wide boundary of a road that doubles as a drainage run. The road survives well as a ditch-bank-ditch-road surface-ditch-bank-ditch form and it is around 10m wide. The outer banks have stone revetting surviving in places. The central 'road' area does not descend uniformly to the south but there is the occasional slight terrace' to check any water flow. Similar design to road/boundaries [3.6], [2.4], [2.5]-[2.1] so they all seem to reflect a single phase of landscape management (probably 18th C). LDR4 boundary follows the centre of this feature for approx. 270m. Since road [4.1] is c.10-15m wide it would be preferable if the LMA for LDR4 followed the eastern surviving edge of Road [4.1] so that it would be preserved in situ.
4.2	Geophysical anomaly that coincides with a curving cropmark on the Google aerial of 31/7/2008. May be associated with curving cropmark [4.3] which would make a circular enclosure 60m in diameter with ditches c.7m wide, which would be on the very large side for a ringfort (unless it was bivallate) but might be a reasonable size for a Late Bronze Age enclosure. However, there is no indication of such a large enclosure in the geophysical survey. This area is a gently sloping terrace with steeper slopes to S. If anomaly [4.2] connected to anomaly [4.3] then approximately half of this feature would be within the LDR4 lands made available.
4.3	Curving cropmark that may have a causewayed gap between it and anomaly [4.2]. However, a gap oriented to the N such as this would be unusual. See above. This part of the cropmark is outside the LDR4 lands made available.
4.4	Drier area of grass in an aerial image. May be a ploughed out boundary bank that coincides with a ditch in the geophysical survey (anomaly 4).
4.5	Erased field boundary. Part of probably 18th C landscape organisation and parallel to Boundary road [4.1]. Boundary [4.8] ties into boundary/track [3.6] and is one of many now-removed field boundaries in this part of Blackwater Park.
4.7	Erased track leading from Boundary [3.6] to Quarry/Pond [4.6] seen on 1915 OS and aerial images.
4.8	Anomalies 5-6 in the Geophysical Survey (area around 45m in diameter). May represent archaeological features or drainage / quarrying activity.
4.9	Quarry labelled on 1837 and 1915 OS mapping. The quarry is dug into the terraced bank of the River Blackwater, but the miners seem to have targeted a localised knoll. Such a localised knoll bordering a river is a likely place for archaeological activity. Area c. 35m in diameter.
5.1	Floodplain of River Blackwater. Present soils are infill since 1915 OS, which shows river Blackwater northern edge as further to N than present line. Present River N edge roughly coincides with the middle of the channel as seen on 1915 OS and the 1939 Cassini maps. Therefore bankside activity may survive in the area at the base of the present riverbank terrace to the N with Area AH4. The material currently making up the ground in floodplain [5.1] could be dredged material from the river channel and therefore may contain archaeological objects that were previously in the river. Area c.90m E-W x 20m N-S.
5.2	River Blackwater present Channel c.22m wide. See notes above. The Blackwater appears to have been thoroughly dredged during the Boyne Drainage Scheme and the channel narrowed and presumably deepened. Low possibility for archaeological object due to dredging but material may have been subsequently washed downstream from upriver.
5.3	Boundary on 1837 OS. This was the boundary for the 'demesne' area of Millbrook House (Paper and Frieze Manufacturing and later Woollen Mill, now ruined). The boundary seems to be a deep ditch perhaps with a bank and may originally date to 1790 or so, but has certainly been altered in part since.
5.4	This area is marked 'Liable to Floods' on the 1939 map. It was partly an orchard or willow/osier bed on the 1837 OS. Therefore the ground level has presumably been raised in the recent past - perhaps with material dredged from the River Blackwater that might contain archaeological objects.
8.1	Navan N51 Inner Relief Road excavation Site 1 06E0274. Considerable archaeological remains that clearly extend beyond the limits of that excavation area. Human Burials discovered to W of Site 1 in 1997 (these remain in situ). Several phases of different field boundary patterns evident from early, later and post-medieval periods.
8.3	Townland boundary between Moathill and Townparks (Navan). The boundary is shown on 1837 and 1915 OS maps but was then reused as a boundary to the entrance driveway to the House [8.4] RPS NT025-015 / NIAH 14008009 (Later St Patrick's School). Present boundary shows a line of trees and the remnants of the driveway associated with Protected Structure [8.4] House NT025-015. Southern end of this boundary has been recently removed through expansion of St Patrick's Classical School.

8.5	Very large boundary that seems to be based on a large earthen bank. The height of this boundary may be exaggerated by the presence of a negative lynchet on the N side (Area AH8) and the quarry pit in which St Patricks School has been built on the S side. This boundary is shown on 1837 and 1915 OS and runs up to the 'Bailey' area of Motte RMP ME025-023/ RPS NT025-009/NIAH 14008044. It previously surrounded a knoll of higher ground that was completely quarried away by quarry [8.6] in the 20th C, but was probably an attractive place for historical settlement. Boundary [8.5] has been removed at the E end and has been replaced with a boundary fence for St Patricks School. The earthwork section of boundary [8.5] should be left in situ as much as possible.
8.7	Motte and Bailey Castle RMP ME025-023/ RPS NT025-009/NIAH 14008044. This area to the north of the mound is considered to have been the Bailey area. Bailey areas were always approached by an access road from which they were defended by a form of gatehouse or bastion. The approach road may have been along boundary [8.14]. Very overgrown area.
8.8	Grassed area on slopes of Moathill Motte ME025-023. Good place for archaeological remains.
8.9	Boundary shown on 1837 and 1915 OS Mapping. The ground level is considerably higher on S side than N side. This might be due to positive lynchet / soil creep on S side and a negative lynchet cutting into the ground on the N side.
9	Proposed N compound area. This zone is shown as field on previous OS mapping. Aerial images show a central irregular line that is probably an old field boundary (ditch) a drain or even perhaps a stream bed. The anomaly forks to the E. At the fork there is a visible hollow in the field.

Source: After Roycroft 2019

13.4.11 Historic Cartographic Evidence

The 1st edition OS map sheet (1835) shows the area of the scheme during the first half of the 19th century (Figure 13-1). The area was largely rural with large fields formed by straight boundaries that show no indications of diverting around topographical or archaeological sites. The line of the scheme is clearly defined by the Kells Road to the south and the Ratholdron Road to the north. The Mill Brook industrial site is clearly marked as a paper and frieze manufactory with the adjacent grounds to west part of the complex. The line of the scheme runs through a field adjacent to the industrial site. This field is largely featureless though a small promontory is apparent jutting into the River Blackwater. A tree-lined boundary is shown enclosing the south extent of the promontory. It has been suggested that this feature could be an archaeological site (Roycroft, 2012).

Figure 13-1 1st edition OS map (1835)

A small quarry (Roycroft Item 4.9) is marked on the north bank of the river though the area is generally rural with the exception of an undulating lane (Roycroft Item 2.5) which runs approximately northwest to southeast across the line of the scheme. This lane is the old road from Navan to Donaghmore (Roycroft 2018). Buildings are marked along this former road in a small settlement to the east of the line of the scheme. A short offshoot is shown running south from a pronounced bend in the former road. Two buildings with associated tree-lined plots of ground are marked to the west of the offshoot. Roycroft (2018) notes that the line of the offshoot approximately corresponds to the route of a road marked on an earlier map of 1817(Roycroft Item 2.4). There are no features marked within the north extent of the scheme to the Ratholdron Road.

The 2nd edition OS map sheet (1911) shows the area of the scheme at the start of the 20th century (Figure 13-2). The area is still largely shown as agricultural with a well-defined field system. The south extent still consists of a field with the enclosed promontory jutting into the Rover Blackwater is apparent to the west. The mill site has expanded and is now identified as a woollen mill. The protected structure weir is clearly marked to the immediate north of the mill. Another industrial site is the railway which is now very apparent aligned north to south spanning the river by the bridge.

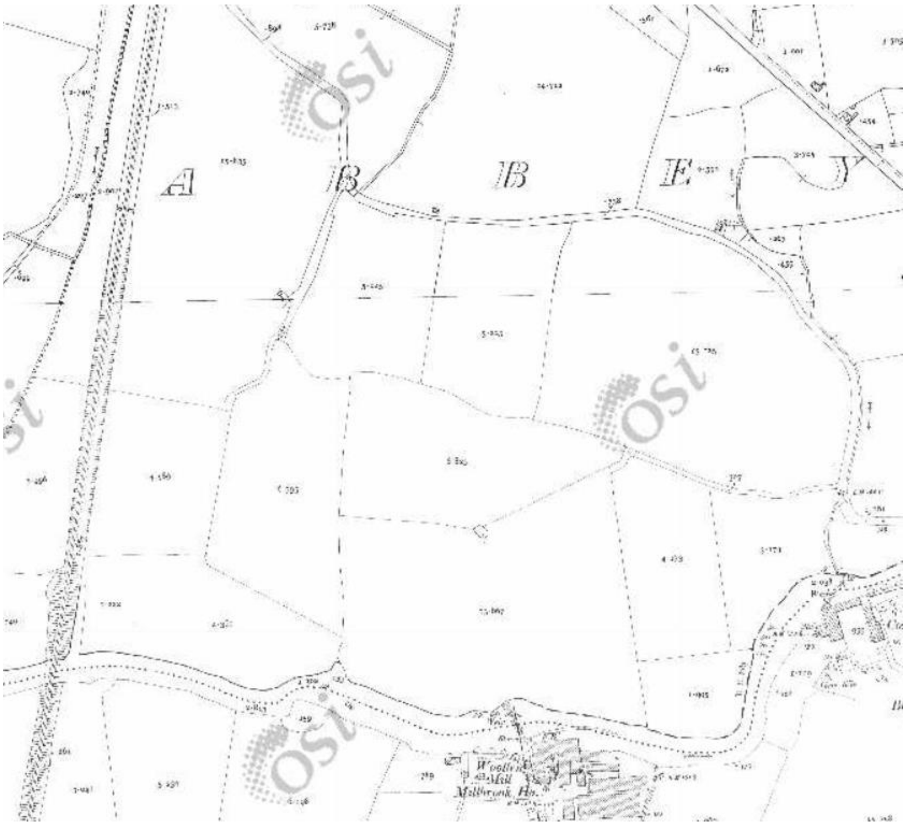


Figure 13-2 2nd edition OS map (1911)

The field system is largely featureless and, while the former roads (Roycroft Items 2.4 and 2,5) are still extant, only one structure is marked. A network of drainage channels is shown within the north extent of the scheme.

The 25 inch edition OS map sheet shows the Proposed Road Development site during the mid-20th century (Figure 13-3). The area is still shown as agricultural though there has been industrial development with overhead power lines running across the south extent of the scheme, over the River Blackwater and continuing northeast beyond the footprint of the scheme. The woollen mill and Millbrook House remain major features to the immediate east at the south extent of the scheme while a carpet factory is now located to the west.

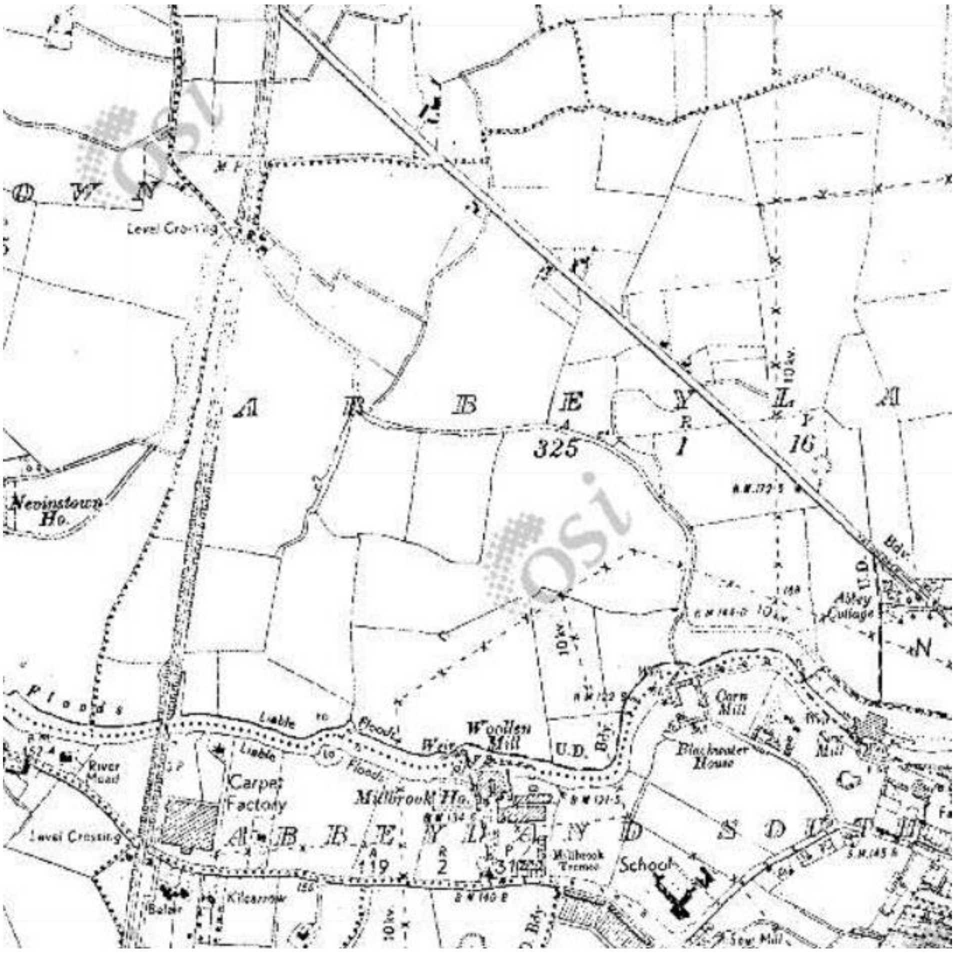


Figure 13-3 25 inch edition OS map sheet

The enclosed promontory is still marked though it is noted that the stretch of the south bank of the river where it and scheme are located is liable to flooding. The north bank of the river is also marked as liable to flooding (Roycroft Item 5.1). The field system and former roads noted on the previous map editions are still extant and show no change.

13.4.12 Aerial Photographic Evidence

Aerial photographic (AP) evidence was examined online at map.geohive.ie. Black and white APs from 1995 show the area before the N51 link road was constructed at the south end of the scheme. The south extent of the scheme is now occupied by the OPW building with car parking and a grassed area further north to the south bank of the river. The possible enclosed promontory is visible as a heavily vegetated area but no details are apparent. The woollen mill and carpet factory are evident to the east and west respectively and the weir and railway bridge are clearly visible crossing the river.

The river appears to have been narrowed with the north bank now extending further into the river than shown on the historic map sources. The majority of the scheme is still agricultural land which appears as good quality pasture on the aerial photograph. The exception to this is an area within the north extent which appears heavily vegetated. There has also been modern development to the east at the north extent of the scheme with housing and a compound now apparent. The lines of former field divisions can be discerned within the central part of the scheme and the line of the former roads are still extant. There are no apparent cropmarks visible which could indicate the presence of sub-surface archaeological features either within the footprint of the scheme or within the adjacent areas to the east where substantial archaeological remains were uncovered recently (Farrimond MacManus 2012). Nor are there any visible signs of the former buildings marked on the historic cartographic evidence.

The subsequent APs are in colour. The AP from 2000 shows no change on the previous 1995 AP layout. The area is still largely agricultural with dense vegetation to north. There are no apparent cropmarks visible on this map sheet with the former field divisions not visible. The AP from 2005 shows no change within the footprint of the scheme though the N51 link road is under construction to the south. The ground running parallel to the immediate east of the railway track appears disturbed with the underlying sub-soil consisting of sand. The most recent AP taken prior to 2012 shows little change within the footprint of the scheme. The N51 link road is now complete and there are no indications of the groundworks previously noted adjacent to the railway. One change within the immediate vicinity is that the former carpet factory to the south of the river has now been replaced by a new development The lines of the former field divisions can be discerned on this AP though there are no visible signs of cropmarks indicating possible archaeological activity either within the scheme or under the adjacent future site of Blackwater Park.

Figure 13-4 Aerial photograph of the site taken prior to 2012 (https://heritagemaps.ie)

13.4.13 Site Visit

The site was visited on the 24th August 2018 by David Kilner. The purpose of the site visit was to verify the results of the baseline study and to assess the archaeological potential of the terrain within the footprint of the scheme. The site visit commenced at the south extent of the scheme. With the exception of the creation of Blackwater Park on the north bank of the river, land use and topography within the footprint of the scheme and immediate area is identical to that shown on the most recent AP.

The south extent of the scheme will run from the N51 link road through the former OPW building to the Blackwater River. The site of the OPW building is still extant though the building is currently unoccupied (Figure 13-5). The topography slopes downhill from road level to the river and the intervening terrain shows evidence of terracing to accommodate the OPW building and car park. The terrain to the north of the building is level consisting of a car park and a grassed area beyond (Figure 13-6). The car park and grassed areas both show evidence of underground services and drainage while overhead lines also cross the property including to north across the river. The grassed area is uneven underfoot and is noticeably higher than the ground levels within adjacent property. This suggests that it has been raised with imported fill material to create a level surface and possibly protect against flooding.

Figure 13-5 Looking north across OPW building

Figure 13-6 Looking south towards OPW building

Crossing the Blackwater River, the terrain on the north bank is low lying and flat (Figure 13-7). It is uneven underfoot and appears to be infill material added during the 20th century. The possible enclosed promontory is visible from the north bank of the river though it is heavily overgrown with no features visible. The terrain surrounding the promontory is also overgrown and appears to consist of marginal ground. The line of the River Blackwater is considered a Zone of Archaeological Potential which includes the original line of the north bank before the modern infill material was added.

Figure 13-7 Looking southwest across north bank of river at possible enclosed promontory

Continuing north, the terrain within the footprint of the scheme rises uphill away from the river (Figure 13-8). The overhead power cables noted in the OPW building continue north within the scheme. This area of the scheme is adjacent to Blackwater Park which is accessed by a loop of foot path. The terrain within this area is marginal and unkempt apart from a strip of ground along the peripheries used by walkers.

Figure 13-8 Looking south across the Blackwater River at OPW building

The terrain continues to rise uphill to the north with the footprint of the scheme separated from the adjacent agricultural field by a mature hedgerow (Figure 13-8). The terrain starts to level into the summit of the ridge. An attenuation pond and walking and cycling links to Blackwater Park are proposed for this area.

Figure 13-9 Looking south across area of scheme at area of the proposed attenuation pond

Further north, the line of the scheme crosses west into the adjacent agricultural field (Figure 13-10). This field is sub-rectangular and is separated from the adjacent park by a large earth bund which appears to have been created when Blackwater Park was constructed. The terrain within the field is level and under pasture with overhead power cables crossing the northwest extent. The west boundary of this field is formed by the line of the former road noted on 1812 map sheet. This is heavily overgrown with vegetation.

Figure 13-10 Looking north across sub-rectangular field

The line of the scheme crosses into the adjacent field to west. This is a large sub-triangular pasture field with level ground to north (Figure 13-11). A trackway runs west to east across this field which corresponds to the former line of the road / lane noted on the historic cartographic evidence while overhead power lines run north across the line of the scheme.

Figure 13-11 Looking north at mature tree plantation

The mature tree plantation occupies the north extent of the scheme. Swathes have been cut through this plantation to facilitate the routes of power cables and underground services. The largest swathe through the plantation runs west to east and the terrain within this area is level and under grass (Figure 13-12).

Figure 13-12 Swathe of open ground within tree plantation

The line of the scheme joins the Ratholdron Road to the north of the tree plantation. This will require the realignment of a current access laneway and it is proposed this join the Rathodron Road further to the west. The proposed realignment will cross the east extent of a sub-triangular pasture field (Figure 13-13). The terrain within this field is level and shows no obvious sign of disturbance.

Figure 13-13 Area where realigned access track will run

Blackwater Park is located adjacent to the east of the scheme. Archaeological features, including evidence of enclosures and three kilns, were uncovered when this park was constructed in 2012 under the current car park in the north of the park (Figure 13-14), and two Bronze Age ring ditches and later burials were uncovered under an area now used as sports pitches (Figure 13-15).

Figure 13-14 Car park in Blackwater Park where enclosures and kilns were uncovered

Figure 13-15 Pitches where ring ditches and later burials were uncovered

13.5 Assessment of Impacts

The purpose of the impact assessment is to consider the likely and significant effects on the archaeological and architectural heritage both during the construction and post works completion. The assessment of impact follows guidance set out in the Advice Notes on Current Practices in the preparation of Environmental Impact Statements, EPA, 2017 and Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes, NRA 2006 as detailed in Section 13.2.6.

13.5.1 Summary of Baseline and Archaeological Potential

The baseline study has revealed that there are no recorded archaeological sites within the footprint of the scheme though 28 are noted within the surrounding 1 km study area. None of these will be physically impacted by the scheme.

The scheme crosses a Zone of Archaeological Potential associated with the River Blackwater. All riverine environs are considered to have an inherent archaeological potential as they would have provided valuable resources in terms of food and communication, attracting activity since prehistoric times. A possible enclosed promontory has been identified from historic mapping within the vicinity of the scheme though this possible asset is located outside the footprint of the scheme and should not be physically impacted. In later centuries, activity would have included industrial use and evidence of this is apparent within the immediate vicinity of the scheme in the form of the mill sites and their associated weirs.

Historic mapping shows that the area of the river within and adjacent to the line of the scheme was prone to flooding. This would have limited the range of activities within this area though seasonal use would have been possible. The area of the north bank has been extended with fill material during the 20th century while the level of the south bank has also been raised with fill material within the boundaries of the former OPW building. It is likely that any archaeological remains within these infilled areas, should they have existed, will have been heavily disturbed or destroyed.

The original line of the bank on the north side of the river is still discernible and it is possible that sub-surface archaeological features and artefacts relating to riverine activity could exist in situ within this area.

The line of the scheme continues uphill onto the summit of the ridge on the north side of the river valley. This area would have been a desirable location for activity in the past and evidence for this is present in the archaeological assets recorded as upstanding remains or through excavation. In particular, evidence for activity dating to the Bronze Age and Early Medieval periods has been uncovered during the archaeological monitoring of groundworks associated with the construction of Blackwater Park. The footprint of the scheme contains similar terrain to that of

Blackwater Park and there is a strong possibility that archaeological activity could extend into this area. This has been substantiated by the geophysical survey which has recorded anomalies which are suggestive of archaeological features and deposits. Additionally, there is historic cartographic and upstanding earthwork evidence for communications and agricultural activity dating to the Post Medieval and modern periods. This evidence takes the form of banks, ditches and roads (Roycroft, 2019).

13.5.2 Construction Phase

The construction phase will see works within the entire footprint of the scheme. The south section of the scheme footprint is located within the land occupied by the OPW building. This area appears to have been severely disturbed during the construction of the building with the result that any archaeological assets which may have existed will have been destroyed. It is assessed that groundworks associated with construction in this section of the scheme footprint will have no impact on archaeological assets as a result of the previous works.

There is a possible archaeological site, the enclosed promontory, located on the southern river bank approximately 75 m west of the scheme. This feature is located outside the Proposed Road Development area and will not be physically impacted; it is assessed therefore that there will be no impact arising from the construction of the scheme.

The proposed scheme approach spans the river with the north bridge pier located within the Zone of Archaeological Potential associated with the Blackwater River. Groundworks associated with the construction of this pier would severely impact upon any archaeological remains should they be present in this area. Any archaeological remains present are likely to be of local interest and therefore low importance as defined by the criteria in Table 13-2. The magnitude of this effect would be very high as defined by the criterial in Table 13-3 leading to a significance of effect of significant, as defined by the criteria in Table 13-4.

The scheme will cross agricultural land that has good potential to contain previously unrecorded archaeological features as shown by the ring ditches, enclosures and kilns uncovered during the construction of the adjacent Blackwater Park in 2012 and the geophysical survey carried out in July 2019. Any such archaeological features are likely to be of local interest and of low importance as defined by the criteria in Table 13-2. Groundworks associated with the construction of the scheme would severely impact upon any such archaeological remains should they exist and would alter the special interests or qualities of an asset. The magnitude of this effect would be very high as defined by the criterial in Table 13-3 leading to a significance of effect of significant, as defined by the criteria in Table 13-4.

Similarly, evidence for communications and agricultural related activity in the form of banks, ditches and roads, dating to the Post-Medieval and modern periods is present within the footprint of the scheme. These are of local interest and of low importance as defined by the criteria in Table 13.1. Groundworks associated with the construction of the scheme would severely impact upon these assets and would alter their special interests or qualities. The magnitude of this effect would be very high as defined by the criterial in Table 13.2 leading to a significance of effect of significant, as defined by the criteria in Table 13.3.

The potential effects during Construction are outlined in Table 13-6.

Table 13-6 Potential Effects during Construction Phase

Asset Reference	Importance	Description of Effect (Type, Duration)	Magnitude of Effect	Significance of Effect
Zone of Archaeological Potential associated with the Blackwater River	Low	Permanent physical negative effect to potential unrecorded archaeological assets through construction of the Proposed Road Development	Very High <u>if present</u>	Significant
Potential unrecorded archaeological assets	Low	Permanent physical negative effect through construction of the Proposed Road Development.	Very High, if present	Significant
Banks, Ditches and Roads	Low	Permanent physical negative effect through construction of the Proposed Scheme.	Very High	Significant

13.5.3 Operational Phase

The ACA associated with Navan's Historic Core is an asset of regional importance and is located approximately 1 km to the southeast of the Proposed Road Development site (Figure 13-16).

Figure 13-16 Looking southeast towards Navan ACA

The ACA covers the historic core of the town which includes the medieval streetscape with later townhouses and commercial buildings of the 18th and 19th century. There are no identified key views out of the ACA towards the Proposed Road Development. The site visit demonstrated that the ACA is largely screened by modern development and topography with only the tallest buildings in the skyline of the ACA partially visible from the highest point on the ridge. The Proposed Road Development will not reduce the architectural, historic or archaeological interest of the ACA and will therefore have a neutral effect upon the ACA.

The weir (NT025-105) is the closest protected structure to the scheme located approximately 90 m east on the River Blackwater. It is regionally important and there are currently no views of the weir from either bank of the river though it will be visible from the scheme once the bridge is operational. The presence of the scheme will impact upon the setting of the weir which currently includes the adjacent former woollen mill, the river and the adjacent open ground which has not altered significantly since the weir was constructed during the late 18th century. The presence of the scheme will introduce a road with a large volume of traffic adjacent to the weir. It should be noted that the weir was originally associated with a paper and frieze manufactory which was later expanded into a much larger woollen mill. This current mill building is not the original structure associated with the weir and when operational would have created much noise and activity within the vicinity of the weir. The change to setting would be such that the special interests or qualities of the weir are slightly affected without a noticeable change leading to a magnitude of effect of low as defined by the criteria in Table 13-3 leading to a significance of effect of slight, as defined by the criteria in Table 13-4. The moderate significance of effect will be long-term and adverse.

The protected structure railway bridge (NT025-173) is located approximately 361 m west of the scheme and carried the railway line north over the River Blackwater. This regionally important asset consists of a single-span single track railway bridge with rusticated limestone abutments, iron trestle beams and iron handrail dating from 1870 (Figure 13-17). The bridge is part of the Kingscourt railway line which transported passengers until 1947 then industrial product in the form of gypsum until 2001.

Figure 13-17 The protected structure railway bridge (NT025-173)

The railway is no longer operational though the track remains in place as it may be used in future. The bridge is overgrown with vegetation while the footprint of the line is bounded by mature hedgerows. There are currently no clear views between the bridge and the line of the scheme with topography and dense mature tree growth along the river screening views. It is likely that the scheme will be partially visible and noise from traffic heard from the bridge once operational. However, the Proposed Road Development will not reduce the architectural, historic or archaeological interest of the bridge and will therefore have a neutral effect upon it.

The Protected Structures within the immediate vicinity of the scheme are located approximately 412 m to the east. The first of these is Spicers Blackwater Mills (NT025-106) and its associated limestone and concrete mill weir and sluice (NT025-107) are located approximately 412 m to the east (Figure 13-18). The mill and weir are currently screened by local topography and mature vegetation so that there are no clear views with the scheme. It is likely that once the scheme is operational, it will be intervisible with the mill. This will alter the setting of the protected structures which are currently features on the riverside walk in Blackwater Park with noise, dust and vibration from the additional traffic also creating an impact. This will cause a minimal change to the asset that has little effect on its special interests or qualities leading to a magnitude of effect of low as defined by the criterial in Table 13-3 leading to a significance of effect of slight, as defined by the criteria in Table 13-4. The slight significance of effect will be long-term and negative.

Figure 13-18 The Protected Structures Spicers Mill and weir

The motte (ME025-023001) located approximately 245 m to the southwest of the scheme on top of a fairly high ridge (Figure 13-19). This Protected structure and Recorded Monument is nationally important. The setting of the motte is defined primarily by its strategic location on an elevated ridge above the Rivers Boyne and Blackwater, which would have afforded long range views along the valleys. This asset is intervisible with the southwest extent of the scheme though views across the entire scheme during operation will likely be screened by intervening topography and mature vegetation. The setting of the motte has changed over time and currently includes the N51 link road. The operational scheme will introduce a new component into views from the motte. This new component will cause a minimal change to the asset that has little effect on its special interests or qualities leading to a magnitude of effect of low as defined by the criteria in Table 13-3 leading to a significance of effect of slight, as defined by the criteria in Table 13-4. The slight significance of effect will be long-term and negative

Figure 13-19 Looking southwest at motte (ME-025-023001)

Table 13-7 Potential effects during Operational Phase

Asset Reference	Importance	Description of Effect (Type, Duration)	Magnitude of Effect	Significance of Effect
Millbrook Weir (NT025-105)	Regional	Permanent, negative effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Negative
Spicers Blackwater Mills (NT025-106)	Regional	Permanent, negative effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Negative
Concrete Weir and sluice (NT025-107)	Regional	Permanent, negative effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Negative
Motte (ME025-23001)	National	Permanent, negative effect upon the setting of the asset during operation of the development.	Low	Slight Long-Term Negative

13.5.4 'Do-nothing' Scenario

In the 'do-nothing' scenario, the scheme would not be constructed and, therefore would not result in any significant changes to the baseline conditions of the archaeological and architectural heritage resource.

13.5.5 'Worst Case' Scenario

In the worst case scenario, the scheme will be constructed with no mitigation measures in place and without any resolution of the archaeological and architectural issues outlined. This would result in damage to, or the destruction of currently unknown sub-surface archaeological sites with the consequent and significant loss of knowledge.

13.5.6 Mitigation Measures

Archaeological Works

Archaeological testing will be carried out at the pre-construction phase in areas identified in the construction impacts section above where the Proposed Road Development has the potential to impact upon archaeological remains All archaeological works (which will be agreed by the Archaeological Consultant and the NMS will be 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 and licensed Archaeological contractor will be appointed to carry out the archaeological fieldwork. Relevant licenses will be acquired from the Department of Cultural Heritage and the Gaeltacht (DoCHG)/NMS and the NMI for all archaeological works, which will be carried out in accordance with an Overarching Method Statement for Archaeological Works prepared by the Archaeological Consultant and agreed with the NMS. It is anticipated that all archaeological works will be completed pre-construction. This is in accordance with the Code of Practice between the NRA (now TII) and the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (formerly Arts, Heritage, Gaeltacht and Islands), 2000.

The archaeological fieldwork will be undertaken following the programme outlined which is standard mitigation procedure for all road projects:

- Archaeological test trenching will be carried out following planning permission to a quantity of 12% of the green field areas. This will equate to every hectare (10,000 sqm) of green field construction area, there will be 1200 sqm of trenching opened.
- Should test trenching reveal archaeological deposits then a phase of archaeological rescue excavation will be undertaken. This archaeological rescue excavation will be programmed to be completed in advance of construction where possible.

- It is envisaged that there will be sufficient archaeological test trenching and rescue excavation to ensure that areas accessible for advance works will not require archaeological monitoring during construction. This will be subject to agreement with National Monuments Service.
- Should there be areas that will be impacted by construction but are not accessible for archaeological works in advance of construction, then archaeological monitoring of these areas may be required.

Construction

Archaeological issues will be resolved where possible, at the pre-construction stage of the development. This will include topographical survey of the communications and agricultural assets located within the scheme footprint. If unexpected archaeological remains or artefacts are discovered during construction work, work in that area will cease and the area will be protected. An unexpected finds procedure will be included in the Overarching Method Statement for Archaeological Works. The Archaeological Consultant and NMS will be notified, and the unexpected find protocol will be implemented.

The Protected Structure Millbrook weir (NT025-105) is located approximately 90m east of the scheme on the River Blackwater while the possible archaeological site, the enclosed promontory, is located approximately 75 m to the west. Both of these are located outside the Proposed Road Development and should not be impacted upon. However, care should be taken during the construction phase that damage is not accidently caused to either.

Operational Phase

No additional mitigation measures are required for the operational phase of the Proposed Road Development.

13.6 Residual Impacts

A summary of residual impacts is provided in Table 13-8. 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

13.6.1 Assets of National, Regional and Local importance

Millbrook Weir (NT025-105) has also been identified as experiencing a low effect from the Proposed Road Development during operation. This effect will not change so the overall residual significance of effect will not change from slight.

The residual significance of effect would be slight, long-term and negative.

The motte (ME025-023001) is Nationally important while the assets Spicers Blackwater Mills (NT025-106), concrete weir and sluice (NT025-106) are Regionally important. They have been identified as experiencing a low effect from the Proposed Road Development. Landscape planting around the development boundaries will not perceptibly reduce the overall level of the significance of effect from slight. The residual significance of effect would be slight, negative and long-term.

Potential currently unrecorded archaeological deposits which are likely to be present within the site including the Zone of Archaeological Potential would experience a very high effect 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, negative and long-term.

Table 13-8 Residual Impacts

Asset Reference	Importance	Description of Effect (Type, Duration)	Magnitude of Effect	Significance of Effect	Mitigation	Residual Effect
Millbrook Weir (NT025-105)	Regional	Permanent, negative effect upon the setting of the asset during operation of the Proposed Road development.	Low	Slight Long-Term Negative	Not applicable	Slight Long-Term Negative

Asset Reference	Importance	Description of Effect (Type, Duration)	Magnitude of Effect	Significance of Effect	Mitigation	Residual Effect
Spicers Blackwater Mills (NT025-106)	Regional	Permanent, negative effect upon the setting of the asset during operation of the Proposed Road Development.	Low	Slight Long-Term Negative	Not applicable	Slight Long-Term Negative
Concrete Weir and sluice (NT025-107)	Regional	Permanent, negative effect upon the setting of the asset during operation of the Proposed Road Development.	Low	Slight Long-Term Negative	Not applicable	Slight Long-Term Negative
Motte (ME025-23001)	National	Permanent, negative effect upon the setting of the asset during operation of the Proposed Road Development	Low	Slight Long-Term Negative	Not applicable	Slight Long-Term Negative
Zone of Archaeological Potential	Local	Permanent physical negative effect upon any archaeological remains if present through construction of the Proposed Road Development	Very high, if present	Significant Long-Term Negative	Archaeological testing, excavation and recording, if required	Moderate Long-Term Negative
Potential unrecorded archaeological assets	Local?	Permanent physical negative effect through construction of the Proposed Road Development	Very high, if present	Significant Long-Term Negative	Archaeological testing, excavation and recording, if required	Moderate Long-Term Negative
Communications and agricultural associated assets	Local	Permanent physical negative effect through construction of the Proposed Road Development	Very high	Significant Long-Term Negative	Archaeological topographical recording	Moderate Long-Term Negative

13.7 Difficulties Encountered

No difficulties were encountered during the compilation of this report and during the site inspection.

13.8 Conclusion

The Proposed Road Development will create a feeder road to the west of Navan which will impact upon known and unknown archaeological and architectural assets. 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 Navan.

13.9 References

- Bangerter, R. (2005). River Blackwater Abbeylands South, Navan, Meath (Licence No: 05D075, 05R058) in Bennett, I. (Ed) Excavations.ie Database of Irish Excavation Reports (https://excavations.ie).
- Code of Practice between the National Roads Authority (NRA) and the Minister for Arts, Heritage and the Gaeltacht, June 2000.
- CCC. (2006). Guidance Notes for the Appraisal of Historic Gardens, Demesnes, Estates and their Settings, An Action of the County Cork Heritage Plan 2005/2010. Cork County Council, Cork, Ireland.
- Department of Arts, Heritage, and the Gaeltacht, 1999, Frameworks and Principles for the Protection of the Archaeological Heritage. The Stationary Office, Dublin, Ireland.

- Department of Arts, Heritage and the Gaeltacht. (2002). National Heritage Plan. Department of Arts, Heritage and the Gaeltacht, Dublin, Ireland.
- Department of Arts, Heritage and the Gaeltacht. (2011). Architectural Heritage Protection, Guidelines for Planning Authorities. The Stationary Office, Dublin, Ireland.
- Department of Arts, Heritage and the Gaeltacht. (2013). NIAH Handbook.
- Department of Environment, Heritage and Local Government. (2009). Government Policy on Architecture 2009 – 2015. Department of Environment, Heritage and Local Government, Dublin, Ireland.
- Earthsound Geophysics. (2019). Investigation of Lands at the Local Distributor Road 4 (LDR 4) Abbeyland & Moathill, Navan, Co. Meath Archaeological Geophysical Survey Detection Licence No. 19R0127
- EPA. (2017). *EPA Guidelines on the information to be contained in Environmental Assessment Reports, Draft, August 2017*, EPA, Wexford, Ireland.
- Farrimond MacManus Ltd. (2012). Post Excavation Design in Relation to Archaeological Excavation at Navan Town Park (Navan / Abbeylands / Abbeylands South), Navan, Co. Meath, Ireland.
- Finn, D. (2005). Former Navan Carpets Factory Site, Abbeylands South, Navan Meath, Licence No: 05E0454) in Bennett, I. (Ed) Excavations.ie Database of Irish Excavation Reports (https://excavations.ie).
- Giacometti, Antoine. (2006). Site 1, Navan Inner Relief Road, Moathill, Navan, Meath (Licence No: 06E0274) in Bennett, I. (Ed) Excavations.ie Database of Irish Excavation Reports (https://excavations.ie).
- Halliday, S. (2006). Sites 2 and 3, Navan Inner Relief Road, Moathill, Navan, Meath (Licence No: 06E0024) in Bennett, I. (Ed) Excavations.ie Database of Irish Excavation Reports (https://excavations.ie).
- The Heritage Council. (2000). Archaeology & Development: Guidelines for Good Practice for Developers. The Heritage Council, Dublin.
- HE. (2017). *Historic Environment Good Practice Advice in Planning: Note 3 (Second Edition) – The Setting of Heritage Assets*, Historic England
- Lewis, S. (1837). A Topographical Dictionary of Ireland. S Lewis & Co, Aldersgate Street, London.
- MCC. (2013). *Meath County Development Plan 2013 – 2019*, Meath County Council, Meath, Ireland.
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, Meath, Ireland.
- MCC. (2009). Navan Development Plan 2009-2015 Appendix I: Record of Protected Structures, Meath County Council, County Meath
- Meenan, Rosanne. (2005). Canon Row / Kennedy Road, Navan, Meath (Licence No: 05E0754) in Bennett, I. (Ed) excavtions.ie Database of Irish Excavation Reports (https://excavations.ie)
- NRA. (2006). *Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes.* National Roads Authority, Dublin, Ireland.
- Roycroft, Niall. (2012). Navan Abbeylands Preliminary Assessment Summary (unpublished assessment report for Meath County Council, February 2012)
- Roycroft, Niall. (2018). Local Distributor Road 4, Abbeylands, Navan Co Meath Archaeological Review ITM: 686018, 768357 Vicinity of 12E0103 (figure-of-eight shaped enclosure, field system and burials) (unpublished assessment report for Meath County Council, December 2018
- Roycroft, Niall. (2019). Local Distributor Road 4, Abbeyland, Navan Co Meath Archaeological Review of Preferred Route ITM: 686018, 768357 Vicinity of 12E0103 (figure-of-eight shaped enclosure, field system and burials) (unpublished assessment report for Meath County Council, 29th August 2019
- Russell, Ian. (2002). *Abbey Road, Navan*, Meath (Licence No: 02E1456) in Bennett, I. (Ed) excavtions.ie Database of Irish Excavation Reports (https://excavations.ie)

Online Sources

- ASI at http://webgis.archaeology.ie/NationalMonuments/FlexViewer/
- Excavations.ie Database of Irish Excavation Reports at https://www.excavations.ie/
- Heritage Maps Map viewer at https://heritagemaps.ie

- NIAH Heritage at http://buildingsofireland.ie/
- OSI at http://osi.ie/Home.aspx
- OSI at https://www.osi.ie

Cartographic Sources

- 1835 First Edition OS map
- 1911 Edition OS map
- 1940s Cassini 6-inch map

Chapter 14:
Material Assets

14

14. Material Assets

14.1 Introduction

The Material Assets chapter evaluates potential effects the Proposed Road Development may have on Material Assets. Material Assets are defined in the '*Guidelines on the information to be contained in an Environmental Impact Assessment Reports*' (EPA, 2017) as "*built services*" and "*infrastructure*".

A development may affect material assets if it involves any of the following:

- Acquisition of land;
- Demolition of residential and commercial properties;
- Revaluation of or change in the development potential of adjoining lands/properties; or,
- Modifications to existing utilities / infrastructure.

This chapter will evaluate the following economic assets of the site and environs:

- Utilities
  - Electricity Network;
  - Telecommunications (including phone and broadband);
  - Gas Distribution Networks;
  - Water supply networks;
  - Sewerage networks; and
- Land Use and Property (agricultural and non-agricultural); an assessment of impacts on housing, ownership, severance, loss or rights of way or amenities, or other changes likely to alter the character and use of the surroundings.

The assessment of potential impacts associated with the generation of unusable or unwanted waste materials that may arise during the construction phase is also addressed in this chapter.

Waste is defined as per the Waste Framework Directive, as amended, as "*any substance or object which the holder discards or intends or is required to discard*."

Chapters 5 and 13 discuss the assessment of Traffic Analysis and Cultural Heritage respectively and therefore will not be discussed in this chapter. Impacts to sensitive receptors from air, noise, and traffic are outlined in the Chapter 6 (Population and Human Health) chapter.

14.2 Methodology

14.2.1 Policy, Legislation and Guidance

The following guidelines were used to prepare this chapter:

- Revised Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA, 2017); and
- Advice Notes for Preparing Environmental Impact Statements (EPA, 2003).

The assessment of waste impacts was informed by the legislation, regulations, policies and guidance in the key documents as outlined in Table 14-1.

Table 14-1 Policy, Legislation and Guidance

Policy, Legislation and Guidance	Year	Key Points
Waste Framework Directive 201/851	2018	Directive (EU) 2018/851 amends Directive 2008/98/EC including: increase targets for preparing for re-use and recycling of waste; remove substances intended for animal feed from the scope of Directive 2008/98/EC; add a number of new definitions; change end-of-waste conditions and requirements; set out exemptions for separation of waste collection; establish bio-waste separation; establish household hazardous waste collection; and update record keeping requirements. This Directive adds the following three new targets: By 2025, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 55% by weight; By 2030, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 60% by weight; and By 2035, the preparing for re-use and the recycling of municipal waste shall be increased to a minimum of 65% by weight.
EIA Directive 2011/92/EU, as amended by Directive 2014/52/EU	2015	Article 3 (1) of the Directive outlines a number of factors that should be identified, described and assessed; this includes material assets
Eastern Region Waste Management Plans	2015-2021	For the purposes of waste management planning, Ireland is now divided into three regions: Southern, Eastern-Midlands and Connacht-Ulster. Waste management plans for the three regions were published in May 2015. The proposed project is location within the Eastern region. The WMP for the Eastern Region is the framework for the prevention and management of wastes in a safe and sustainable manner.
A Resource Opportunity – Waste Management Policy in Ireland	2012	Waste policy and legislation are implemented largely by the EPA and the local authorities. The current waste management policy is set out in A Resource Opportunity – Waste Management Policy in Ireland (pdf), which was published in 2012. Among other things, this policy document sets out the policy on eliminating landfill, reducing the amount of waste produced and maximising waste as a source of products and renewable energy. The EPA's main activities in the waste management area are: Drawing up and reviewing the National Hazardous Waste Management Plan; The integrated pollution prevention and control (IPPC) licensing system, which deals with the generation, recovery and disposal of waste; Development of guidelines for the selection, management, operation and ending of use of landfill sites; Authorisation of waste imports; and Maintenance of a national waste database. The local authorities are responsible for: Authorisation and control of commercial waste collection activities; Authorisation of waste exports and monitoring of internal movements of hazardous wastes; Waste permits for small-scale recovery and disposal activities; Ensuring adequate waste collection, recovery and disposal arrangements in their areas; and Monitoring and inspection of waste activities generally.
European Communities (Waste Directive) Regulations, 2011, S.I. No 126 of 2011	2011	This regulation allows an operator to decide that a material is a by-product and not a waste material if approved by the EPA.
Waste Management Act 1996 and Amendment Act 2001	2001	The Waste Management Acts provide for a general duty on everyone not to hold, transport, recover or dispose of waste in a manner that causes or is likely to cause environmental pollution.
Meath County Development Plan	2013-2019	The Meath Development Plan 2013-2019 is The MCC's Corporate Plan 2015-2019 mission statement is "*drive the economic, social, cultural and environmental growth of our County in a balanced manner that is inclusive of all our citizens*." The Corporate Plan sets out a vision "*Meath County Council to lead economic development, deliver efficient and good value services, and represent the people and communities of County Meath, as effectively and accountably as possible*."

Policy, Legislation and Guidance	Year	Key Points
		Key waste objectives in the Meath Development Plan are as follows: WM OBJ 1: To facilitate the provision of appropriate waste recovery and disposal facilities in accordance with the principles set out in the appropriate WMP applicable from time to time made in accordance with the Waste Management Act 1996. WM OBJ 8: To facilitate the implementation of national legislation and national and regional waste management policy.
Navan Development Plan	2009-2015	The aim of the Navan Development Plan is to establish a framework for the planned, co-ordinated and sustainable development of Navan and for the conservation and enhancement of its natural and built environment over the Plan period and beyond. Key polices in relation to waste include: INF POL 68: To promote and encourage the recycling of construction and demolition waste in accordance with approved construction and demolition waste management plans. INF POL 69: To ensure such measures as are reasonably necessary are taken to secure appropriate provision for the management of waste (and, in particular, recyclable materials) within developments, including the provision of facilities for the storage, separation and collection of waste.

14.2.2 Assessment Methodology

The assessment is based on the characteristics of the Proposed Road Development described in Chapter 4 (Description of the Proposed Road Development').

The methodology used for evaluating impact levels and the terminology for describing the quality, significance, extent, probability and duration of effects is set out in Section 3.7.3 of the EPA's '*Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR*), Draft, August 2017'.

A qualitative approach was used in this evaluation. Figure 14-1 below from the EPA EIAR guidance (2017) shows how comparison of the description of effects; for example, duration, and quality, to the sensitivity of the receiving environment can determine the significance of the effect. Table 14-2 to Table 14-7 below outline the terminology used when describing the of effects of the Proposed Road Development on the receiving environment.

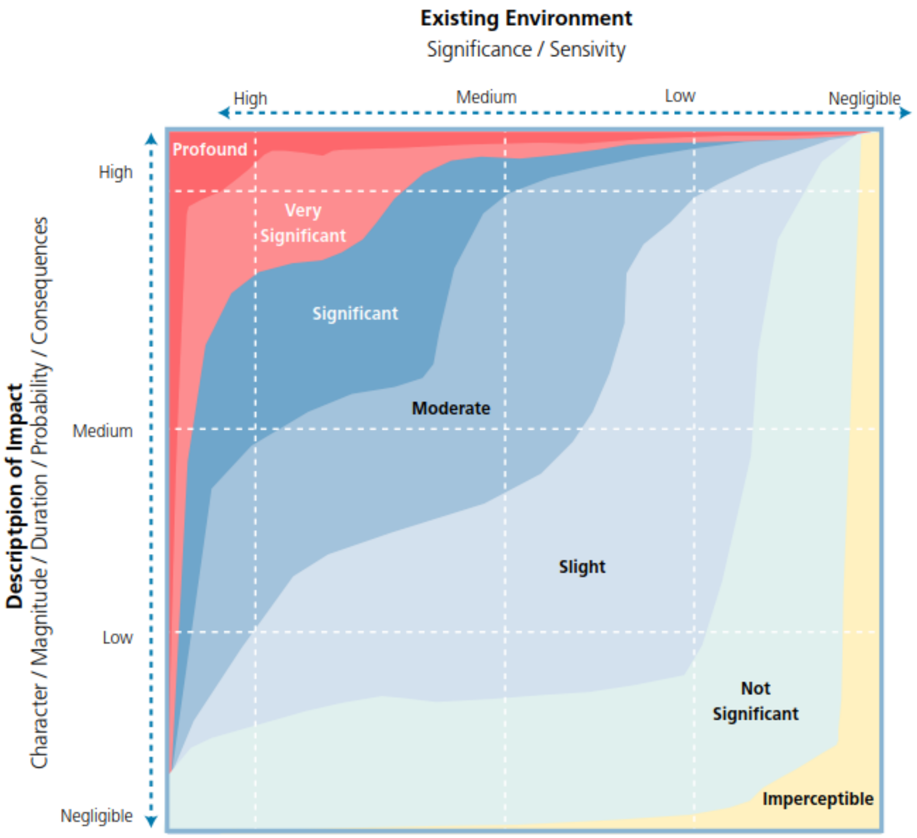


Figure 14-1 Determination of the Significance of the Effect (EPA, 2017)

Table 14-2 Describing the Quality of Effects

Quality of Effects	Description
Positive Effect	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).
Neutral Effect	No effects or effects that are imperceptible, within normal bounds of variation or within the margin of forecasting error.
Negative/adverse Effects	A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing nuisance).

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

Table 14-3 Describing the Duration and Frequency of Effects

Duration of Effects	Description
Momentary Effects	Effects lasting from seconds to minutes
Brief Effects	Effects lasting less than a day
Temporary Effects	Effects lasting less than a year
Short-term Effects	Effects lasting one to seven years.
Medium-term Effects	Effects lasting seven to fifteen years
Long-term Effects	Effects lasting fifteen to sixty years.
Permanent Effects	Effects lasting over sixty years

Duration of Effects	Description
Reversible Effects	Effects that can be undone, for example through remediation or restoration

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

Table 14-4 Describing the Probability of Effects

Probability of Effects	Description
Likely Effects	The effects that can reasonably be expected to occur because of the planned project if all mitigation measures are properly implemented.
Unlikely Effects	The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

The following table outlines a description of the effects based on the above criteria, including duration, probability, quality of effects:

Table 14-5 Description of Impacts/Effects

Description of Impacts/Effects	Description
High	An effect on the material asset where the use of the material cannot continue.
Medium	An effect on the material asset where the use of the material asset can continue. An effect of permanent duration resulting in a change to the character of the material asset (operational).
Low	An effect on the material asset where the use of the material asset can continue. An effect of temporary duration with minimal effect on the character of the material asset (construction). An effect of permanent duration with a minimal effect on the character of the material asset (operational).
Negligible	An effect on the material asset that does not affect the use of the material asset (e.g. acquisition of public road/private road only (operational)).

Table 14-6 Describing the Significance of Effects

Significance Level	Description/Example
Imperceptible	An effect capable of measurement but without significant consequences. Occurs where part of a property or other material asset is acquired, resulting in minimal changes to the environment of the property or material asset. This includes impacts on properties which are currently occupied by a public right-of-way.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences. For example, the removal of a boundary wall or entrance to a property; the diversion of low and medium voltage ESB

Significance Level	Description/Example
	network, telecommunications or water supply and foul sewer services.
Slight Effects	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities. For example. occurs where part of a property or other material asset is acquired, resulting in little change to the environment, e.g. a small portion of land take from a property
Moderate Effects	An effect that alters the character of the environment in a manner that is consistent with existing and emerging baseline trends. For example, occurs where part, or all, of a property or other material asset is acquired, resulting in a major change to the environment of the property or material asset.
Significant Effects	An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment. Occurs where part, or all, of a property or other material asset is acquired, which may result in demolition of the property or removal of the asset.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment. Occurs where part, or all, of a non-agricultural property or other material asset is acquired, which may result in demolition of the property or removal of more than one asset in the area
Profound Effects	An effect which obliterates sensitive characteristics. Occurs where a property or other material asset of national or regional importance is acquired and/or demolished.

Source: EPA Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR), Draft, August 2017

14.2.2.1 Sensitivity of the Existing Environment

The sensitivity of the existing environment 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 networks infrastructure, land use and properties within the study

Terminology used to describe the sensitivity of the receptor is as per the EPA guideline (EPA, 2017):

Table 14-7 Describing the Sensitivity of Effect

Sensitivity of Effect	Example
High	• Residential and commercial properties • Land use including public recreational areas and valuable agricultural land
Medium	• Residential/commercial properties (vacant/derelict/ruin) • Agricultural land • Utilities networks
Low	• Property consisting of public road/private road and small plots of land • Land acquired temporarily
Negligible	• Small lots of land acquired temporarily

14.2.2.2 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 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
- 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.

Terminology used to describe the effects on waste management infrastructure capacity for this assessment is as follows:

- High: significant reduction or alteration in the capacity of waste infrastructure at a national scale
- Medium: slight reduction or alteration in the capacity of waste infrastructure at a national scale
- Low/Negligible: minimal/no reduction or alteration in the capacity of waste infrastructure at a national scale

14.2.3 Desktop Study

A desktop assessment was undertaken to identify the location of the existing material assets in the area. In addition to this, scheme mapping, and engineering proposals were looked at.

Consultation with a number of relevant bodies, including IW, GNI and the ESB were undertaken during the preliminary design phase in order to identify the location of existing services in the area. Preliminary utilities searches were undertaken in consultation with the other utility providers in October 2017. Surveys will be carried out prior to construction to confirm the exact location of the existing utilities.

14.3 Description of the Existing Environment

14.3.1 Utilities

14.3.1.1 Electricity

14.3.1.1.1 Electricity Network - Low and Medium Voltage

Consultations with ESB have confirmed the presence of medium voltage (MV) (10kV / 20kV) and low voltage (LV) (230V / 400V) electricity lines (both overhead lines and underground cables) within the Proposed Road Development site. The locations of these services are listed below and are shown in Figures 4.26 to 4.29 inclusive contained in Volume 3 of this EIAR.

- MV cables run underground along the eastern side of L34094-1 Clonmagadden Road meeting the underground cable running along the northern side of L3409 Ratholdron Road, crossing the road at the location of the proposed junction and continuing to run along the southern side of L3409 Ratholdron Road.
- LV overhead cables run along the southern side of L3409 Ratholdron Road, crossing the LDR4 at the proposed junction. On the western arm of the proposed junction, the low voltage overhead cables cross the Ratholdron Road and then run along the northern side of the L3409 Ratholdron Road.
- MV single phase overhead lines cross above the mainline in a north-west to south-east direction at Ch. 0+247.
- MV three phase overhead lines travel in a north-south direction crossing the mainline between Ch. 0+460 and 0+495.
- MV three phase overhead lines travel in a north-south direction crossing the mainline between Ch. 0+495 and 0+565.

- MV underground cables run in a north-east to south-west direction crossing the mainline between Ch. 0+835 and 0+850, after crossing the mainline it changes to an east-west direction crosses the mainline again at Ch. 0+910.
- MV three phase overhead lines travel in an east-west direction crossing the mainline at Ch. 1+000.
- MV three phase overhead lines run along the western earthworks of the proposed mainline from Ch. 1+000 to Ch. 1+015.
- LV underground cables run along the western earthworks of the proposed mainline from Ch. 1+015 to Ch. 1+070.
- LV single phase overhead lines travel in a north-south direction across the R147 directly west of the proposed junction. ESB low voltage underground cables travel in an east-west direction across the mainline directly north of the proposed junction.

14.3.1.1.2 Electricity Network - High Voltage

Consultations with ESB have confirmed the presence of high voltage (HV) (110kV / 38kV) electricity lines (both overhead lines and underground cables) within the Proposed Road Development site. The locations of these services are listed below and are shown in Figures 4.26 to 4.29 inclusive contained in Volume 3 of this EIAR.

- A HV 110kV overhead line runs in a north-south direction across the north junction, crossing the L34094-1 Clonmagadden Road 15m to the north the existing junction and then crossing L3409 Ratholdron Road directly east of proposed junction.
- HV 38kV overhead lines cross the proposed mainline in a north-west to south-east direction at Ch. 0+093.
- HV 110kV overhead lines run in a north-south direction crossing the proposed mainline between Ch. 0+400 and 0+440.

No conflicts with high voltage electricity lines are encountered at the southern junction.

14.3.1.2 Public Lighting

The existing junctions on the L34094-1 Clonmagadden Road and L3409 Ratholdron Road are currently lit. The lighting columns at these junctions are connected via underground ducts. There are conflicts where the new mainline will tie in to the north and south junction.

14.3.1.3 Telecommunications (including phone and broadband)

Consultations with telecommunication providers have confirmed the presence of several telecommunication services (Eir, Enet and Virgin Media) within the Proposed Road Development site. These locations of these services are listed below and are shown in Figures 4.26 to 4.29 inclusive contained in Volume 3 of this EIAR.

- Eir cables run on both sides of the L3409 Ratholdron Road crossing the road directly to the east of the proposed junction. Eir cables also run on the western side of the L34094-1 Clonmagadden Road.
- Virgin Media cables run along the northern side of the L3409 Ratholdron Road crossing the L34094-1 Clonmagadden Road directly north of the existing junction and continuing along the eastern side of the L34094-1 Clonmagadden Road.
- Eir cables run on both sides of the R147 and N51 crossing the N51 to the south, North and East of the proposed junction. Eir cables run on the western side of and under the proposed road, as well as crossing the proposed road 3 times directly north of the proposed junction. Eir cables run to the east of the existing OPW building.
- Enet cables run on both sides of the N51 south of the proposed junction, crossing the N51 directly south of the junction. Enet cables run in an east-west direction to the under the R147, the proposed junction and the N51.

No conflicts with telecommunications services are encountered along the central section of the Proposed Road Development.

14.3.1.4 Gas Distribution Network

Consultations with Gas Network Ireland have confirmed the presence gas services within the Proposed Road Development site. The locations of these services are listed below and are shown in Figures 4.26 to 4.29 inclusive contained in Volume 3 of this EIAR.

- A medium pressure (4 bar) transmission gas pipes with cover of 0.7m is located on the eastern side of L34094-1 Clonmagadden Road. This pipe connects to another medium pressure (4 bar) transmission gas pipe with a cover of 1.0m under L3409 Ratholdron Road at the proposed north junction.
- A medium pressure (4 bar) distribution pipe is located under the proposed mainline to the north of the proposed south junction.
- A medium pressure (4 bar) distribution pipe with a cover depth of 0.95 m is located to the north of the R147, which then crosses the road directly to west of the proposed south junction. This gas pipe then continues under the proposed south junction, with a cover depth of 1.2 m. After crossing the proposed south junction, this gas pipe then continues further along the southern side of the N51 to the east of the proposed south junction, with a cover depth of 0.8m initially which then increases to a cover depth of 1.0 m.
- A medium pressure (4 bar) distribution pipe is located to the east of the N51 to the south of the proposed south junction, with a cover depth of 0.8 m.

It is noted that the majority of the gas services are located at the north and south junctions of the Proposed Road Development and there are no records of gas services along the central section of the Proposed Road Development.

14.3.1.5 Water Supply Network

Consultations with IW have confirmed the presence water services within the Proposed Road Development site. The locations of these services are listed below and are shown in Figures 4.26 to 4.29 inclusive contained in Volume 3 of this EIAR.

- Water mains (IW) run in a north-south direction under the L34094-1 Clonmagadden Road, crossing the L3409 Ratholdron Road at the proposed north junction and continuing along the southern side of L3409 Ratholdron Road.
- Water mains (IW) run in an east-west direction underneath the R147 and N51. Water mains (IW) also run parallel to the proposed mainline on the western side, as well as directly underneath the proposed mainline. Both of these water mains then connect to the east-west running pipe under the proposed junction. There is also an IW water main running parallel to the N51 on the western side to the south of the proposed south junction.

14.3.1.6 Sewerage Networks - Foul Sewer

Consultations with IW have confirmed the presence foul sewers within the Proposed Road Development site. The locations of these services are listed below and are shown in Figures 4.26 to 4.29 inclusive contained in Volume 3 of this EIAR.

- An IW foul sewer gravity main runs in a north-south direction under the L34094-1 Clonmagadden Road, crossing the L3409 Ratholdron Road at the proposed junction and continuing along the southern side of L3409 Ratholdron Road (Ch 0+000).
- An IW foul sewer gravity main crosses the proposed mainline in an east-west direction at Ch. 1+015.

14.3.1.7 Sewerage Networks - Surface Water Sewer

Consultations with IW have confirmed the presence surface water sewers within the Proposed Road Development site. The locations of these services are listed below and are shown in Figures 4.26 to 4.29 inclusive contained in Volume 3 of this EIAR.

- An surface water sewer crosses the proposed mainline in an east-west direction between Ch. 0+070 and 0+080.

14.3.2 Land Use and Property

14.3.2.1 Agriculture

The Proposed Road Development site is set within an agricultural land/parkland setting (Blackwater Park) with some wooded areas in the section north of the River Blackwater, running to the west of Blackwater Park.

14.3.2.2 Non-Agricultural

Residential land uses are located to the north and east of the Proposed Road Development site, with a mixture of residential, commercial and industrial land uses to the south, including Balmoral Industrial Estate and a Teagasc building.

There is also a row of residential properties with gardens located to the west of the Proposed Road Development site, with Blackwater Retail Park beyond.

A commercial building is located in the southern section of the Proposed Road Development site and will be demolished as part of the Proposed Road Development.

Further information on existing land use can be found in Chapter 8 (Land & Soils).

14.3.3 Waste

The Proposed Road Development is located within the Eastern Midlands Region (EMR), managed by Dublin City Council, the Waste Enforcement Regional Lead Authority (WERLA). In terms of waste management, the WERLA are responsible for implementing the Eastern-Midlands Regional Waste Management Plan (EMRWMP) 2015-2021 (ERM, 2015), as well as setting priorities and common objectives for waste enforcement within the region.

Waste management in Meath is largely governed by the requirements set out in the EMRWMP. The plan provides a framework for the prevention and management of waste in a sustainable manner in 12 local authority areas. The three key objectives of the EMRWMP are:

- Prevent waste: a reduction of one per cent per annum in the amount of household waste generated over the period of the plan;
- More recycling: increase the recycle rate of domestic and commercial waste from 40 to 50 per cent by 2020; and
- Further reduce landfill: eliminate all unprocessed waste going to landfill from 2016.

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 WFD, as amended. Uncontaminated excavated soil and stones (EPA's List of waste (LoW code 17 05 04)) is specifically excluded from this target. In 2014, 3,314 ktonnes of construction, demolition and excavation waste in Ireland were finally treated (recovered or disposed). Soil and stones accounted for 74 % of the total quantity. Mineral waste (concrete, bricks, gypsum) accounted for 12 per cent of the total quantity (EPA, 2014).

The EPA's 'Progress to EU Targets' report (updated on 21st October 2019) shows that Ireland achieved 71% recovery in 2016 and are on track to meet the target deadlines.

14.4 Assessment of Impacts

During the construction phase of the Proposed Road Development, some realignment, or replacement of services and utilities may be required in conjunction with or to accommodate the proposed works. In addition to this, the diversion of a high voltage electricity line crossing the mainline (including the provision of associated support poles) will be diverted to accommodate the works. 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.

Co-ordination is on-going between the project team and the relevant service providers, including ESB, IW, and Gas Networks Ireland and other relevant service providers within the locality; this is to ensure a smooth construction schedule to minimise disruption to the local and business community.

The following sections provide a description of the potential impacts on the exiting environment during the construction and operational phases.

14.4.1 Utilities

14.4.1.1 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; the majority of which are at various locations along the main line of Proposed Road Development.

As a result of these conflicts, necessary service diversions of a high voltage electricity line crossing the mainline and the provision of associated support poles, as well as underground cables diversions, were incorporated into the preliminary designs. The Proposed Road Development includes the provision for new overhead electricity lines and cables, which could result in a suspension of services during the construction and diversion works; this is likely to result in a negative, temporary, low effect on an existing environment of medium sensitivity; therefore, the significance of the effect on the existing electricity network is considered slight. Effects on local domestic connections will be addressed at the detailed design stage.

During the construction phase, electricity to the site compound[50] may be supplied to the site using on-site generators or via a temporary connection to the ESB network. The construction works should not require a connection to the existing supply. Therefore, it is anticipated that effects on the existing electricity network will likely be neutral.

During the operational phase, power will be required to provide public lighting and junction lighting. A new connection to the existing network shall be required to power the public lighting. The location of the connection will be selected at detailed design in consultation with the ESB. The additional demands on the existing network is likely to result in a low effect on an existing environment of medium sensitivity; therefore, the significance of the effect on the existing electricity network is considered slight.

14.4.1.2 Telecommunications

Consultation with a number of telecommunication service providers in the area have confirmed that the majority of the conflicts between the Proposed Road Development and the existing telecommunication services are in the proposed northern and southern junctions.

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 locally diversions of overhead cables to underground ducts where conflicts occur. These works could potentially disrupt services in the local area, which is likely to result in a negative, temporary, low effect on an existing environment of medium sensitivity/significance; therefore, the significance of the effect on the existing network is considered not significant. Impacts on local domestic connections will be addressed at the detailed design stage.

There will be no additional demand on the telecommunications network during the construction and operational phase; therefore, it is anticipated that effects on the existing telecommunications network will likely be neutral.

14.4.1.3 Gas Distribution Network

During the preliminary design phase, the exact locations where conflicts with gas networks occur along the route were confirmed with Gas Networks Ireland. In these locations, the existing pipes will be relocated or have in-situ protection during the construction phase. These works could potentially disrupt services in the local area, this is likely to result in a negative, temporary, low effect on an existing environment of medium sensitivity; therefore, the significance of the effect on the existing gas distribution network is considered not significant.

No additional gas supply is required for the Proposed Road Development during the construction and operational phase; therefore, it is anticipated that effects on the existing gas distribution network will likely be neutral.

14.4.1.4 Water Supply Networks

During the construction phase, water supply could be suspended temporarily during excavation works for realignment at the proposed north and south junctions. The contractor may request a new temporary connection to the water network from IW to supply to the Proposed Road Development site compound and construction works during the construction phase. These works could also potentially disrupt services in the local area. The service suspension will likely result in a negative, temporary, low effect on an existing environment of medium sensitivity; therefore, the significance of the effect on the existing water supply network is considered not significant. Effects on local domestic connections will be addressed at the detailed design stage.

No water supply is required for the Proposed Road Development during the operational phase; therefore, it is anticipated that effects on the existing water supply network will likely be neutral.

14.4.1.5 Sewerage Networks (Foul and Stormwater)

Chapter 9 (Water) deals with impacts associated with foul effluent during the construction phase on the receiving water environment, as well as stormwater drainage associated with the Proposed Road Development during both the construction phase and operational phase.

[50] A construction compound will be required along or in the vicinity of the Proposed Road Development. It was proposed that the primary construction compound would be located in the land located to the south-west of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. An alternative and secondary compound is proposed to the north of the existing N51/R147 roundabout on the land currently occupied by a commercial building to be demolished.

No major diversions of existing sewerage network pipes (including both the foul and stormwater sewer) are proposed other than the relocation or in-situ protection. These works could potentially disrupt services in the local area, this is likely to result in a negative, temporary, low effect on an existing environment of medium sensitivity; therefore, the significance of the effect on the existing sewerage network is considered not significant.

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; it is anticipated that effects on the existing foul sewerage network will likely be neutral.

No connections to the sewerage networks are required for the Proposed Road Development during the operational phase; therefore, it is anticipated that effects on the existing sewerage network will likely be neutral.

14.4.2 Land Use and Property

14.4.2.1 Permanent Land Acquisition - Agricultural

The Proposed Road Development will require the partial acquisition of 2.18 ha of agricultural lands, which will result in land severance. The severance and partial loss of agricultural land will likely result in a permanent, negative, and medium effect on an existing environment of medium sensitivity; therefore, the significance of the effect on the existing agricultural land use is considered moderate during the construction and operational phases.

It is anticipated that there will be no impacts on farm buildings or facilities from the Proposed Road Development.

See Table 14-8 for full details on permanent agricultural land being acquired.

14.4.2.2 Permanent Land Acquisition - Non-Agricultural

14.4.2.2.1 Full Land Acquisition

The Proposed Road Development involves the full acquisition and demolition of the commercial building in the south of the Proposed Road Development site, resulting in permanent, negative, and high effect on an existing environment of medium sensitivity/significance; therefore, the significance of the effect is considered significant during construction and operation.

14.4.2.2.2 Partial Land Acquisition

The Proposed Road Development will require the partial acquisition of 1.76 ha of parkland, which will likely result in a permanent, negative, and medium effect on an existing environment of high sensitivity. However, it is anticipated that the significance of the effect is considered slight during the construction and operational phase due to the improved accessibility to the park provided through the pedestrian connections to the mainline of the scheme. During the construction phase, there will also be no access restrictions to Blackwater Park, which is currently accessed through a car park on Ratholdron Rd.

The Proposed Road Development will result in the permanent and partial acquisition of land designated as ‘River’; however, access and use of this land will not be impacted during the operational phase, therefore the it is anticipated that effects on the existing land use will likely be imperceptible. During the construction phase, the private fishing rights will be temporarily extinguished and there will be temporary access restrictions to this land, this will likely result in a temporary, negative and low effect on an existing environment of low sensitivity; therefore, the significance of the effect is considered to imperceptible.

The Proposed Road Development will directly impact a number of other commercial properties; for example, by replacing boundary walls. The impact is likely to result in a permanent, negative, and low effect on an existing environment of low sensitivity; therefore, the significance of the effect is considered slight.

There will be a permanent, negative and medium effect on land classed as ‘Amenity Area’ on the south bank of the river crossing (low sensitivity) due to land severance at the back of residential property (0.19 ha); therefore, the significance of the effect is likely to be slight.

The Proposed Road Development will require the acquisition 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 anticipated during both the construction and operational phase, the impact will likely result in a permanent, and negligible effect on an existing environment of low sensitivity; therefore, the significance of the effect is likely to be imperceptible.

In addition to this, the Proposed Road Development will require the acquisition of land classified as Private Access. It is anticipated that the impact from the loss of land is likely to result in a permanent, negative, and a negligible to low effect on an existing environment of low sensitivity; therefore, the significance of the effect is considered to be imperceptible. However, one example of land classified as ‘Private Access’ (CPO Refer 102) will result in the severance of an existing farm access track to Nevinstown House and surrounding fields. It is anticipated that the impact will likely result in a permanent, negative and low effect on an existing environment of medium sensitivity; therefore, the significance of the effect is likely to be slight.

See Table 14-10 for full details on permanent non-agricultural land being acquired.

During the construction phase, there is potential for ground vibration due to the construction phase works which will mainly result from the use of vibratory rollers to compact earthworks and road surfacing. Residential properties on Windtown Road, directly to east of new link road, and Windtown Crescent have the potential to be worst affected by vibration, should vibratory rollers be used for surfacing compaction activities. However, it is it is unlikely that limits set by the NRA/TII will be met and hence the likelihood of damage to buildings as a result of the use of vibratory rollers is considered to be negligible. Therefore, the significance of the effect is considered imperceptible (as outlined in Chapter 11 (Noise and Vibration)).

During the operational phase, the Proposed Road Development will indirectly facilitate access to zoned lands for residential development to the west of the Proposed Road Development as outlined within the NDP 2009-2015. This will likely result in a long term, positive and medium effect of an existing environment of medium sensitivity; therefore, the significance of the effect on the surrounding land use is considered moderate.

14.4.2.3 Temporary Land Acquisition (Agricultural and Non-Agricultural)

In addition to the permanent acquisition, 2.17 ha of land will be temporarily acquired (encompassing and mix of agricultural and non-agricultural land use) during the construction phase.

Temporary acquisition has been sought where the lands are required temporarily to facilitate the construction/demolition of discreet elements of the work. There will be no access restrictions from the temporary land acquisition. It is anticipated that there will a temporary, negative, and low effect on an existing environment of negligible to low sensitivity as a result of the temporary acquisition of lands; therefore, the significance of the effect is considered imperceptible.

See Table 14-9 and Table 14-11 for full details on temporary agricultural and non-agricultural land being acquired.

Table 14-8: Permanent Land Acquisition - Assessment of the Impact of the Proposed Road on Agricultural Property (Construction and Operational phase)

CPO Ref.	Description	Area (ha)	Impact Details	Description of Effect	Sensitivity of the Existing Environment	Significance (Pre-Mitigation)	Mitigation Measures	Residual Effect Significance
102	Part of Agricultural Land	2.1837	Reduction in land area. Severance of existing farm access track to Nevinstown House and surrounding fields.	Medium	Medium	Moderate	Any land take will be acquired through a CPO process, unless other direct agreement (payment) are reached with individual landowners. However, the following best practice measures are proposed: • Replace boundary. • Provide new access road and entrance of Ratholdron Road (L3409). • Provide new field access to east of proposed mainline (Ch 0+125). • Provide access tracks to provide connectivity between fields to the east of mainline (Ch 0+230). • Provide access tracks to provide connectivity between fields to the west of mainline (Ch 0+600).	Slight

Table 14-9 Temporary Land Acquisition - Assessment of the Impact of the Proposed Road on Agricultural Property (Construction phase)

CPO Ref.	Description	Area (ha)	Impact Details	Description of Effect	Sensitivity of the Existing Environment	Significance (Pre-Mitigation)	Mitigation Measures	Residual Effect Significance
102	Part of Agricultural Land	0.8553	Reduction in land area.	Low	Low	Imperceptible	Although it has been determined that impacts will likely be of imperceptible significance, the following best practice measures are proposed: • Replace boundary. • Provide new access road and entrance of Ratholdron Road (L3409). • Provide new field access to east of proposed mainline (Ch 0+125). • Provide access tracks to provide connectivity between fields to the east of mainline (Ch 0+230). • Provide access tracks to provide connectivity between fields to the west of mainline (Ch 0+600).	Imperceptible

Table 14-10 Permanent Land Acquisition - Assessment of the Impact of the Proposed Road on Non-Agricultural Property (Construction and Operation)

CPO Ref.	Description	Area (ha)	Impact Details	Description of Effect	Sensitivity of the Existing Environment	Significance (Pre-Mitigation)	Mitigation Measures	Residual Effect Significance
Full Land Acquisition								
NA*	Part of Commercial Property	0.6115	Acquisition of the entire property and demolition of the building.	High	Medium	Significant	None. The loss of the commercial property cannot be adequately mitigated against.	Significant
NA*	Part of Public Road	0.0635	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
Partial Land Acquisition								
101	Part of Public Road	0.9599	Public road only.	Negligible	Low	Imperceptible	Restore entrance and access. Relocate Stone Mason statue.	Imperceptible
101	Part of Recreational Land	1.7614	Reduction in land area.	Medium	Medium	Slight	Any land take will be acquired through a CPO process, unless other direct agreement (payment) are reached with individual landowners.	Slight
101	Part of Commercial Property	0.0187	Reduction in land area.	Low	Low	Slight	None	Slight
101	Part of Private Access	0.0004	Impact on existing entrance.	Negligible/low	Low	Imperceptible	Restore entrance and access.	No residual impact
102	Part of Public Road	0.1237	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
102	Part of Private Access	0.0197	Severance of existing farm access track to Nevinstown House and surrounding fields.	Low	Medium	Slight	Provide new access road and entrance of Ratholdron Road (L3409).	Imperceptible
103	Part of Public Road	0.0192	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
104	Part of Amenity Land	0.1850	Reduction in land area.	Medium	Low	Slight	None	Slight
105	Part of Public Road	0.1014	Impact on existing entrance (pedestrian only).	Negligible	Low	Imperceptible	Restore entrance and access.	No residual impact
106	Part of River	0.1167	River only. Temporary access restrictions to this land and temporarily extinguish the private fishing rights during the construction phase only.	Negligible	Low	Imperceptible	None	No residual impact

CPO Ref.	Description	Area (ha)	Impact Details	Description of Effect	Sensitivity of the Existing Environment	Significance (Pre-Mitigation)	Mitigation Measures	Residual Effect Significance
107	Part of Commercial Property	0.0136	Reduction in area of property. Impact on entrance and property boundary.	Low	Low	Slight	Restore entrance and access. Reinstate affected property boundary.	Not Significant
107	Part of Public Road	0.0284	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
108	Part of Public Road	0.0002	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
109	Part of Public Road	0.0494	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
110	Part of Public Road	0.0054	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
111	Part of Public Road	0.1580	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
112	Part of Public Road	0.0144	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
113	Part of Public Road	0.0087	Public road only.	Negligible	Low	Imperceptible	None	No residual impact
114	Part of Public Road	0.0158	Public road only.	Negligible	Low	Imperceptible	None	No residual impact

** Some lands required for the Proposed Road Development are owned by a State Body, namely The Commissioners of Public Works in Ireland (OPW). These lands are exempt from CPO process and accordingly have not been included in the CPO schedule. Further details are provided in Section 14.5.2 below.*

Table 14-11 Temporary Land Acquisition - Assessment of the Impact of the Proposed Road on Non-Agricultural Property (Construction phase)

CPO Ref.	Description	Area (ha)	Impact Details	Description of Effect	Sensitivity of the Existing Environment	Significance (Pre-Mitigation) during construction phase	Mitigation Measures	Residual Effect Significance
101	Part of Recreational Land	1.1753	Reduction in area. Impact on property boundary.	Low	Low	Imperceptible	Although it has been determined that effects will likely be of imperceptible significance, the following best practice measures are proposed • Provide 2 No. pedestrian access between the park and the LDR4 mainline.	No residual impact

CPO Ref.	Description	Area (ha)	Impact Details	Description of Effect	Sensitivity of the Existing Environment	Significance (Pre-Mitigation) during construction phase	Mitigation Measures	Residual Effect Significance
102	Part of Private Access	0.1265	Severance of existing farm access track to Nevinstown House and surrounding fields.	Low	Low	Imperceptible	Although it has been determined that effects will likely be of imperceptible significance, the following best practice measures are proposed: • Provide new access road and entrance of Ratholdron Road (L3409).	No residual impact
103	Part of Public Road	0.0030	Impact on existing entrance.	Low	Negligible	Imperceptible	Although it has been determined that effects will likely be of imperceptible significance, the following best practice measures are proposed: • Restore entrance and access.	No residual impact
107	Part of Commercial Property	0.0107	Reduction in area of property. Impact on entrance and property boundary.	Low	Low	Imperceptible	Although it has been determined that effects will likely be of imperceptible significance, the following best practice measures are proposed: • Restore entrance and access. Reinstate affected property boundary.	No residual impact
108	Part of Commercial Property	0.0010	Reduction in area of property. No impact on existing property access. Impact on property boundary.	Low	Negligible	Imperceptible	None	No residual impact
109	Part of Public Road	0.0010	Impact on existing entrance.	Low	Negligible	Imperceptible	Although it has been determined that effects will likely be of imperceptible significance, the following best practice measures are proposed: • Restore entrance and access.	No residual impact
110	Part of Private Access	0.0026	Private access only	Low	Negligible	Imperceptible	None	No residual impact
111	Part of Private Access	0.0006	Private access only	Low	Negligible	Imperceptible	None	No residual impact

14.4.3 Waste

This section describes the potential for waste to be generated during the excavation, construction and operation of the Proposed Road Development. This section therefore examines the potential environmental effects of the generation and management of solid waste streams arising from the Proposed Road Development, 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 the demolition of the existing commercial building, and will likely include the following:

- Excavated material;
- Rubble;
- Steel;
- Timber;
- Plastic;
- Cardboard packaging; and
- Small quantities of hazardous waste (e.g. mastic and adhesives).

Further building surveys on the commercial building that is scheduled to be demolished will be carried out prior to the detailed design phase.

There is significant scope for reuse and recycling of materials and waste but the quantity achievable cannot be definitively determined at this stage. However, the construction sector seeks to recycle and reuse waste in response to legislative, fiscal and policy drivers, as well as cost minimisation, which would result in a likely reduction in the quantity of material that would leave site and require disposal to landfill.

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 TII guidance document on '*The Management of Waste from National Road Construction Projects'* (TII, 2017).

Therefore, it is anticipated that the Proposed Road Development will likely result in a low effect on waste management infrastructure. The significance of the effect from the generation and management of solid waste streams arising from the Proposed Road Development is therefore considered to be imperceptible as no significant reduction or alteration in the capacity of waste infrastructure at a national scale is anticipated.

There will be no operational phase waste impacts from the Proposed Road Development.

14.5 Mitigation and Monitoring Measures

14.5.1 Utilities

Although it has been determined that effects on the existing utilities network will likely be of imperceptible/slight significance, a number of best practice measures will be implemented during the construction phase of the Proposed Road Development.

Prior to excavation diversion works, the appointed contractor will be supplied with accurate service drawings additional site investigations will be carried out if necessary, to ensure services are not damaged during construction works. 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.

In addition to the above, prior to any demolition, excavation or construction, a CEMP will be produced by the successful contractor, which will detail the contractor’s overall management and administration of the works and incorporates and further develops a C&D WMP, which clearly sets out the contractor's proposals regarding the treatment, storage and recovery or disposal of waste. These mitigation measures will be incorporated into any future construction contract as the minimum standard required to be implemented by the contractor.

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 C*ode of Practice for Avoiding Danger from Overhead Electricity Lines'*, 2008 and the HSA '*Code of Practice for Avoiding Danger from Underground Services*', 2010.

14.5.2 Land Use and Property

The majority of the land required for the Proposed Road Development will be acquired through a CPO process, unless other direct agreement (payment) are reached with individual landowners. However, compensation to be agreed as part of the land acquisition are outside the scope of the EIA process.

It is also noted that some lands required for the Proposed Road Development are owned by a State Body, namely The Commissioners of Public Works in Ireland (OPW). These lands are exempt from CPO process and accordingly have not been included in the CPO schedule. The Commissioners of Public Works in Ireland (OPW) have however agreed in principle, subject to development consent being obtained, to the transfer of these lands required to Meath County Council. This agreement has been recorded in Letter of Consent dated 9 January 2020.

Access roads will be provided to access severed lands in cases where acquiring the severed lands is generally more expensive than the cost of providing the access. New vehicular accesses to residential properties shall be constructed to replicate the existing access layout as far as is practicable, whilst ensuring that visibility from the access is provided.

Specific mitigation measures for properties and land types being acquired can be found in Table 14-8 to Table 14-11.

14.5.3 Waste

Notwithstanding the impact 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 CEMP and C&D WMP will be produced by the successful contractor. The C&D 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.
- 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.

14.6 Cumulative Impacts

Cumulative impacts are defined as the combination of many minor impacts creating one, larger, more significant impact (NRA, 2009 and EPA, 2017). Cumulative impacts consider existing stresses on the natural environment as well as developments that are underway and in planning.

Anticipated demands from the Proposed Road Development on existing utilities networks are not excessive, as discussed above, and will not likely result in significant effects when considered in combination with other proposed developments, during the operation and construction phase. The relevant service providers (ESB, Gas Networks Ireland and IW) 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.

No additional cumulative impacts have been identified.

14.7 Do Nothing Scenario

If the Proposed Road Development did not proceed, there would be no change to the existing material assets. However, as land west of the Proposed Road Development is categorised as “New Development”, the site may be used for future developments, therefore changing the state of the existing material assets.

14.8 Residual Impacts

14.8.1 Utilities

With the implementation of mitigation measures outlined in Section 14.5.1, the residual effects on existing utilities network will likely be reduced to 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 effects on the existing electricity network will remain slight during the operational phase as a result of the additional power demands on the existing supply.

No additional residual impacts on the utility’s networks are anticipated during the operational phase.

14.8.2 Land Use and Property

The residual effect resulting from the commercial building being acquired and demolished will remain as significant as no mitigation is possible to reduce the effect. The residual impact post compensation cannot be assessed as the compensation to be agreed as part of the land acquisition are outside the scope of the EIA process.

The residual effects from the acquisition of partial agricultural land take, will be reduced to slight as a result of the proposed mitigation measures; for example, by providing new access road and entrances. The residual effects from the acquisition of partial non-agricultural land, including land categorised as ‘Part of Recreational Land’; ‘Part of Amenity Land’; and ‘Part of Commercial Property’ will remain slight as no additional mitigation is possible to reduce the impact from the loss of land.

There will be no residual impacts on lands classified as Private Access/Public Road, as well as small number of commercial properties.

There will be no residual impacts on land acquired temporarily during the construction phase.

14.8.3 Waste

Following implementation of the best practice measures outlined in Section 14.5.3, the residual effects significance from the generation and management of solid waste streams arising from the Proposed Road Development during the construction is considered to remain imperceptible.

14.9 Difficulties Encountered

No difficulties were encountered during the assessment and preparation of the Material Assets chapter.

14.10 References

- DECLG. (2012). *A resource opportunity, waste management policy in Ireland.* Department of the Environment, Community and Local Government.
- EPA. (2003). *EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements.* Environmental Protection Agency, Wexford, Ireland.
- EPA. (2014). *Construction & Demolition Waste Statistics for Ireland*, Environmental Protection Agency, Wexford, Ireland.
- EPA. (2017). *EPA Guidelines on the information to be contained in Environmental Assessment Reports*, Draft, August 2017, Environmental Protection Agency, Wexford, Ireland.
- EPA. (2019). *Progress to EU Targets*, Environmental Protection Agency, Wexford, Ireland.

- EU. (2018). Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste, European Union.
- Government of Ireland. (2001). Waste Management (Amendment) Act, 2001.
- Government of Ireland. (2011). S.I. No. 126/2011 - European Communities (Waste Directive) Regulations 2011.
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, Meath, Ireland.
- MCC. (2013). *Meath County Development Plan (2013-2019),* Meath County Council, Meath, Ireland.
- TII. (2017). *The Management of Waste from National Road Construction Projects*. Transport Infrastructure Ireland, Dublin, Ireland.

Appendix 15: Major Accidents and Disasters

15

15. Major Accidents and Disasters

15.1 Introduction

This chapter relates to MADs and the assessment of likely significant adverse effects on the environment arising from the vulnerability of the Proposed Road Development to MADs. This topic is a new topic within the EIA process as outlined within the revised EIA Directive 2014/52/EU, which entered into force in May 2017. The directive states a requirement to access "*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 a naturally occurring phenomenon such as an extreme weather event (e.g. storm, flood, extreme temperatures) or ground-related hazard events (e.g. subsidence, landslide, earthquake) with the potential to cause an event or situation that leads to immediate or delayed serious damage to human health, welfare and/or the environment and requires the use of resources beyond those of the developer or its contractors to manage.

A major accident, in the context of this assessment, means an uncontrolled event caused by a man-made activity or asset that may result in immediate or delayed serious damage to human health, welfare and/or the environment and requires the use of resources beyond those of the proposed developer or its contractors to manage.

Important considerations are the potential of the Proposed Road Development to cause MADs during the construction and operational phases, and the vulnerability of the Proposed Road Development to potential man-made and natural disasters. The assessment of MADs considers all disciplines outlined within the revised EIA Directive 2014/52/EU (population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape).

The purpose of this chapter is to outline the requirement for an assessment of MADs and to outline our approach to the assessment to occur as part of the EIA process.

Reference should be made to the characteristics of the Proposed Road Development outlined in Chapter 4 (Description of the Proposed Road Development).

15.2 Methodology

15.2.1 Study Area

The assessment takes into consideration the study area and assessment under population and human health, biodiversity, noise and vibration, land, soil, water, air and climate, material assets, cultural heritage and the landscape.

15.2.2 Legislation and Guidance

This section identifies the relevant policy and legislation which will inform the scope of the assessment. This section will also set out the requirements as set out in the EIA Directive 2014/52/EU and the EPA EIA draft guidelines (2017).

EIA Directive 2014/52/EU

The revised EIA Directive 2014/52/EU states the following in relation to MADs:

"*In order to ensure a high level of protection of the environment, precautionary actions need to be taken for certain projects which, because of their vulnerability to major accidents, and/or natural disasters (such as flooding, sea level rise, or earthquakes) are likely to have significant adverse effects on the environment. For such projects, it is important to consider their vulnerability (exposure and resilience) to major accidents and/or disasters, the risk of those accidents and/or disasters occurring and the implications for the likelihood of significant adverse effects on the environment. In order to avoid duplications, it should be possible to use any relevant information available and obtained through risk assessments carried out pursuant to Union legislation, such as Directive 2012/18/EU of the European Parliament and the Council (4) and Council Directive 2009/71/Euratom (5), or through relevant assessments carried out pursuant to national legislation provided that the requirements of this Directive are met*".

The information relevant to MADs to be included in the EIAR are set out in Section 8 of Annex IV of the EIA Directive as follows:

"(8) *A description of 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 disasters which are relevant to the project concerned. Relevant information available and obtained through risk assessments pursuant to Union legislation such as Directive 2012/18/EU of the European Parliament and of the Council or Council Directive 2009/71/Euratom or relevant assessments carried out pursuant to national legislation may be used for this purpose provided that the requirements of this Directive are met. Where appropriate, this description should include measures envisaged to prevent or mitigate the significant adverse effects of such events on the environment and details of the preparedness for and proposed response to such emergencies*".

The directive also outlines that the population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage, the landscape, and the interaction between the factors should "*include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned*". The information to be included within EIAR reports in relation to MADs is contained within Annex IV of EIA Directive 2014/52/EU.

EPA EIA draft guidelines (2017)

The draft EPA EIA guidelines state the following (Section 3.7.3):

"To address unforeseen or unplanned effects the Directive further requires that the EIAR takes account of the vulnerability of the project to risk of major accidents and /or disasters relevant to the project concerned and that the EIAR therefore explicitly addresses this issue. The extent to which the effects of major accidents and / or disasters are examined in the EIAR should be guided by an assessment of the likelihood of their occurrence (risk). This may be supported by general risk assessment methods or by systematic risk assessments required under other regulations e.g. a COMAH (Control of Major Accident Hazards involving Dangerous Substances) assessment."

15.2.3 Assessment Methodology

15.2.3.1 Overview

The current EIA assessment approach (prior to the revised EIA Directive 2014/52/EU) already considered some accidents and disasters such as the potential for pollution to ground and surface waters, the potential pathways to sensitive biodiversity receptors (through AA) and the potential for flood events (through flood risk assessments).

The assessment of MADs is a new requirement; however, national guidelines are not yet available. In the absence of such guidance, Highways England's (HE) (equivalent body to TII) guidance (HE, 2017) has been consulted, which sets how projects must implement the new requirements of the 2014/52/EU Directive.

The HE guidance identifies that the general scope should cover:

- Vulnerability of the project to risks of MADs; and
- Any consequential changes in the predicted effects of that project on environmental topics.

To achieve this, the instructions identify that projects should:

- Apply professional judgement to develop project specific definitions of MADs;
- 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.

For the assessment, the scope and methodology are based on the assumption that the Proposed Road Development will be developed in line with relevant best practice guidelines; therefore, minimising the likelihood of the occurrence of MADs. However, the assessment will be carried out in order to identify MADs that could potentially occur during both the construction and operational phases and ensuring due consideration has been taken during the design process.

MAD risks covered within this chapter are typically rare or low likelihood events with the potential to cause 'serious damage[51]'. For the Proposed Road Development, a significant adverse effect is considered to mean the loss of life or permanent injury, and/or permanent or long-lasting damage to an environmental receptor.

Low consequence events do not meet MADs definitions and therefore are not considered in this assessment. For example, slips, trips and falls would be dealt with under contractor's management systems and do not fall within the scope of this assessment. Effects associated with minor spills or mobilising existing contamination within soils are assessed within Chapter 8 (Land and Soils) and Chapter 9 (Water). Expected or planned impacts associated with the construction or operation of the Proposed Road Development, such as those reported within Chapters 6 to 14, will not been considered further within this chapter.

Any impact that is local, temporary and reversible is unlikely to be considered significant against criteria typically used in EIA, and therefore will not be considered in this assessment[52].

15.2.3.2 Assessment Scope

A risk analysis-based methodology was used in the assessment scope, covering identification, likelihood and consequence of MAD risks, derived from the EPA guidance. The assessment of the MAD risks will consider all factors defined in the EIA Directive 2014/52/EU, i.e. population and human health, biodiversity, land and soil, water, air and climate, material assets, cultural heritage and the landscape. The approach is based on the EPA's '*Guidance on Assessing and Costing Environmental Liabilities'* (EPA, 2014) and the '*Guide to Risk Assessment in Major Emergency Management*' (Department of the Environment, Heritage & Local Government, 2010).

The following stages were undertaken as part of the risk assessment:

Stage 1: Risk identification/baseline establishment – confirm the existing baseline; establish an understanding of the interface of the Proposed Road Development with existing operations; identify possible risks and review potential receptors to identify any groups not considered necessary to include in the assessment.

Risk identification consisted of collating data from existing sources and collating risks identified during design and environmental evaluation process in order to identify MAD risks that could occur, and to which the Proposed Road Development is particularly vulnerable, or which the Proposed Road Development has a particular capacity to exacerbate. Only risks with a feasible source-pathway-receptor were considered in the assessment:

- Source: Original cause of the hazard; for example, adverse weather event.
- Pathway: The route by which the source reaches the environmental receptor; for example, flooding.
- Receptor: The component of the environment impacted; for example, the natural environment and/or local communities.

A 'long list' of potential risks that were initially identified for the Proposed Road Development was then produced (Table 15-4). A screening exercise was then undertaken to give consideration to the risks relevant to the Proposed Road Development, and therefore whether they should be included on the project specific 'short list' of risks which potentially require further consideration in the EIAR.

Although the majority of MAD risks on the 'long list' are already considered under other legislative or design requirements, this was not considered to be a sufficient reason to eliminate the risks from inclusion on the project specific 'short list'. However, where it is concluded that the need for compliance is so fundamental, and the risk of any receptors being affected so remote, such MAD risks have not been included on the short list.

Likewise, it is considered reasonable and proportionate to exclude certain receptor groups from the outset. Construction workers, as a receptor, can be excluded from the assessment, because existing legal protection is sufficient to minimise any risk from major events to a reasonable level. Relevant legislation includes the Safety, Health and Welfare at Work (Construction) Regulations 2013 (S.I. No. 291 of 2013).

MAD risks included on the 'short list' were not assessed or brought forward to Stage 2 for a variety of reasons which included:

- No source, pathway or receptor exists;

[51] Serious damage= "*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*".
[52] This is project/site dependant and may vary between projects.

- The risk 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 a significant adverse impact;
- The risk could realistically occur, but for which the proposed project, and associated receptors, are no more vulnerable than any other development (e.g. a new road scheme is likely to be just as vulnerable to snow and ice conditions as the rest of the existing road network); and
- The risk is being adequately assessed in another part of the EIAR.

Risks are screened such that only low likelihood, but potentially high consequence risk events remain. Figure 15-1 below illustrates the risk screening process.

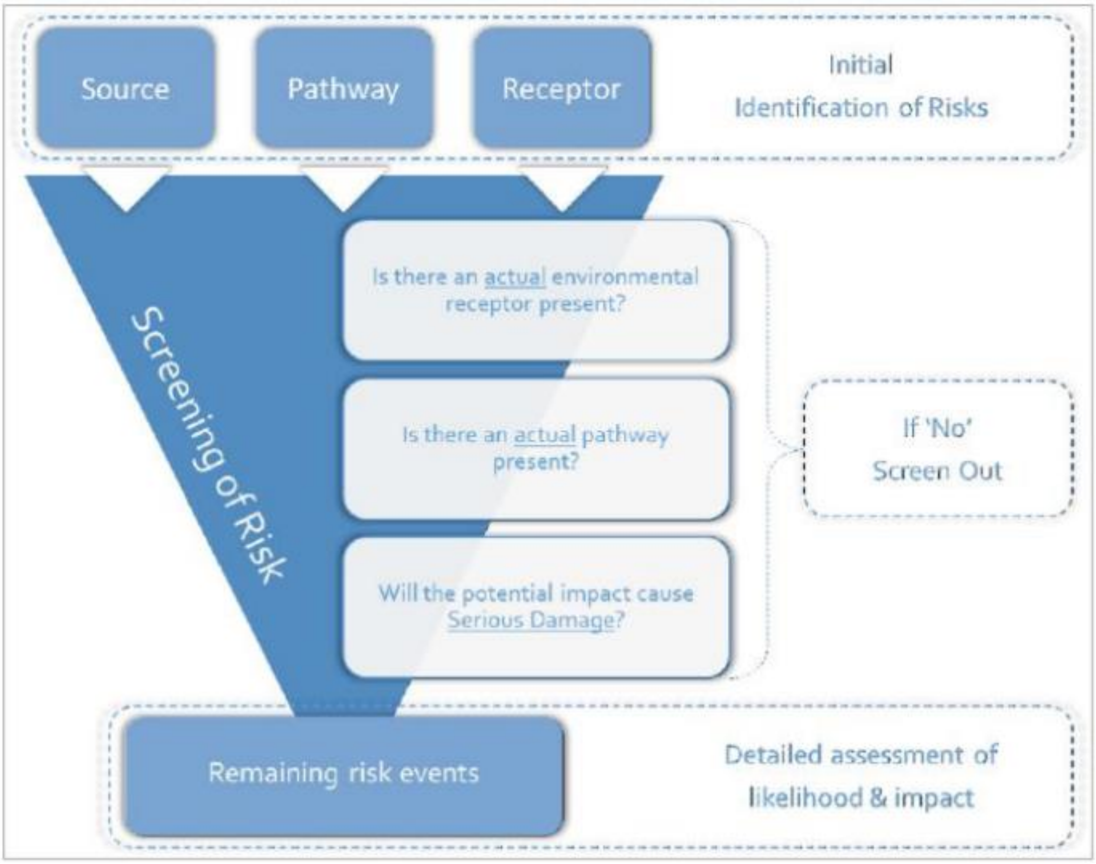


Figure 15-1 Risk Screening Process

Stage 2: Risk classification: likelihood and consequence–If MAD risks requiring further consideration in the EIAR are identified in Stage 1, the likelihood of a risk occurring and the consequence of the risk if the event occurs will be assessed.

An analysis of the proposed environmental mitigation measures throughout the EIAR will be considered where appropriate when estimating the likelihood of the identified potential risks occurring. It should also be noted that when the consequence rating is categorised to each risk, it will assume all proposed mitigation measures and safety procedures have failed to prevent the potential MADs.

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.

Ranking	Category	Description
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: Guide to Risk Assessment in Major Emergency Management (Department of the Environment, Heritage and Local Government, 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. <0.5M 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. 0.5-3M 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 10-25M 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. >25M 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: Guide to Risk Assessment in Major Emergency Management (Department of the Environment, Heritage and Local Government, 2010).

Stage 3: Risk evaluation/risk management options –The likelihood and consequence ratings are then multiplied to form a risk score for each risk and subsequently ranked based on the risk score. The purpose of the risk evaluation is to assist in making decisions, using the outcomes of the risk analysis identifying and prioritising the risks for mitigation/treatment. A risk matrix has been developed to allow the risks to be easily displayed and prioritised (Table 15-3).

Any risks identified during Stage 3 will remain on the design risk register until they are adequately closed out though design.

Table 15-3 Risk Matrix

Likelihood							
	5	Very Likely					
	4	Likely					
	3	Unlikely					
	2	Very unlikely					
	1	Extremely Unlikely					
Severity			1	2	3	4	5
			Minor	Limited	Serious	Very Serious	Catastrophic

15.3 Characteristics of the Proposed Road Development

The Proposed Road Development comprises a local distributor road, incorporating footway and cycleway provision of approximately 1.15 km in length.

The proposed alignment commences with a proposed signalled junction at the N51/R147 on the north western side of Navan town centre in the townland of Abbeyland. The route runs in a north easterly direction across the River Blackwater SAC, where a new bridge crossing is proposed.

The route continues in a north westerly direction from here crossing through the south west corner of Blackwater Park and a number of open greenfields. The route then crosses in a north easterly direction through a small section of wood and/shrubland before joining Ratholdron Rd in the north.

15.4 Description of the Existing Environment

15.4.1 Natural Disasters

With regards natural disasters, severe weather conditions pose one of the most common risks to the Republic of Ireland and to the Proposed Road Development site.

15.4.2 Major Accidents

No sources of significant major accidents were identified in the existing environment.

As part of this commission, AECOM undertook an initial assessment of the road safety impact of the existing infrastructure in Navan and its environs, to determine the impact on road safety the introduction of the Proposed Road Development within Navan would have.

This assessment identified that numerous minor severity collisions have taken place on the roads surrounding the study area, with some limited clustering within the network, namely the junctions of Ratholdron Road / Clonmagadden Road and N51 / Kells Road, and roundabout of N51 / R147.

15.5 Risk Screening

This section details the screening process and the conclusions of assessments undertaken as part of the design and environmental evaluation process. A screening exercise was undertaken to review the long list of MAD risks identified in order to give consideration to their relevance to the Proposed Road Development and therefore whether they should be included on the project specific short list (risks identified for potential further consideration in the EIAR). A copy of the long list of potential MAD risks is provided in Table 15-4.

Table 15-4 Major Accidents and Disasters Long List

		Potential Receptors?	Relevant to the Proposed project?	Covered already in EIAR? If so, where?	Include in short list?
			Natural Disasters		
1	**Geological disasters**				
1.1	Avalanches and landslides	N/A	N/A	N/A	No
1.2	Earthquakes	N/A	N/A	N/A	No
2	**Hydrological disasters**				
2.1	Flood Events	Road users, property and people in areas of increased flood risk.	Yes. Onsite observations confirmed that the lands immediately adjacent to the river are likely to be prone to flooding as this area is relatively flat and at a lower elevation than surrounding lands. One flooding event at the Proposed Road Development site is recorded on the OPW CFRAM database.	Yes - Chapter 9 (Water) and 16 (Climate)	Yes
2.2	Tsunami/Storm surge	N/A	N/A	N/A	No
3	**Meteorological disasters**				
3.1	Blizzards	N/A	N/A	N/A	No
3.2	Cyclonic storms	N/A	N/A	N/A	No
3.3	Droughts	N/A	N/A	N/A	No
3.4	Thunderstorms	Road users	No. The proposed bridge designs will consider the potential risk of lightning strikes, though the risk is not considered to be any greater than any other road bridge.	No	No
3.5	Hailstorms	N/A	N/A	N/A	No
3.6	Heat waves	N/A	N/A	N/A	No
3.7	Wildfires	N/A	N/A	No	No
3.9	Air Quality Events	Road users and local residents	Yes. Vehicle emissions can contribute to poor air quality.	Yes - Chapter 10 (Air Quality)	Yes
			Major Accidents		
4	**Transport**				
4.1	Major road accident during the construction and operational phase	Road users, pedestrians, aquatic environment	Yes. There is risk of spillage from hazardous loads as a result of a road traffic accident e.g. fuel tankers. These types of vehicles already use the existing road and given the reduced accident rate on the proposed scheme, it is likely that the risk will decrease.	Yes - Chapter 05 (Traffic Analysis), Chapter 08 (Land and Soils) and Chapter 09 (Water)	Yes

4.2 Major Rail Accidents	N/A	N/A	N/A	No
4.3 Major Aircraft Disasters	N/A	N/A	N/A	No
4.4 Maritime Disasters	N/A	N/A	N/A	No
5 Engineering Accidents/Failures				
5.1 Bridge Failure	Road users	No. Accidental and failure criteria for the bridge will be in accordance with the Eurocode requirements. The bridge will be designed and detailed with a 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 shall be resisted by ensuring sufficient redundancy is provided within the design in accordance with IS EN 1991-2. The accidental actions shall 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 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.	No	No
5.2 Tunnel Failure or Fire	N/A	N/A	N/A	No
5.3 Dam Failure	N/A	N/A	N/A	No
5.4 Flood Defence Failure	Road users	N/A	N/A	No
5.5 Mast and Tower Collapse	N/A	N/A	No	No
5.6 Building failure or fire	N/A	N/A	N/A	No
5.7 Utilities failure (gas, electricity, water, sewage, communications)	Road users, local residents	Yes. During the construction phase of the Proposed Road Development, some realignment, or replacement of services and utilities may be required in conjunction with or to accommodate the proposed works.	Yes – Chapter 14 (Materials Assets)	Yes
6 Disease				
6.1 Human disease	N/A	N/A	No	No
6.2 Animal and Plant disease	N/A	N/A	No	No

Table 15-5 overleaf outlines the MAD risks short listed for potential further consideration within the EIAR. As outlined in Section 15.2.3, potential MAD risks were not considered for further investigation within the EIAR for a variety of reasons including; no receptors and source of major accidents and/or pathway exists; the potential impact will unlikely cause serious damage, and the risk is being adequately assessed in another part of the EIA, amongst others.

The screening process also took cognisance of the design measures and mitigation measures included in other chapters of the EIAR to reduce the significance of MAD risks.

Table 15-5 Short List of MAD risks

MAD Risk	Effect	Potential Receptors	Will the potential impact cause Serious Damage (i.e. could it result in a MAD?)	Embedded/Good Practice Mitigation	Does MAD need to be considered further in the EIAR?	Comments
Natural Disasters hazards:						
Flood Event	Fatalities, injuries and damage to property within the study area, potential for release of environmentally damaging substances.	Road users and local residents, surface water, ground water and land-based receptors.	Yes	• Construction drainage strategy • Safe Systems of Work • Compliance with national legislation • Control measures set out in Chapter 09 (Water). • Design features of the road (oil i	No	Both the vulnerability of the Proposed Road Development to flooding, and its potential to exacerbate flooding, are covered in the FRA and will also be reported in EIA terms in Chapter 09 (Water) and Chapter 16 (Climate) in the EIAR, both in terms of the risk to the scheme and increased risk due to the scheme. The proposed attenuation pond/tanks 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. 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, meaning 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.
Air Quality Events	Injuries, potential for release of environmentally damaging substances.	Road users and local residents; biodiversity.	No	• Compliance with national legislation • Implementation of a CEMP • Mitigation measures set out in Chapter 10 (Air Quality).	No	Although relevant, as vehicles emissions can contribute to poor air quality, it is not considered necessary to undertake any more assessment than is already proposed for the Air Quality assessment – see Chapter 10 (Air Quality).
Major Accidents and Hazards:						
Utilities Failure (gas, electricity, water, sewage, communications)	Fatalities, injuries and damage to property within the study area.	Buildings/local residents.	Yes	• Safe Systems of Work • Site specific Health and Safety (H&S) Plan • Compliance with national legislation • Earthworks design • Consultation with relevant utility providers • Implementation of a CEMP • High safety design standards	No	Proposed utilities diversions will be done in consultation with the relevant statutory bodies. 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.

MAD Risk	Effect	Potential Receptors	Will the potential impact cause Serious Damage (i.e. could it result in a MAD?)	Embedded/Good Practice Mitigation	Does MAD need to be considered further in the EIAR?	Comments
				• Control and Mitigation measures set out in Chapter 14 (Material Assets).		
Major transport accident during the construction and operational phase	Fatalities, injuries and damage to property within the study area, potential release of environmentally damaging substance	Road users and local residents surface water, ground water and land-based receptors.	Yes	• Safe Systems of Work • Site specific Health and Safety (H&S) Plan • Implementation of a CEMP • Compliance with national legislation • High safety design standards • Design features of the road	No	The Proposed Road Development will be of a higher safety standard than existing routes and will, therefore, contribute to a network wide reduction in collisions. The Proposed Road Development includes the provision for cut-off and storage in the event of a road accident causing spillage of deleterious materials.

15.6 Assessment of Impacts

15.6.1 Construction and Operational

As shown in Table 15-5 above, the MAD risks screened in at Stage 1, which were identified as requiring potential further consideration within the EIAR, are all already being adequately considered as part of the Proposed Road Development design or within relevant EIAR chapters. For example, a potential source of a major accident related to road developments is road traffic accidents during their operation; these can clearly impact on people though fatalities and serious injury, but can also impact on the environment, through the spillage of fuel and hazardous loads.

However, the Proposed Road Development, as outlined in Chapter 5 (Traffic Analysis), will be of a higher safety standard than existing routes and will therefore contribute to a network wide reduction in collisions. In addition to this, the Proposed Road Development will provide road surface water runoff collection and treatment facilities so that rainfall from all paved areas is effectively removed from the road surface and treated before discharge to the existing water environment. This includes the provision for cut-off and storage in the event of a road accident causing spillage of deleterious materials (Chapter 9: Water). 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. The spillage assessment carried out on the Proposed Road Development demonstrates a very low magnitude of risk for individual or grouped catchment outfalls and shows the overall spillage risk for the entire scheme to be 1 in 8128 years. Shut-down facilities at outfalls has been provided as a precautionary measure due to the presence of the SAC and SPA.

With regards to flood risk, the proposed attenuation pond and attenuation tanks 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 would also assist in the prevention of bank erosion within the channel, lowering sediment release and the subsequent potential for adverse impact on the fish population. 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, meaning 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.

In addition to this, a number of embedded control measures, which are outlined in Chapter 4 (Description of the Proposed Road Development), in addition to mitigation measures outlined in Chapter 16 (Climate), the development’s resilience to climate change (including flood risk) during construction and operation will increase. Therefore, no residual impacts have been identified in relation to climate change resilience (CCR) (this is discussed further in Chapter 16 (Climate)).

No MAD risks have been identified that require additional consideration within the EIAR; therefore, it was determined that the risk classification and evaluation process is not required.

15.7 Mitigation and Monitoring Measures

There are a number of mechanisms which currently manage accidents outside of the EIA process, including a site-specific H&S Plan which will be adopted during the construction phase of the Proposed Road Development. These mechanisms are currently effective at reducing these risks to an acceptable level whereby the risk is unlikely and unexpected as a result.

The consideration of embedded control measures and compliance with legislation and best practices has demonstrated that there will be no risks associated with MADs in the context of the Proposed Road Development. Therefore, no additional mitigation is considered to be required.

15.8 Do Nothing Scenario

In the do-nothing scenario, there would be no potential risk of the Proposed Road Development causing, or being affected by a MAD.

15.9 Cumulative Impacts

Given the scale of the Proposed Road Development, no significant cumulative MAD risks are anticipated.

15.10 Residual Impacts

No significant residual risks associated with MADs in the context of the Proposed Road Development were identified.

15.11 Difficulties Encountered

No difficulties were encountered during the assessment.

15.12 References

- EPA. (2014). *Guidance on Assessing and Costing Environmental Liabilities'* (2014) *Guide to Risk Assessment in Major Emergency Management*, Environmental Protection Agency, Wexford, Ireland.
- EPA. (2017). EPA Guidelines on the information to be contained in Environmental Assessment Reports, Draft, August 2017, Environmental Protection Agency, Wexford, Ireland.
- 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
- Department of the Environment, Heritage & Local Government. (2015). *Guide to Risk Assessment in Major Emergency Management*
- HE. (2017). *Environmental Impact Assessment: Implementing the Requirements of 2011/92/EU as amended by 2014/52/EU (EIA Directive),* Highways England, UK.

Chapter 16:
Climate

16

16. Climate

16.1 Introduction

This chapter of the EIAR reports the findings of an assessment of the likely significant effects on the climate as a result of the Proposed Road Development in the MCC area. It also considers the resilience of the Proposed Road Development to the physical impacts of future climate change. As noted in Chapter 2 (Need for the Proposed Road Development and Planning Policy Context), this scheme has been developed in order to unlock development lands. This scheme further promotes a modal shift towards the use of pedestrian, cyclists and bus facilities.

In line with IEMA guidance (IEMA, 2015; 2017) , consideration has been given within this EIA 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 16.2.4.1);
- 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 16-1.

Table 16-1 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 FRA (see Appendix A8-2; Volume 4) 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 is within a predominantly greenfield site, characterized by the presence of open greenfield area with some wooded areas in the section north of the River Blackwater, and as such will have a negligible heat urban island effect.
Precipitation	The impact of increased rainfall due to climate change is considered as part of the FRA (see Appendix A8-2; Volume 4). 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.

16.2 Methodology

This section of this EIA 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.

16.2.1 Guidelines, Policy and Legislation

16.2.1.1 Climate Agreements

Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994, and the Kyoto Protocol in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1999 and Framework Convention on Climate Change, 1997). For the purposes of the European Union burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six Greenhouse Gases (GHGs) under the Kyoto Protocol to 13% above the 1990 level over the period 2008 to 2012. The Kyoto Protocol (WRI, 2012) was amended in 2012 to include a 7^{th} mandatory GHG (nitrogen trifluoride; NF_3).

According to the '*Ireland's Greenhouse Gas Emission Projections 2012-2030' (*EPA, 2013) report, Ireland was on track to meet its commitment under the Kyoto Protocol. This is in marked contrast to the projection in Ireland's 2007 National Climate Change Strategy which forecast a total distance to target of 18Mtonnes of CO_2e. The reason Ireland was on track was primarily as a direct result of economic recession and economic outlook for the future. Nevertheless, as the economy recovers, there continues to be a significant risk that Ireland will not meet its 2020 EU targets, even under the most ambitious emission reduction scenario, as detailed below.

With reference to '*Ireland's Environment – An Assessment 2016*' (EPA, 2016), the EU 2020 target of a 20% reduction of non-EU Emissions Trading System (ETS) sector emissions on 2005 levels is based on a combination of annual targets from 2013 to 2020 to give an overall reduction by 2020. According to the latest projections for 2020, produced by the EPA (March 2016), Ireland's emissions could be in the range of 6-11% below 2005 levels, representing a significant shortfall.

These projections are therefore a cause for significant concern in the context of the anticipated requirements for further reductions in GHG emissions in the period 2021−2030. Failure to meet the 2020 target would make future compliance challenges more difficult and costly.

In December 2015, at a meeting of the UNFCCC in Paris, a new global agreement was reached to address climate change (UN, 2015). Expected to enter into force in 2020, the agreement aims to:

- hold the increase in the global average temperature to well below 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C;
- increase the ability to adapt to the adverse impacts of climate change and foster climate resilience and low GHG emissions development in a manner that does not threaten food production; and
- make finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.

With reference to the EPA's '*Ireland's Environment – An Assessment 2016*' (EPA, 2016*)* to achieve this, GHG emissions must peak as soon as possible and then be reduced rapidly in order "*to achieve a balance between anthropogenic emissions by sources and removals by sinks of GHGs in the second half of this century*".

The Agreement establishes a long-term adaptation goal of "*enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the 2°C temperature goal*". This makes it clear that, if mitigation activities succeed in limiting the rise in global temperature, less adaptation will be needed.

For Ireland, climate change mitigation and adaptation actions are therefore framed and informed by UN, EU and national policy. These include the UNFCC, the Kyoto Protocol, the UN Paris Agreement, the EU Strategy on Adaptation to Climate Change, the EU Climate and Energy Package, the National Policy Position on Climate Change and the Climate Action and Low Carbon Development Act 2015.

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'* (Government of Ireland, 2014) in April 2014, committing Ireland to an 80% reduction in carbon emissions in the energy sector on 1990 levels by 2050. A more ambitious target, outlined in the Climate

Action Strategy (detailed below) is net zero carbon emissions by 2050 compared to 1990 levels in the electricity generation, built environment, and transport sectors.

In the context of the Proposed Road Development, the private car remains the dominant mode of transport in Ireland. As detailed within '*Ireland's Environment – An Assessment 2016' (*EPA, 2016*)* the private car accounts, on average, for 74% of all journeys and 79% of all journeys outside Dublin. The dependency on car transport outside Dublin can be partially explained by the low-density, dispersed nature of the rural population, making it very difficult to effectively operate a public transport service in rural Ireland. This high dependency has a very significant environmental impact in terms of both GHG and air pollutant emissions.

The total number of licensed vehicles on Irish roads exceeded 2.5 million for the first time in 2014 which included over 1.9 million private cars. With reference to the latest DTTASs' bulletin of Vehicle and Driver Statistics (DTTAS, 2019):

- The total number of licensed (taxed) vehicles recorded on Irish roads at the 31st December 2018 is 2,717,722. This represents an increase of 41,843 vehicles (1.56%) on the previous year. The main components of the vehicle fleet include 2,106,369 private cars, 355,273 goods vehicles, 75,196 agricultural tractors and 40,198 motorcycles
- In the passenger car category, the number of vehicles at 2,106,369 represents an increase from 2,066,112 in the previous year (1.95% increase).
- A total of 1,386,208 passenger cars are now taxed based on their CO_2 emissions rating. This represents an increase of 191,052 (15.99%) units on the previous year figures and the CO_2 based vehicles now represent 65.8% of the overall passenger car fleet. There are 87.45% of vehicles bases in the 'A' and 'B' CO_2 bands less than 141g/km.

While private car ownership levels in Ireland are still below the EU average, the challenge for 'policymakers' is to try to develop a sustainable transport model that can meet the DTTAS sustainable transport vision of:

- maximising efficiency and alleviating congestion;
- minimising the impacts of air pollutants and GHG emissions; and
- reducing overall travel demand and commuting distances by private car.

By implementing the Proposed Road Development, the last of the three points is obviously a visionary objective that the scheme does not facilitate the achievement of. As the Proposed Road Development is intended to be a cost-effective solution to provide necessary relief to congestion within Navan, its purpose is to redistribute traffic movements to maximise efficiency and alleviate congestion (as per the first visionary objective). In doing so, conformance with the second visionary objective (minimising the impacts of air pollutants and GHG emissions) is considered within the lifecycle GHG impact assessment.

16.2.1.2 National Planning Policy

16.2.1.2.1 Project Ireland 2040: National Planning Framework

The NPF (Government, 2019a) 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*".

16.2.1.2.2 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 NPF(above). This Development Plan emphasises the need for "*investment to support the achievement of climate action objectives and discourage investment in high-carbon technologies*".

16.2.1.2.3 Ireland's Greenhouse Gas Projections 2018-2040

The EPA's Ireland's Greenhouse Gas Projections 2018-2040 report provides an updated assessment of Ireland's total projected greenhouse gas emissions out to 2040 which includes an assessment of progress towards achieving its emission reduction targets out to 2020 and 2030 set under the EU Effort Sharing Decision (Decision No 406/2009/EU) and Effort Sharing Regulation (Regulation (EU) 2018/842).

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, which was published in 2018.

This is evident in the With Additional Measures scenario which assumes full implementation of the programmes, policies and measures included in the National Development Plan.

Fossil fuels such as coal, peat and gas continue to be key contributors to emissions from the power generation sector. However, a significant reduction in emissions over the longer term is projected as a result of the expansion of renewables (e.g. wind), assumed to reach 41-54% by 2030, with a move away from coal and peat.

A growth in emissions from the transport sector continues to be projected which is largely attributed to fuel consumption from diesel cars and diesel freight. A decrease in emissions over the longer term, most notably in the With Additional Measures scenario, is largely attributed to assumed accelerated deployment of 500,000 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 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.

The 2019 emission projections do not consider the impact of new policies and measures that are included in the Climate Action Plan (Government of Ireland, 2019b). It is anticipated that emission projections prepared to inform the preparation of Ireland's final National Energy and Climate Plan will include the additional impact of the 2019 Climate Action Plan. At the time of undertaking this assessment, the National Energy and Climate Plan is still in draft form, with the latest version dated December 2018. As '*Ireland's Greenhouse Gas Emissions Projections 2018-2040*' was published more recently, the projections provided here have been used for the purposes of the lifecycle GHG impact assessment.

16.2.1.2.4 Climate Action Plan (2019)

The objective of the Climate Action Plan (Government of Ireland, 2019b). is to enable Ireland to meet its EU targets to reduce its carbon emissions by 30 per cent between 2021 and 2030 and lay the foundations for achieving net zero carbon emissions by 2050. The Plan outlines 180 actions that need to be taken across all the key sectors. An updated Climate Action Plan which was published in early 2019.

Specifically, in relation to the transport sector, key actions include encouraging the uptake of biofuels and accelerating the uptake of Electric Vehicles (EVs) so that all new cars and vans are EVs by 2030.

Targets also include developing coherent reduction strategies for waste and resource use, and increasing the level and quantity of recycling, with less contamination and greater replacement of virgin materials.

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 CCR into new development.

Lifecycle GHG emissions from the Proposed Road Development will need to be put in context of Ireland achieving these targets and any carbon budgets that are set before or during the duration of the assessment.

16.2.1.2.5 Smarter Travel – A Sustainable Transport Future (A New Transport Policy for Ireland 2009-2020)

The actions set out in the DTTAS '*Smarter Travel – A Sustainable Transport Future*' (DTTAS, 2009) should be implemented to improve air quality. 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.

It is the aim of this policy that by 2020, Transport will make a meaningful contribution to Ireland's commitment under the proposed EU effort-sharing arrangement in relation to climate change and real reductions on current levels of emissions will be achieved. The full extent of this target cannot be determined until the broader national targets under a revised National Climate Change Strategy are determined in response to any agreement on Ireland's target for emissions at EU level. Depending on a number of factors, including any final decisions by Government on fiscal measures, carbon related emissions could fall by between 4Mtonnes to 8Mtonnes of CO_2 equivalents.

16.2.1.3 Local Planning Policy

16.2.1.3.1 Meath County Development Plan 2013-2019 (Consolidated Version, 2016)

Reducing transport emissions is a key aim of the MCDP (MCC, 2013). The Plan aims to improve accessibility to transport, while encouraging and prioritising pedestrians, cyclists and public transport users with the aim of reducing GHG emissions. In terms of waste management, the main objective is to fully implement the waste hierarchy and particularly to facilitate the development of recycling in order to minimise the use of landfill.

The Plan also highlights the need to respond to the issue of climate change and the impact of increased flood risk due to extremes of weather by implementing flood risk management. The Plan states that "*Given the onset of climate change and increased flood risk from extreme events, flood risk assessment and management are required in relation to all aspects of the Development Plan"* (MCC, 2016).

16.2.1.3.2 Meath Climate Action Strategy 2019-2024

The Meath Climate Action Strategy (MCC, 2017) outlines the following key objectives in relation to reducing GHG emissions:

- Ensuring new developments are located close to public transport and are well served by walking and cycling facilities;
- Ensuring development plan policies support roll out of EVs;
- Promoting and supporting clean energy and energy efficiency; and
- Requiring certain developers to prepare construction and demolition waste management plans for new construction projects which meet the relevant recycling/recovery targets for such waste in accordance with the national legislation and national and regional waste management policy.

In relation to improving the CCR of infrastructure and assets, policies include:

- Protecting and enhancing flood defences; and
- Conserving water resources.

16.2.1.3.3 Navan Development Plan 2009-2015 (incorporating Variation No.1, No.2 and No.3)

The NDP 2009-2015 (MCC, 2009) was adopted by MCC and Navan Town Council on the 2nd and 3rd of November 2009 respectively, and subsequently updated in October 2019. The aim of this Plan is to establish a framework for the planned, co-ordinated and sustainable development of Navan and for the conservation and enhancement of its natural and built environment over the Plan period and beyond.

According to the Plan, in terms of transportation a well-developed transport network and improving accessibility and connectivity is central to the sustainable development of Navan. It is critical that this is balanced across all the various modes of transport by facilitating walking and cycling, the use of public transport and an efficient road network. It also advocates reducing overall travel demand in the first instance by prioritising mixed use development and the development of areas in proximity to existing services and facilities. This approach to transport will minimize the negative impacts of transport on the environment through reducing GHG emissions.

The NDP 2009-2015 outlines a series of proposed new road schemes planned to support the sustainable development of the town. The Proposed Road Development is identified as one of these road schemes, the development of which is recommended as part of Infrastructure Objective 2(b).

16.2.2 Assessment Methodology

16.2.2.1 Lifecycle GHG Impact Assessment

16.2.2.1.1 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 and WRI. (n.d.). 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.

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 have 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 a calculation-based methodology as per the following equation as stated in the Defra (2019) emissions factors guidance:

Activity data x GHG emissions factor = GHG emissions value

In line with 'The GHG Protocol'[9], when defining potential impacts (or 'hot spots'), the seven Kyoto Protocol GHGs have been considered, specifically:

- Carbon dioxide (CO_2);
- Methane (CH_4);
- Nitrous oxide (N_2O);
- Sulphur hexafluoride (SF_6);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs); and
- 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) or $MtCO_2e$ (Megatonnes of CO_2 equivalent).

Where data are not available, a qualitative approach to addressing GHG impacts has been followed, in line with the IEMA guidance.

Table 16-2 summarises the key anticipated GHG emissions sources associated with the Proposed Road Development and whether they have been scoped into the assessment.

Table 16-2 Scope of Potential GHG Emissions Sources from the Construction Stages

Lifecycle stage	Activity	Primary emission sources	Scoped In/Out
Pre-construction stage	On-site construction activity. Disposal and transportation of earthworks/ waste.	GHG emissions from fuel consumption by construction plant and vehicles, generators on site, and worker commuting. GHG emissions from disposal and transportation of earthworks/ 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	On-site construction activity. Transport of construction workers.	Energy (electricity, fuel, etc.) consumption from plant and vehicles, generators on site, and construction worker commuting. 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.

16.2.2.1.2 Operational effects

The methodology for determining operational GHG emissions is the same as for pre-construction and construction emissions. Table 16-3 summarises the key anticipated emissions sources and whether they have been scoped into the assessment.

Table 16-3 Scope of Potential GHG Emissions Sources from the Operation Stage

Lifecycle stage	Activity	Primary emissions sources	Scoped In/Out
Operation stage	Use of vehicles i.e. cars and motorcycles	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 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. Any future decommissioning would require a separate planning submission, at which point any likely significant effects will be assessed.

16.2.2.2 Climate Change Resilience Review

In line with the IEMA guidance (IEMA, 2015; 2017), the vulnerability of the Proposed Road Development to climate change has been considered. A high-level review of CCR 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. An EPA-funded report (Nolan, 2008) on the regional climate model projections for Ireland has been used to determine the likely impacts of climate change on the Proposed Road Development.

CCR measures that have been designed into the Proposed Road Development are outlined in Section 16.5.

16.2.3 Classification of Significance of Effects

There are no specific criteria for determining the significance of GHG emissions for EIAR. The IEMA guidance on GHG in EIAR states that *'any GHG emissions or reductions from a project might be considered to be significant'*. As such, the National Emissions Inventories for Ireland, as compiled by the EPA, have been used as a proxy for the level of effect of GHG emissions as a result of the Proposed Road Development on the global climate. Consideration has also been given to the transportation sector within the National Emissions Inventories for Ireland to further contextualise the impact of GHG emissions. Additional GHG emissions as a result of the Proposed Road Development have also been considered in the context of Ireland's carbon reduction targets and the impact they may have on these targets being achieved.

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 PAS 2050 (BSI, 2011) Specification 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 national inventory would be minimal in its contribution to the wider national GHG emissions.

To put the impact from estimated annual GHG emissions from the project into further context a reporting threshold of 25,000tCO2e per annum used by the International Finance Corporation (IFC) (2011) for projects that it contributes funding to has also been used to determine the magnitude of the impact. Therefore, emissions of <25,000 tCO_2e as a result of a development might also be considered to be of low magnitude.

In the absence of specific criteria for defining the significance of GHG emissions, the IEMA guidance suggests that professional judgement should be used to contextualise the GHG impact. The approaches outlined above have been adopted to assess the magnitude of the GHG impact associated with the Proposed Road Development and the associated criteria are outlined in Table 16-4.

Table 16-4 Magnitude Criteria for the Lifecycle GHG Impact Assessment

Magnitude	Magnitude criteria
High	Annual GHG emissions represent equal to or more than 1% of the relevant annual National Carbon Budget or are more than 25,000 tCO_2e in any year.
Low	Annual GHG emissions represent less than 1% of the relevant annual National Carbon Budget and are less than 25,000 tCO_2e in any year.

16.2.4 Limitations in the Methodology and Gaps in Information

The current Proposed Road Development site is responsible for minor levels of associated GHG emissions as the land use is largely agricultural. For the purposes of this assessment, it is assumed baseline emissions associated with existing energy and fuel use will be negligible in the context of the Proposed Road Development. Therefore, the energy and fuel use baseline is assumed to be zero.

For the purposes of this assessment, it has been assumed that the land area to be replaced with hardstanding currently consists of 70% grassland, 20% hedgerows and 10% woodland.

It has been assumed that 5no. 45 m W19 precast concrete beams will be required to span the 16.5 m width of the proposed bridge, each of which has been assumed to weigh 135 tonnes. As a detailed breakdown of plant and machinery use on site is not available at this stage, fuel use on site 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 Defra 2019 emissions factor for diesel 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 Defra 2019 emissions factor for an average sized petrol car and prorated based on the comparative road lengths of the benchmark scheme and the Proposed Road Development.

The Defra emissions factor for 'Rigid HGV – 7.5-17t, 50% laden' has been used to estimate GHG emissions associated with HGGV transportation. It is assumed that HGVs will be on average 50% laden as they will be 100% laden for one leg of their journey, and 0% laden for the other.

A wastage rate of 5% was applied to all construction materials. As outlined in Chapter 14 (Material Assets), 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).

As road user emissions have not been modelled beyond 2037, the 2037 figure has been assumed each year for the remainder of the design lifetime.

The Sustainable Energy Authority Ireland (SEAI) emissions factor (SEAI, 2018) for electricity has been used to calculate greenhouse gas emissions from operational energy use. As the SEAI emissions factor only accounts for CO_2, it has been adjusted upwards proportionately to account for the other Kyoto Protocol WBCSD and WRI. (n.d.) (GHGs (CO_2e) based on the difference between the Defra 2019 emissions factors for CO_2 and CO_2e.

Maintenance activities during the lifetime of the Proposed Road Development will consist of resurfacing of the road and replacement of road restraint systems and kerbs 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.

16.3 Description of the Existing Environment

16.3.1 Lifecycle GHG Impact Assessment

The land within the boundary of the Proposed Road Development consists mainly of arable land, hedgerows and trees. Trees are present individually in some areas as well as rows of trees and small woodland areas. Existing vegetation on the Site will act as a carbon sink. Also, current use of the Site has minor levels of associated GHG emissions as the land use is largely agricultural. Baseline agricultural GHG emissions are dependent on soil and vegetation types present, and fuel use for the operation of vehicles and machinery.

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 Site boundary and indirect emissions from activities outside the Proposed Road Development site boundary (for example, the transportation of materials to Site and embedded carbon within construction materials).

The baseline for the GHG emissions assessment is a 'business-as-usual' scenario whereby the Proposed Road Development does not go ahead.

16.3.2 Climate Change Resilience Review

16.3.2.1 Current Baseline

The current baseline for the CCR assessment is the current climate in the location of the Proposed Road Development. Historic climate data obtained from the Met Eireann website (Met Eireann, 2020) recorded at the Dublin Airport meteorological station (the closest station to the site for which sufficient historic data was available) for the 20-year period of 1981-2000, in line with the climate projections below, is summarised in Table 16-5.

Table 16-5 Climate - Current Baseline

Climatic Factor	Month	Figure
Average annual maximum daily temperature (ºC)	-	13.1
Warmest month on average (ºC)	July	19.5
Coldest months on average (ºC)	January & February	2.6
Mean annual rainfall levels (mm)	-	747.2
Wettest month on average (mm)	December	77.1
Driest month on average (mm)	July	47.4

16.3.2.2 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 (Nolan, 2008) 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’[53] for winter of 24% and 30%, respectively, are reported under the high emissions scenario.
- 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.
- 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.

16.4 Assessment of Impacts

16.4.1 Lifecycle GHG Impact Assessment

16.4.1.1 Effects During Construction

The total GHG emissions from construction are estimated to be 4,050 tCO_2e. The primary GHG emissions sources and the breakdown of the calculated GHG emissions are shown in Table 16-6.

The greatest contribution to construction emissions is the embodied carbon within construction products (69% of construction emissions), which is not dissimilar to other similar road developments.

Table 16-6 Construction GHG Emissions

Project activity / Emissions source	Total GHG emissions (tCO_2e)	% of construction emissions
Land use change	205	5%
Products	2,810	69%
Construction activities	495	12%
Transport of materials	345	9%
Worker travel	85	2%
Waste disposal	108	3%
Total	4,050	

GHG emissions from construction activities will be limited to the anticipated duration of the construction programme (1.5 years between 2021 and 2022) where all enabling, construction and landscaping will be taking place (that is, workers are on site and plant is running). The average annual construction emissions equate to 2,700 tCO_2e overall.

16.4.1.2 Effects During Operation

Operational GHG emissions are summarised in Table 16-7.

Table 16-7: Operational GHG Emissions

Project activity / Emissions source	Total GHG emissions (tCO2e) (over 60-year design life)	% of operational emissions
Operational energy use	1,385	34%
Maintenance activities	1,335	33%
Vehicle use	1,335	33%
Total	4,060	

[53] A “wet day” is defined as one on which the daily precipitation amount is greater than 20mm. A “very wet day” is defined as one on which the daily precipitation is greater than 30 mm.

Annually, the average operational GHG emissions from operational energy use and maintenance activities equate to approximately 70 tCO_2e, however this figure varies depending on the year of operation (from 45 to 71 tCO_2e) due to the variation in modelled operational vehicle use emissions.

Additional GHG emissions associated with operational vehicle use have been modelled for the year 2022 (-2 tCO_2e) and 2037 (26 tCO_2e). For the purposes of this assessment, an incremental increase has been assumed between 2022 and 2037, and the 2037 figure has been assumed for the rest of the design lifetime.

The operational 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. Also, a power rating of 250W has been assumed for street lighting units; however, due to the incorporation of LED bulbs and dimmable technology in the lighting design, rated power is likely to be lower than 250W and units are not likely to be operating at full power all the time.

16.4.1.3 Significance of Effects

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 (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.*"

The impact of the Proposed Road Development has been compared with Ireland's projected National Emissions Inventories for 2022 and 2040 (under the With Additional Measures scenario) (EPA, 2019) to determine significance. The impact of the Proposed Road Development has also been contextualised by comparing the GHG emissions with the projected Transport Emissions Inventories for 2022 and 2040 (under the With Additional Measures scenario), and with Ireland's transport sector emissions requirements if the 2050 target is to be met.

Table 16-8 GHG Emissions Against Future National Emissions Inventory Scenarios

Year	*Emissions (tCO_2e)*	*Projected national emissions inventory (tCO_2e)*	*Emissions as a % of national emissions inventory*	*Significance*
2022	2,700	61,510,000	0.0044%	Minor
2040	71	55,070,000	0.0001%	Minor

Table 16-9 GHG Emissions Against Future Transport Emissions Inventory Scenarios

Year	*Emissions (tCO_2e)*	*Projected/ required transport emissions inventory (tCO_2e)*	*Emissions as a % of transport emissions inventory*
2022	2,700	13,000,000	0.0208%
2040	73	10,000,000	0.0007%
2050	73	1,000,000	0.0071%

As the GHG emissions associated with the Proposed Road Development do not represent $\geq$1% of the projected National or Transport Emissions Inventories for 2022 and 2040, and as emissions do not exceed the IFC significance threshold of 25,000 tCO_2e in any given year, GHG emissions during construction and operation are considered to be of minor significance.

When contextualised against the Transport Emissions Inventory projections for 2022, 2040 and 2050, GHG emissions as a result of the Proposed Road Development equate to <1%.

16.4.2 Climate Change Resilience Review

16.4.2.1 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.

16.4.2.2 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.
- Increased summer and winter temperatures leading to increased heat stress on infrastructure and assets.

See Section 16.5 for a list of adaptation measures built into the design of the Proposed Road Development to increase its resilience to climate change during operation.

16.4.2.3 Embedded Control Measures

The following CCR measures have been built into the design of Proposed Road Development:

- Climate change impacts will be considered within final detailed drainage system design.
- 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, meaning 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.
- River Blackwater bridge layout and heights have been developed following assessment of potential 1 in 100-year plus climate change.

16.5 Mitigation and Monitoring measures

Although it has been determined that effects from GHG from the Proposed Road Development will likely be of minor significance, the following best practice measures have been proposed:

16.5.1 Lifecycle GHG Impact Assessment

The following GHG mitigation measures have been built into the construction stage of the Proposed Road Development:

- A TMP shall be produced prior to construction and implemented in full, minimising congestion and encouraging car sharing and the use of public transport.
- It is a requirement that a CEMP would 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
- Handling materials efficiently on site 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. GGBS and PFA)
- A requirement for the contractor to implement an Energy Management System for the duration of the works

16.5.1.1 Additional Mitigation and Monitoring

No further mitigation and monitoring beyond the measures already described above are required during the construction and operation of the Proposed Road Development.

16.5.2 Climate Change Resilience Review

Mitigation measures in relation to CCR include:

- The construction stage CEMP will include a requirement to plan for additional mitigation measures to avoid wind-blown dust issues during extending periods of dry weather during the construction period
- Climate change impacts will be considered within maintenance plans and site safety plan

16.5.2.1 Additional Mitigation and Monitoring

No further mitigation and monitoring beyond the measures already described above are required during the construction and operation of the Proposed Road Development.

16.6 Cumulative Impacts

16.6.1 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. 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, as the identified receptor is the global climate and effects are therefore not geographically constrained. Also, as the assessment methodology uses the GHG emissions inventory for Ireland 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.

16.6.2 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.

16.7 Residual Impacts

This section identifies the residual impacts, following the implementation of mitigation and monitoring measures, known as ‘residual impacts’ which cannot be eliminated through design changes or the application of standard mitigation measures.

16.7.1 Lifecycle GHG impact assessment

There will be GHG emissions resulting from both the construction phase and the operational phase of the Proposed Road Development as materials, energy and fuel use, and transport will be required. 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 16.5.

Table 16-10 provides a summary of residual effects on climate.

Table 16-10 Climate Summary of Potential Effects

Description of Effect	*Sensitivity of Receptor*	*Nature of Effect / Geographic Scale*	*Magnitude of Effect*	*Initial Classification of Effect (with embedded mitigation)*	*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)

16.7.2 Climate change resilience review

No residual impacts have been identified in relation to CCR. It is therefore not appropriate to define any mitigation measures further to the ones detailed in Section 16.5.

16.8 Difficulties Encountered

Any difficulties encountered while undertaking this assessment such as incomplete or missing data, and the assumptions made to overcome these difficulties, are outlined in Section 16.2.4.

16.9 References

- BSI. (2011). *PAS 2050:2011 Specification for the assessment of the life cycle greenhouse gas emissions of goods and services,* British Standards Institution.
- Defra. (2019). *UK Government GHG Conversion Factors for Company Reporting,* Department for Environment, Food and Rural Affairs and the Department of Business
- DTTAS. (2009). *Smarter Travel – A Sustainable Transport Future (A New Transport Policy for Ireland 2009 – 2020),* Department of Transport, Tourism and Sport.
- DTTAS. (2019) *Bulletin of Vehicle and Driver Statistics* [online]. Department of Transport, Tourism and Sport .Available at: http://www.dttas.old.gov.ie/press-releases/2019/bulletin-vehicle-and-driver-statistics, Department of Transport, Tourism and Sport.
- Nolan, P. (2008). *Ensemble of Regional Climate Model Projections for Ireland,* Irish Centre for High-End Computing and Meteorology and Climate Centre, School of Mathematical Sciences, University College Dublin, Environmental Protection Agency Research, Wexford, Ireland.
- EPA. (2013). *Ireland's Greenhouse Gas Emission Projections 2012-2030,* Environmental Protection Agency, Wexford, Ireland.
- EPA. (2016). *Ireland's Environment: An Assessment 2016*, Environmental Protection Agency, Wexford, Ireland.
- EPA. (2019). *Ireland's Greenhouse Gas Emissions Projections 2018-2040*, Environmental Protection Agency, Wexford, Ireland.
- Government of Ireland. (2002). *National Spatial Strategy for Ireland 2002 – 2020*.
- Government of Ireland. (2014). Climate Action and Low Carbon Development National Policy Position
- Government of Ireland. (2018). *Project Ireland 2040: National Development Plan 2018-2027*
- Government of Ireland. (2019a). *Project Ireland 2040: National Planning Framework*
- Government of Ireland. (2019b). *Climate Action Plan 2019: To Tackle Climate Breakdown*
- IEMA. (2015). *Environmental Impact Assessment Guide to: Climate Change Resilience and Adaptation,* Institute of Environmental Management and Assessment
- IEMA. (2017). *Environmental Impact Assessment Guide to: Assessing Greenhouse Gas Emissions and Evaluating their Significance*, Institute of Environmental Management and Assessment
- IFC. (2011). *Guidance Note 3.* International Finance Corporation
- MCC. (2013). *Meath County Development Plan 2013-2019 (Consolidated Version, 2016).* Meath County Council, Meath, Ireland.
- MCC. (2009). *Navan Development Plan 2009-2015 (*Incorporating Variation 1, Variation 2 and Variation 3), Meath County Council, Meath, Ireland.
- MCC. (2019). *Meath Climate Action Strategy 2019-2024*. Meath County Council, County Meath.
- Met Eireann. (2020). *Historical Data: Display and Download Historical Data from Current Stations*.
- SEAI. (2018). *Conversion Factors* [online]. Available at: https://www.seai.ie/data-and-insights/seai-statistics/conversion-factors/, Sustainable Energy Authority Ireland
- TII. (2017). *Gas Protocol, A Corporate Accounting and Reporting Standard, The Management of Waste from National Road Construction Projects*, Transport Infrastructure Ireland, Dublin, Ireland.
- WBCSD and WRI. (n.d.). *The Greenhouse,* World Business Council for Sustainable Development and World Resources Institute

Chapter 17: Interactions of the Foregoing

17

17. Interactions of the Foregoing

This chapter of the EIAR evaluates the potential interaction of impacts described within this EIAR, which the Proposed Road Development may have on the receiving environment and sensitive receptors.

As a requirement of the 2014 Directive, and of best practice guidelines and advice notes, the inter-relationships between individual factors must be identified and assessed.

Pursuant to section 50(3)(b) of the Roads Act 1993 (as amended) the EIAR (or EIS as then was under the Roads Act) is to contain:

"*50(3)(b) a description of the aspects of the environment likely to be significantly affected by the proposed road development, including in particular—*

- *human beings, fauna and flora,*
- *soil, water, air, climatic factors and the landscape,*
- *material assets, including the architectural and archaeological heritage, and the cultural heritage,*
- *the inter-relationship between the above factors"*

Article 3 of the 2014 Directive requires that the interactions between the following be assessed:

- Population and Human Health;
- Land and Soil;
- Water;
- Biodiversity;
- Air Quality;
- Cultural Heritage;
- Landscape and Visual; and
- Material Assets.

The interactions between these elements above and that of noise and vibration, climate, as well as major accidents and disasters have also been considered in this chapter.

The EIAR has addressed each of the elements likely to have potential for environmental impact, during the construction and operation phase of the Proposed Road Development. This has been an in-depth and detailed study.

All of the potential impacts 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 impact assessment studies. As a result, any potential impacts were either avoided through design measures, or have been addressed through specific mitigation measures within respective chapters within this EIAR.

No additional mitigation is proposed in this chapter.

This chapter presents a summary of each assessment of the interaction (inter-relationship) of impacts (from the Proposed Road Development) between the various environmental factors.

17.1 Traffic:

Traffic will interact with the following

17.1.1 Landscape

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.

During the operations phase, the Proposed Road Development will introduce traffic and higher traffic speeds than those that occur at present in some parts of the landscape. The existing L34094-1 and R147 provide a precedent for similar scale road infrastructure in some parts of the study area.

Moderate to Significant Adverse effects on the local landscape character of the River Blackwater and its setting will be experienced due to the introduction of roadway infrastructure, bridge and associated components along with the introduction of vehicle movements in a location where there haven't been any previously. Higher visual and landscape effects have been avoided through mitigation by the approach taken to design of the new bridge and the proposed replanting (as outlined in Chapter 12 (Landscape and Visual)).

An indirect positive effect on the landscape/townscape character is the reduction of traffic through the historic core of Navan. The residual effect on the historic townscape of central Navan is therefore Moderate Positive.

Proposed landscape mitigation measures, as outlined in Chapter 12 (Landscape and Visual), their successful implementation and maintenance will result in a reduction of visual effects over time as the proposed screening vegetation matures. However, vehicles will remain visible from a number of viewing locations particularly from residential properties to the immediate south of the River Blackwater and from open areas within Blackwater Park.

17.1.2 Biodiversity

The generation of traffic and the physical presence of the Proposed Road Development during the operational phase has the potential to negatively impact on biodiversity, potentially resulting in severance, disturbance and mortality impacts. Mobile species such as bats, barn owls and other birds could potentially collide with traffic or structures resulting in mortality. The flight paths of bats could also potentially be severed due to the physical presence of the Proposed Road Development. Furthermore, the introduction of lighting in otherwise unlit areas could potentially negatively impact bat activity. As discussed previously, 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 either avoided altogether through design measures or they were addressed through specific mitigation measures in the Chapter 7 (Biodiversity).

17.1.3 Population and Human Health

There is the potential for some negative effects to Population and Human Health to be experienced during the construction phase of the Proposed Road Development; for example, there are likely to be traffic management impacts during the construction of the side road realignments and the at-grade junctions. However, impacts during the construction will be localised and short term in nature. Mitigation measures are outlined in Chapter 6 (Population and Human Health), including traffic control as part of the TMP, and road cleaning and signage are likely to reduce construction phase impacts. In addition to these, only authorised site access points, as directed by the LA, will be used by construction vehicles, which will reduce the potential negative traffic impacts on both road users and local residents.

During the operational phase, the Proposed Road Development will potentially have a net positive effect on the surrounding community. The Proposed Road Development will likely reduce traffic volumes within Navan and at points of traffic congestion on the existing network at crossings of the River Blackwater, potentially improving journey amenity and characteristics for driver. There is also the potential for improvement in general amenity for motorised and non-motorised users and a reduction in severance between Navan town and areas north of the River Blackwater. 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 town and surrounding environs. This also has the potential to indirectly improve physical exercise and health in environs surrounding the Proposed Road Development.

17.1.4 Water

During the construction and operational phase of the Proposed Road Development, there is risk of pollution due to accidental spillage and leaks from activities carried out close to the River Blackwater, as well as a risk of polluted drainage and discharges from site entering receiving water courses.

However, the embedded control measures outlined in Chapter 7 (Water) will minimise the potential for any adverse impacts to receiving water courses from the construction and operational phases of the Proposed Road Development; for example, 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.

17.1.5 Land and Soils

Accidental spillage or leakage of oils and fuels from construction machinery or site vehicles may 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. However, the implementation embedded control measures outlined in Chapter 08 (Land and Soils) will significantly reduce the likelihood and magnitude of the potential impacts on land and soils occurring during the operational phase.

17.1.6 Noise and Vibration

There is potential for negative noise and vibration impacts to occur at residential properties and other sensitive receptors as a result of construction traffic using the existing road network during the construction phase. The potential for such impacts, and hence significant adverse effects, is dependent on the volume and route of construction traffic. Although the volume of construction traffic and its routing is not available, it is considered that significant adverse effects due to construction traffic are unlikely to occur. Construction traffic levels are expected to be below 10% of current AM/PM peak traffic levels and will be managed via a construction stage traffic management plan.

Subject to the installation of low noise road surfacing materials and the installation of a noise barrier during the operational phase, as discussed in Chapter 11 (Noise and Vibration), all residential receptors will comply with the TII/NRA design criteria; therefore, no significant effects are likely to occur.

17.1.7 Air Quality

The major air quality impacts will be associated with dust generation during site preparation and construction works. The implementation of appropriate control measures, and best management practices will minimise the generation of dust during construction, therefore no significant effects are anticipated

During the operational phase the main air emission will be from road traffic using the Proposed Road Development; however, an air quality assessment during the operational phase of the Proposed Road Development was carried out and the results show that all of the predicted concentrations are in compliance with the air quality standard, as outlined in Chapter 10 (Air Quality).

17.1.8 Climate

During construction phase, onsite construction activities such as the disposal and transportation of earthworks and waste would result in GHG emissions resulting from fuel consumption by construction plant and vehicles, generators in use on site and worker commuting. During the operational phase, GHG emissions can result from vehicle use from additional journeys, energy use for aspects of the Proposed Road Development such as lighting, and the maintenance of infrastructure and assets.

The GHG emissions associated with the Proposed Road Development do not exceed the IFC significance threshold in any given year and do not represent >1% of the projected National or Transport Emissions Inventories for 2022 and 2040, GHG emissions during construction and operation are considered to be of minor significance.

There will be GHG emissions resulting from both the construction and operational phase of the Proposed Road Development as materials, energy and fuel use, and transport will be required. However, as none of the effects are major and of high significance it is not appropriate to define any additional mitigation measures then those outlined in Chapter 16 (Climate).

17.1.9 Cultural Heritage

The introduction of traffic during the operational phase will create new noise sources to some of the identified protected structures in the area. However, this will not reduce the architectural, historic or archaeological interest of the bridge and will therefore have a neutral effect upon it.

17.1.10 Major Accidents and Disasters

A potential source of a major accident related to road developments is road traffic accidents during construction and operation; these can clearly impact on people though fatalities and serious injury, but can also impact on the environment, through the spillage of fuel and hazardous loads. The Proposed Road Development, as outlined in Chapter 5 (Traffic Analysis), will be of a higher safety standard than existing routes and will therefore contribute to a network wide reduction in collisions.

The consideration of embedded control measures; for example, with regards to flood risk, the proposed settlement pond and tanks 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; compliance with legislation and best practices has demonstrated that the risk of a major traffic related accident is considered low.

17.2 Land and Soils

Land and Soils will interact with the following:

17.2.1 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 may result in some temporary air quality, noise and neighbourhood amenity impacts.

Appropriate mitigation measures outlined in Chapter 6 (Population and Human Health), will likely reduce identified construction phase negative impacts.

17.2.2 Biodiversity

Various construction activities have the potential to release sediment and cause unacceptable sediment levels in the catchment area, which have potentially significant pollution impact on water quality or the physical structure of the river bed. These potential impacts could significantly affect spawning habitats for QI Atlantic salmon and river lamprey of the River Boyne and Blackwater SAC, reduce available invertebrate prey for QI Atlantic salmon, and/or reduce available fish prey of river lamprey.

Any significant effects on fish or water quality in the Blackwater River could also significantly affect QI otter of the River Boyne and Blackwater SAC, and SCI kingfisher of the River Boyne and Blackwater SPA.

The embedded control measures outlined in Chapter 8 (Land and Soil) will minimise the potential for any adverse effects to biodiversity from contaminated sediment from the Proposed Road Development during the construction and operational phase.

17.2.3 Cultural Heritage

The Proposed Road Development will cross agricultural land that has good potential to contain previously unrecorded archaeological features as shown by the ring ditches, enclosures and kilns uncovered during the construction of the adjacent Blackwater Park in 2012. Any such archaeological features are likely to be of local interest and of low importance. Groundworks associated with the construction of the Proposed Road Development would severely impact upon any such archaeological remains should they exist and would alter the special interests or qualities of an asset. The magnitude of this effect would be very high leading to a significant effect. As a result, archaeological testing will be carried out at the pre-construction phase in areas identified in the construction impacts section where the Proposed Road Development has the potential to impact upon archaeological remains. All archaeological works (which will be agreed by the Archaeological Consultant and the NMS will be 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).

17.2.4 Water

Various construction activities have the potential to release sediment and cause unacceptable sediment levels in the catchment area. Site stripping and bulk earthworks would 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.

The embedded control measures outlined in Chapter 8 (Land and Soil) will minimise the potential for any adverse impacts to water features in the area from the Proposed Road Development.

17.2.5 Landscape and Visual

Site clearance and earthworks are among the more visible operations and will inevitably have a 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, as outlined in Chapter 12 (Landscape and Visual).

17.2.6 Noise and Vibration

The excavation, processing and transportation of material on and off site have the potential to create negative noise impacts during the construction phase. Appropriate mitigation measures to help reduce such noise impacts are outlined in Chapter 11 (Noise and Vibration).

17.2.7 Air Quality

The excavation, processing and transportation of material on and off site have the potential to create negative air quality impacts from dust arising during the construction phase. Appropriate mitigation measures to help reduce such air impacts are outlined in Chapter 10 (Air Quality).

17.2.8 Climate

Construction activities such as land clearance and land use change can effect GHG emissions resulting from a loss of a carbon sink.

However, with embedded control measures and identified mitigation measures, as outlined in Chapter 16 (Climate) none of the potential effects from GHG emissions were identified to be of major or high significance.

17.3 Noise and Vibration

Noise and Vibration will interact with the following:

17.3.1 Cultural Heritage

It is likely that the Proposed Road Development will be partially visible from the protected structure railway bridge (NT025-173) and noise from traffic heard from the bridge once operational. However, the Proposed Road Development will not reduce the architectural, historic or archaeological interest of the bridge and will therefore have a neutral effect upon it.

It is likely that once the Proposed Road Development is operational, it will be visible from the protected structure Spicers Blackwater Mill. This will alter the setting of the protected structure which is currently a feature on the riverside walk in Blackwater Park with noise from the additional traffic also creating an impact. Mitigation in the form of screening of development boundaries will be completed although this would not perceptibly reduce the overall level of the significance of effect from slight. The residual significance of effect would be slight, negative and long-term.

17.3.2 Population and Human Health

Given the likely methods of work, scale and materials involved in the construction phase, it is considered that with good site practice, impacts from construction works, including noise and vibration impacts, would be managed.

During the operational phase, two residential properties were predicted to exceed the TII/NRA's design criteria prior to mitigation; however, the use of low noise road surfacing materials and the installation of a noise barrier will result in these residential receptors complying with the aforementioned criteria. The Proposed Road Development is likely to decrease the volume of traffic on the existing N51 corridor through the town centre, as traffic is transferred onto the Proposed Road Development. The improved traffic flows would be expected to reduce noise impacts in the town centre.

17.3.3 Landscape

During the operational phase, the proposed noise barrier at a height of 1.5 m high will introduce structures associated with large scale road infrastructure into the landscape adjacent to existing residential receptors where there is currently mature tree vegetation. Native woodland screen planting has been used to soften the effect of this noise mitigation measure, which will result in a reduction of visual effects over time as the proposed screening vegetation matures.

17.3.4 Biodiversity

Noise and visible presence from construction staff and vehicles could displace foraging or commuting QI otter and SCI kingfisher of the River Boyne and Blackwater SAC if present during construction. Potential displacement impacts to foraging otter and kingfisher would be limited to local level for the duration of construction (i.e. short-term). Appropriate mitigation measures, as outlined in Chapter 7 (Biodiversity), including appointing a site Ecologist who shall supervise setting out of the works will likely reduce negative impacts.

17.3.5 Material Assets

During the construction phase, there is potential for ground vibration due to the construction phase works which will mainly result from the use of vibratory rollers to compact earthworks and road surfacing. Residential properties on Windtown Road, directly to east of new link road, and Windtown Crescent have the potential to be worst affected by vibration, should vibratory rollers be used for surfacing compaction activities. However, it is unlikely that values set by the TII/NRA will be met and hence the likelihood of damage to buildings as a result of the use of vibratory rollers is considered to be negligible. Therefore, significant adverse effects due to vibration during construction works are unlikely to occur.

17.4 Water

Water will interact with the following:

17.4.1 Population and Human Health

The Proposed Road Development will produce surface water and waste water discharges; for example, discharge from vehicle wash-down water, which have the potential to impact human health.

During the construction phase and operational phase, the mitigation measures outlined in Chapter 9 (Water) will ensure that no sediment contamination, contaminated runoff or untreated wastewater will enter watercourses on or near the Proposed Road Development site. For example, during the operational phase, 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 hydrocarbon interceptors prior to discharge to a surface water siltation and attenuation pond or tanks before entering the River Blackwater.

17.4.2 Biodiversity

Silt, and/or contaminants including oils, fuels, paints, lubricants, and/or concrete washings could have potentially significant pollution impacts on water quality or the physical structure of the river bed during the constriction and operational phase. These potential impacts could significantly affect spawning habitats for QI Atlantic salmon and river lamprey of the River Boyne and Blackwater SAC.

The mitigation measures outlined in Chapter 7 (Biodiversity), as well as the implementation of embedded control measures will significantly reduce the likelihood and magnitude of the potential impacts on the water environment occurring during the construction phase.

17.4.3 Land and Soils

The embedded control measures outlined in Chapter 9 (Water) will minimise the potential for adverse impacts to land and soils from water discharges from the Proposed Road Development during the construction and operational phase. As such, likely significant permanent effects on receiving watercourses are not anticipated.

17.4.4 Major Accidents and Disasters

As outlined in Section 17.1.10, road traffic accidents can also impact on the environment, through the spillage of fuel and hazardous loads. The Proposed Road Development will provide road surface water runoff collection and treatment facilities so that rainfall from all paved areas is effectively removed from the road surface and treated before discharge to the existing water environment. This includes the provision for cut-off and storage in the event of a road accident causing spillage of deleterious materials. Therefore, the consideration of embedded measures, and best practices has demonstrated that risk of a major accident is low during the operational phase.

Both the vulnerability of the Proposed Road Development to flooding, and its potential to exacerbate flooding, are covered in the FRA and Chapter 9 (Water) in the EIAR, both in terms of the risk to the scheme and increased risk due to the scheme. With regards to flood risk, the proposed settlement pond and attenuation tanks 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, as outlined above. Therefore, the consideration of embedded measures, and best practices has demonstrated that risk of a major flood disaster is low.

17.5 Biodiversity

Biodiversity will interact with the following:

17.5.1 Landscape and Visual

Mitigation measures outlined in the Biodiversity chapter include the planting of native, species-rich woodland and grassland areas within the Proposed Road Development site, which will in turn assist in reducing identified potential adverse landscape and visual impacts.

17.6 Air Quality

Air Quality will interact with the following:

17.6.1 Population and Human Health

There will be the potential for dust emissions during the construction stage of the Proposed Road Development; these will be managed by a dust control management plan to minimise potential for impact to human health.

During the operational phase, the Proposed Road Development is likely to decrease the volume of traffic on the existing N51 corridor through the town centre, as traffic is transferred onto the Proposed Road Development. The improved traffic flows would be expected to improve air quality impacts in the town centre.

17.6.2 Biodiversity

As described in Chapter 10 (Air Quality), air emissions are predicted to comply with relevant guidance and standards. As such, the effects of air quality will be managed so as to have neutral effect on biodiversity.

17.6.3 Major Accidents and Disasters

Vehicles emissions can contribute to poor air quality; however, results from the air quality assessment during the operational phase of the Proposed Road Development carried out show that all of the predicted concentrations are in compliance with the air quality standards.

The assessment of construction phase impacts predicts a slight adverse impact on amenity due to dust, and a negligible effect on health as a result of increases in PM_{10} concentrations. However, with the implementation of the mitigation measures, no significant residual effects are likely; therefore, the risk of a major air quality event is considered low.

During the operational phase, no predicted exceedances of the Air Quality Standard Limit Values are expected, thus there would be no significant effects on air quality; therefore, the risk of a major air quality event is considered low.

17.6.4 Climate

The total GHG emissions from construction are estimated to be 4,050 tCO2e. The greatest contribution to construction emissions that will impact on climate is the embodied carbon within construction products (69% of construction emissions), which is not dissimilar to other similar road developments. GHG emissions from construction activities will be limited to the anticipated duration of the construction programme (1.5 years between 2021 and 2022).

Annually, the average operational GHG emissions from operational energy use and maintenance activities equate to approximately 70 tCO2e; this figure varies depending on the year of operation (from 45 to 71 tCO2e) due to the variation in modelled operational vehicle use emissions.

However, as the GHG emissions associated with the Proposed Road Development do not represent $\geq$1% of the projected National or Transport Emissions Inventories for 2022 and 2040, and as emissions do not exceed the IFC significance threshold of 25,000 tCO_2e in any given year, GHG emissions during construction and operation are considered to be of minor significance.

17.7 Landscape and Visual

Landscape and Visual will interact with the following:

17.7.1 Population and Human Health

Construction plant and traffic will potentially distract motorised and non-motorised uses from available amenity views at the junctions at the Ratholdron Road and Clonmagadden Road, and at the N51 and existing R147. Any effects experienced will be restricted to a local scale and will be temporary and short term in nature. As outlined in Section 16.1.1, there are limited opportunities for mitigating the short-term visual effects associated with road construction.

During the operational phase, new pedestrian infrastructure through the study area will be a positive landscape effect as it will formalise existing often semi-official pedestrian crossings and provide a safe access between communities.

During the construction phase, temporary fencing, removal of road/pavement surfaces, road closures, traffic management works, signage and earthworks will have an effect upon the local landscape and views towards the construction site. However, effects will be temporary or short-term and will have no long-term landscape or visual effects.

During the operational phase, vehicles and elevated parts of the road alignment including the new bridge will remain visible from a number of viewing locations particularly from residential properties to the immediate south of the River Blackwater and from open areas within Blackwater Park. Following mitigation planting and the replanting of riverside vegetation, close distance visibility of the new bridge will be limited to a relatively short stretch of the Blackwater River and limited areas within Blackwater Park.

17.7.2 Biodiversity

Vegetation will be required to be removed to facilitate the construction of the Proposed Road Development which will result in negative effects on landscape quality, visual amenity and biodiversity.

Landscape mitigation measures have been developed in line with ecological requirements. For example, wildflower mixes from native stock will be used on verges to maximise biodiversity during the operational phase. In addition to this, native woodlands planting is proposed along roadside embankments and adjacent areas aligned with the new road corridor.

17.8 Material Assets

Material Assets will interact with the following:

17.8.1 Population and Human Health

The Proposed Road Development includes the provision for new overhead electricity lines and cables, as well as the realignment of a number of existing service cables, which could result in a suspension of services during the construction and diversion works. Additionally, water supply could be suspended temporarily during excavation works for realignment at the proposed north and south junction. However, utility service suspensions were identified to be temporary and residual impacts considered imperceptible during the construction phase and as consultation with service providers will ensure the disruption to services or outages will be carefully planned so the duration is minimised. No residual impacts from service suspensions were identified during the operational phase. As the service suspensions are likely to temporary the impact on human health is likely to be neutral.

Disruption to electricity, gas, telecommunications, clean water supply and drainage have the potential to impact on the physical and mental health of a population. However, as the service suspensions are likely to be temporary the effect on the local community is likely to be neutral.

The Proposed Road Development will also result in the permanent acquisition of 2.18 ha of agricultural land and 1.76 ha of park land (The Blackwater Park), resulting in a negative, long term and moderate effect on existing land use in this area. Overall it is expected the construction phase of the Proposed Road Development will have short term neutral effect on severance resulting from diversions and severance of access tracks. During the operational phase, the additional crossing over the River Blackwater and provision of cyclist and pedestrian facilities provided by the Proposed Road Development has potential to have a long term, positive effect on users of the Proposed Road Development.

17.8.2 Major Accidents and Disasters

During the construction phase of the Proposed Road Development, some realignment, or replacement of services and utilities may be required in conjunction with or to accommodate the proposed works. These works could result in utilities failures, potentially resulting in fatalities, injuries and damage to properties. However, 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. In addition to this, any proposed utilities diversions will be done in consultation with the relevant statutory bodies.

Therefore, the consideration mitigation measures, compliance with legislation and best practices has demonstrated that the risk of a major utility failure accident is low.

17.9 Major Accidents and Disasters

Major accidents and disasters will interact with the following:

17.9.1 Population and Human Health

Major accidents and disasters can result in illness, injury or loss of life to a population either directly or indirectly. Chapter 15 (Major Accidents and Disaster) has considered a number of potential accidents and disasters that could result from or affect the Proposed Road Development. These included flood events, air quality events, utilities failure, and major transport accidents. It was concluded that no major accident and disaster risks were identified that would require additional consideration within the EIAR. The consideration of embedded measures and compliance with legislation and best practices has demonstrated that the risks associated with major accidents and disasters in the context of the Proposed Road Development are sufficient for all risks. Therefore, no significant effects from MADs on the population and human health are anticipated.

17.10 Climate

17.10.1 Population and Human Health

Potential climate risks to the Proposed Road Development (climate change resilience) during the construction phase include health and safety risks to the workforce during severe weather events and an inaccessible construction site due to severe weather event (flooding, snow and ice, storms) restricting working hours and delaying construction.

However, with the implementation of climate change resilience mitigation measures outlined in Chapter 16 (Climate), no residual impacts have been identified.

17.10.2 Biodiversity

During the operational phase, the Proposed Road Development may be vulnerable to a range of climate risks, including, increased frequency and severity of extreme weather events (such as heavy and/or prolonged precipitation, storm events and heatwaves) leading to possible flooding from drainage systems during intense or prolonged rainfall, which could lead to negative impacts to sensitive ecological receptors.

However, with embedded control measures for the Proposed Road Development, there is no risk of the operational drainage system being flooded. No residual impacts have been identified in relation to climate change resilience.

17.10.3 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, storm events and heatwaves) which could lead to damage to drainage systems due to flooding from intense rainfall. Increases in winter precipitation could also lead to surface water flooding and standing waters.

However, 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, no residual impacts have been identified in relation to climate change resilience.

17.10.4 Material Assets

Potential climate risks to the Proposed Road Development (climate change resilience) have been identified during both the construction and operational phase; for example, damage to temporary facilities/assets within the Proposed Road Development site boundary, such as offices, compounds, material storage areas and worksites from stormy weather. In addition to this, increased frequency and severity of extreme weather events (such as heavy and/or prolonged precipitation, storm events and heatwaves) could lead to damage to utilities due to stormy periods and intense rainfall, as well as increased summer and winter temperatures leading to increased heat stress on infrastructure and assets during the operational phase. The CEMP will serve to manage these risks where practicable by upkeep of drainage infrastructure on site in a timely and functional manner and the minimisation of unsecured materials on site liable to wind effects.

However, with the implementation mitigation measures identified for the Proposed Road Development in Chapter 16 (Climate), no residual impacts have been identified in relation to climate change resilience.

17.10.5 Major Accidents and Disasters

A number of embedded control measures, which are outlined in Chapter 4 (Description of the Proposed Road Development) will increase the development's resilience to climate change; for example, increased frequency and severity of extreme weather events (such as heavy and/or prolonged precipitation, storm events and heatwaves) during both the construction and operational phase. Therefore, no residual impacts have been identified in relation to climate change resilience (this is discussed further in Chapter 16 (Climate)).

17.11 Summary

In summary, no significant effects are predicted from the interactions of the constituent elements of the Proposed Road Development when viewed in the light of their associated mitigation measures. The interactions are summarised in Table 17-1 overleaf.

Table 17-1 Interactions

Interaction	Population & Human Health		Biodiversity		Land & Soils		Water		Air Quality		Noise & Vibration		Landscape & Visual		Material Assets		Traffic		Cultural Heritage		Major Accidents and Disasters		Climate	
	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.	Con.	Op.
Population & Human Health																								
Biodiversity	✘	✘																						
Land & Soils	✓	✘	✓	✘																				
Water	✓	✓	✓	✓	✓	✓																		
Air Quality	✓	✓	✓	✓	✓	✘	✘	✘																
Noise & Vibration	✓	✓	✓	✓	✘	✓	✘	✘	✘	✘														
Landscape & Visual	✓	✓	✓	✓	✓	✘	✘	✘	✘	✘	✘	✓												
Material Assets	✓	✓	✘	✘	✘	✘	✘	✘	✘	✘	✓	✓	✘	✘										
Traffic	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✘	✘								
Cultural Heritage	✘	✘	✘	✘	✓	✘	✘	✘	✘	✘	✓	✓	✘	✘	✘	✘	✘	✓						
Major Accidents and Disasters	✓	✓	✘	✘	✘	✘	✘	✓	✓	✓	✘	✘	✘	✘	✓	✘	✓	✓	✘	✘				
Climate	✓	✘	✘	✓	✓	✘	✘	✓	✓	✓	✘	✘	✘	✘	✓	✓	✓	✓	✘	✘	✓	✓		

Con.	Construction Phase	✓	Weak / Some / Strong Interaction
Op.	Operational Phase	✘	No Interaction

Appendix 18: Schedule of Mitigation Measures

18

18. Schedule of Mitigation Measures

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
General	N/A	C	Temporary works and traffic management of the existing road network will be required to facilitate the traffic movements during the construction phase of the Proposed Road Development. The actual traffic management plans and diversions to be implemented at the interface between the works and traffic will however be the appointed contractor's responsibility. A Traffic management plan (to be developed in conjunction with the Local Authority Roads Section) including details of routing of network traffic; temporary road closures; temporary signal strategy; routing of construction traffic; programme of vehicular arrivals; on-site parking for vehicles and workers; road cleaning; and other traffic management requirements. The appointed contractor will be also responsible for acquiring the necessary licensing and permissions for the use of these roads with regard to temporary closures and traffic management.
Population and Health	Ch.6, Sec.6.6	C	Road surfaces in the proximity of the construction site are to be kept clear of mud and debris as much as is possible and road closures and restrictions should be planned in agreement with the appropriate stakeholders.
Population and Health	Ch.6, Sec.6.6	O	Landscape mitigation planting should be as outlined within Chapter 12: Landscape and Visual Impact Assessment.
Population and Health	Ch.6, Sec.6.6	O	Route uncertainty should be minimised as much as is possible by the provision of appropriate signage designed and sited in accordance with appropriate standards.
Population and Health	Ch.6, Sec.6.6	O	Surface water runoff is to be managed appropriately in accordance with best practice standards.
HIA	Appendix A6-1	C & O	Closures of footpaths and other NMU routes should be incorporated into a CEMP and include details of any diversion measures and access points that will be implemented.
HIA	Appendix A6-1	C & O	Maintain access for non-motorised users to community assets with minimal disruption as far as is possible. Where diversions are required non-motorised users should be considered and facilitated to continue their journey with minimal disruption as far as possible. This should include provisions for vulnerable non-motorised users such as the elderly and school children.
HIA	Appendix A6-1	C & O	Landscape mitigation planting should be provided to minimise any impacts to amenity as far as is possible.
HIA	Appendix A6-1	C & O	Clear signage of any temporarily diversions to existing motorised and non-motorised routes (including pedestrians and cyclists).
HIA	Appendix A6-1	C & O	Local employment and use of local suppliers during the construction phase should be promoted via local procurement arrangements.
HIA	Appendix A6-1	C & O	The Applicant should consider seeking a contractor who will implement requirements or company policies to offer training and employment opportunities within the local community.
HIA	Appendix A6-1	C & O	Opportunities to re-use material resources should be sought. Use of recycled plastic bitumen in pavements could be considered.
HIA	Appendix A6-1	C & O	Implementation of mitigation measures will be set out in the CEMP. Surface water runoff is to be managed appropriately in accordance with best practice standards.
Biodiversity (General Mitigation)	Ch.7, Sec.7.5	C	Installation of an attenuation pond/tanks, including treatment and attenuation of all surface water to appropriate standards prior to discharge to the River Blackwater.
Biodiversity (General Mitigation)	Ch.7, Sec.7.5	C	Adequate freeboard above the River Blackwater (2.5 m) allowing for safe passage of QI otter of the River Boyne and River Blackwater SAC and SCI kingfisher of the River Boyne and River Blackwater SPA.
Biodiversity (General Mitigation)	Ch.7, Sec.7.5	C	Control measures such as silt fencing will be used throughout the construction phase to reduce the risk to the River Boyne and River

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
			Blackwater and the SAC and SPA. Regular monitoring and recording of the effectiveness of the control measures will be implemented with additional control measures employed if and when required.
Biodiversity (General Mitigation)	Ch.7, Sec.7.5	C	The proposed bridge abutments comprise a setback distance of 10 m and 7.5 m respectively from the River Blackwater, thereby maintaining a natural corridor on either side of the river bank.
Biodiversity (General Mitigation)	Ch.7, Sec.7.5.1.10	C	Implementation of mitigation for breeding birds (Section 7.5.2.11) will avoid vegetation removal during March-August inclusive where possible with the exception of earthworks required from the period July to September inclusive at the location of the proposed cut-off wall proposed bridge abutments (to minimise any potential impacts on fisheries in proximity to the River Blackwater and seasonal constraints in line with IFI Guidelines (IFI, 2016)). A derogation licence under Section 55 of European Communities Regs 2011 may be sought to carry out the works (vegetation clearance) to comply with the requirements of the provisions of Regulation 53. However, construction works will adhere to avoid vegetation removal where possible. The construction works will primarily be carried out during dry weather periods largely restricted to summer months. This mitigation will simultaneously avoid the majority of the main breeding season for pygmy shrew and hedgehog which run from April-October, and stoat, which breeds in May-June (Hayden and Harrington, 2001).
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.1	Pre - C	Prior to commencement of construction, a suitably experienced Ecologist (the Ecologist), will be engaged as part of the ER Team. The Ecologist will be a full member of a relevant professional institute such as the 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 Ecologist shall be appointed sufficiently in advance of the Proposed Road Development to arrange for any mitigation requirements to be incorporated into the appointed contractor's site-specific Method Statements and programme. The appointed contractor will accommodate the Ecologist, whose role will be to: Oversee carrying out of pre-construction surveys to the appropriate NRA specifications (NRA, 2005-2011); Communicate relevant matters to MCC, and other stakeholders as relevant; Review Contractor Method Statements for compliance with the mitigation in this NIS; Attend site meetings and input to contractor toolbox talks prior to commencement of the Proposed Road Development; and, Supervise and direct construction of the Proposed Road Development as part of the ESR Team (Ecological Clerk of Works).
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.2	Pre - C	At least two months in advance of commencing any construction works (including enabling or advance works), the Ecologist will oversee the design and implementation of pre-construction surveys having regard for best available scientific knowledge including the specifications in the NRA 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 2017 and 2018. The required surveys are listed in Section 7.5.1.2 of the EIAR.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	Pre - C	Construction Phase earthworks to avoid periods of relatively high rainfall, in conjunction with flood forecasting
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	Pre - C	Phasing and other silt control measures to be refined by the appointed contractor into a CESCP, which will be agreed between MCC and the appointed Ecologist.
Biodiversity	Ch.7, Sec.7.5.1.3	Pre – C	The primary construction compound would be located in the land located to the south-west of the existing T-junction between L3409 Ratholdron Road and L34094-1 Clonmagadden Road. An

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
(Pollution Control Mitigation)			alternative and secondary compound is proposed to the north of the existing N51/R147 roundabout on the land currently occupied by a commercial building to be demolished.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Use of high-performance silt fencing, whose efficacy has been proven by credible evidence.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Use of a single layer of high-performance silt fence around all other works adjacent or in close proximity to the SAC; and specifically, and exclusively following installation methods outlined in published literature to maximize the effectiveness of particle filtration by geotextiles.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Use of a triple layer of high-performance silt fence, in conjunction with sandbags, within 50 m of the boundary of the River Boyne and River Blackwater SAC/SPA.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Supervision of installation and performance throughout construction of silt fencing and other pollution control measures by the Ecologist and ER Team who will advise the appointed contractor on repairs required to maximize performance (including repair of sandbags).
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Use of silt dewatering bags or tubes in conjunction with filter drains and other means necessary to capture, attenuate, and treat surface water generated during construction prior to any discharge to watercourses (subject to the relevant licenses).
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Use of geo-textile or timber mats within the 0.1% AEP flood level (1:1000 year) to minimise erosion of soils during tracking of machinery over other vegetated ground.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Fuel handling and bunding procedures during the works, in unsurfaced areas of the site and in areas near rivers, streams and watercourses.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Appointed contractor to adopt and provide evidence to MCC and the Ecologist of staff training in Spill Response & Control Plan to minimize the risk of adverse impacts upon surface waters and groundwater in the unlikely event of accidental spillages, flooding or other emergencies.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Procedures for dewatering the working area to include adequate treatment of any resulting silt-laden surface water prior to discharge.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Establishment of contingency measures to cater for impacts to unknown services underlying the construction site (for example, old sewers, culverts)
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Control of mud at entry and exit points to the works area using wheel washes.
Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3	C	Material and machinery storage to be outside the 1% AEP flood level (1:100 year).
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	Pre - C	An ISMP will be produced by the appointed contractor to determine the appropriate methods for treatment, control, and/or removal of Japanese knotweed. The ISMP will be informed by a pre-construction survey. The pre-construction survey will be carried out during the growing season (i.e. from May to September) to assess if new populations of invasive species have become established since the original surveys were completed in 2017 and 2018 to inform this EIAR. The Ecologist will review the draft ISMP to ensure it has due regard for emerging best scientific knowledge.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	Pre - C	In addition to the preparation of an ISMP, the proposed works will adopt best practice control measures to avoid the potential for cross-contamination with infested areas. The project and ISMP will have due regard to the relevant biosecurity measures throughout all phases of the project:

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	Pre - C	Clearly identify and mark out the infested areas of Japanese knotweed to inform construction personnel and operating machinery. Infested areas of Japanese knotweed will be fenced off (where possible) and signage will be installed to highlight the location of invasive species.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	Pre - C	Create dedicated exclusion zone entry and exit points for operators on foot and for mobile equipment in the vicinity of infested areas comprising stands of Japanese knotweed.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	Pre - C	All earthworks machinery will be thoroughly pressure-washed prior to arrival on site and prior to their use elsewhere.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	Pre – C	Wheel washing facilities will be provided at the site entrance. All washing must be carried out in areas with no potential to result in the spread of invasive species.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	C	Care will be taken not to disturb or cause the movement of fragments of invasive species, either intentionally or accidentally.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	C	All plant machinery and construction personnel will be restricted to the footprint of the proposed works area and will avoid unnecessary crossings in adjoining areas known to support stands of Japanese knotweed.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	C	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 seven metres will be applied to avoid disturbance of lateral rhizomes.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	C	Machinery must be thoroughly pressure-washed in a designated area at least 25 metres from any watercourse before moving on to an area that is not yet infected.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	C	All contractors and staff will be briefed about the presence, identification and significance of Japanese knotweed before commencement of works.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4		For any material entering the site, the supplier must provide an assurance that it is free of invasive species (i.e. Japanese knotweed).
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	C	Good construction site hygiene will be employed to prevent the spread of these 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.
Biodiversity (Invasive Species)	Ch.7, Sec.7.5.1.4	C	The treatment and control of invasive alien species will follow guidelines issued by the PCA (2018) – Practical Management of Invasive Non-Native Weeds in Britain and Ireland. And with reference to the NRA's '*The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads'* (NRA 2010) where appropriate.
Biodiversity (Emergency Response and Environmental Training)	Ch.7, Sec.7.5.1.5	Pre - C	The appointed contractor shall produce an ERP based on the contractor's own Risk Assessment, which will be reviewed by the Employer's Representative Team, including the Ecologist. 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 appointed 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 shall be carried by the appointed contractor.
General	Ch.7, Sec.7.5.1.6	Pre - C	Prior to any demolition, excavation or construction, a CEMP will be produced by the appointed contractor, which will detail the appointed contractor's overall management and administration of

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (CEMP) Material Assets	 Ch.14, Sec.14.5.1		the works and incorporates. The CEMP produced by the appointed contractor 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 will be included within the CEMP as well as a method of documenting compliance with the mitigation measures; • The final Schedule of Environmental Commitments will be included in the CEMP. The CEMP will detail implementation methodologies for all environmental commitments. • A list of all applicable environmental legislation requirements and a method of documenting compliance with these requirements. • Outline methods by which construction work will be managed to avoid, reduce or remedy potential adverse impacts on the environment. Contract documents will include a requirement for the appointed contractor to produce, finalise and update the CEMP for the Proposed Road Development prior to construction and to implement and maintain the CEMP during the construction phase.
Biodiversity (CEMP)	Ch.7, Sec.7.5.1.6	C	To oversee the implementation of the CEMP, the appointed contractor will be required to appoint a responsible manager to ensure that the mitigation measures included in the NIS, EIAR and the CEMP, as well as a mitigation requirements outlined within planning conditions are executed in the construction of the works and to monitor that those mitigation measures employed are functioning properly.
Biodiversity (C&D WWP) Material Assets	Ch.7, Sec.7.5.1.6.1 Ch.14, Sec.14.5.1	Pre-C	Included within the CEMP will be the WMP which clearly sets out the appointed 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 the appointed contractor's proposals regarding the treatment, storage and recovery or disposal of waste. These control measures will be incorporated into any future construction contract as the minimum standard required to be implemented by the appointed contractor. • 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.
Biodiversity (CESCP)	Ch.7, Sec.7.5.1.6.2	Pre - C	A CESCP will be prepared at detail design stage for the Proposed Road Development. These mitigation measures will be implemented in full and will ensure that sediment laden runoff from the construction site does not enter watercourses or water bodies with an emphasis on the River Boyne and River Blackwater SAC/ SPA.
Biodiversity (CESCP)	Ch.7, Sec.7.5.2.6	Pre - C	The contract documents for the Proposed Road Development will place an obligation on the appointed contractor to further develop the CESCP 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 appointed contractor to reflect different construction approaches but shall, as an absolute minimum, include all the measures, mitigations, controls, requirements, procedures, etc. included the CESCP.
Biodiversity (Mitigation for European Sites (River Boyne and	Ch.7, Sec.7.5	C	Installation of a temporary cut off wall (i.e. proposed construction sequence for the bridge is to construct a large 1 m wide and up to 5 m deep cut off wall) which will minimise seepage and overtopping from the construction zone adjacent to the River Boyne and River Blackwater SAC and SPA. The temporary cut off

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
River Blackwater SAC and SPA) Biodiversity (Pollution Control Mitigation)	Ch.7, Sec.7.5.1.3		wall coupled with dewatering measures will create a safe and dry works area and will be constructed using an excavator on bog mats and a trench box. The cut off wall will be designed to ensure it caters for the flood level to avoid the risk of flood to the construction zone. The proposed cut-off area serves as a coffer dam to protect the working area from potential ingress of flood waters. As such, no significant pollution impacts will occur from the construction works within the flood plain of the River Blackwater.
Biodiversity (Mitigation for European Sites (River Boyne and River Blackwater SAC and SPA)	Ch.7, Sec.7.5.1.7.2	Pre – C & C	The Ecologist shall supervise setting out of the works to avoid the potential for QI alluvial forest of the River Boyne and Blackwater SAC (which are located c. 25 m west of the Proposed Road Development) to be disturbed during works.
Biodiversity (Mitigation for European Sites (River Boyne and River Blackwater SAC and SPA)	Ch.7, Sec.7.5.1.7.2	C	A number of measures are proposed to avoid disturbance and habitat deterioration of QI alluvial forest (Volume 3, Figure 7.3) during the construction phase of the project. The following measures have been considered in respect of QI alluvial forest: • An exclusion zone will be established to safeguard areas of QI alluvial forest within the Proposed Road Development to avoid any unnecessary disturbance or intrusion during site works. The Ecologist will supervise setting out of all works within European sites and instruct the appointed contractor on areas of alluvial forest and other sensitive habitats to avoid. • Temporary signage will be installed to highlight the location of QI alluvial forest to construction personnel accessing the site. • Any requirement for stockpiling, re-fuelling of machinery, site access, etc. during the construction phase will be sited away from QI alluvial forest. • Machinery access will be restricted to the confines of the Proposed Road Development footprint and the appointed contractor will agree locations of all access routes, temporary storage areas etc., with the appointed Ecologist. The compound locations will be as per the EIAR and planning consent. Any waste/litter generated onsite will be removed offsite to a waste licensed facility. There will be no interference with areas of QI alluvial forest during site works. The Ecologist will verify that the appointed contractor has left the site of the proposed works as found, and where relevant direct the appointed contractor to remove any litter, or materials off-site.
Biodiversity (Mitigation for European Sites (River Boyne and River Blackwater SAC and SPA)	Ch.7, Sec.7.5.1.7.3	C	Due to the ecological sensitivities associated with the River Boyne and River Blackwater SAC and SPA, vegetation clearance and earthworks for the following elements of the Proposed Road Development will be phased for the months July to September inclusive: • The locations of the proposed cut-off wall in proximity to the River Blackwater. Elsewhere, vegetation clearance will be restricted where possible, particularly within the River Boyne and River Blackwater SAC and SPA.
Biodiversity (Bats)	Ch.7, Sec.7.5.1.8.2	C	During construction, an experienced bat ecologist will visit the 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)	Ch.7, Sec.7.5.2.2	Pre-C & O	A suitably experienced bat ecologist, with experience of input to light designs, will be consulted during the detailed design of the operational lighting plan. Assess the adequacy of cowling in the vicinity of:

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
			• Incorporate cowled lighting throughout the Proposed Road Development to direct light spill away from both retained and created habitats • Assess the adequacy of cowling in the vicinity of the (retained) ash tree located at Chainage 0+650 (Volume 3, Figure 7.3 and 7.4), and propose amendments, as informed by site-specific lux level readings (see text following this bullet list); • Use of specialist bollard or low-level downward directional luminaires and red-Light Emitting Diode (LED) fittings on the proposed bridge crossing having regard for research indicating light-sensitive bat species are equally active in such light, as in darkness (Spoelstra et al., 2017). • In all other areas, install luminaires 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. Maximise the separation distance between light mast locations and vegetated features wherever possible, and as a minimum by locating luminaires from Chainages 0+400 to 0+850 (Volume 3, Figure 7.4) on the eastern side of the Proposed Road Development.
Biodiversity (Bats)	Ch.7, Sec.7.5.2.2	O	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 site during operation to measure, using a suitably calibrated light meter, light spill onto vegetated features within 100 m of the Blackwater River. Where additive light spill does exceed 1 lux, the appointed contractor will make retrospective amendments to light cowls, to the satisfaction of and in agreement with the suitably experienced bat ecologist.
Biodiversity (Mammals)	Ch.7, Sec.7.5.1.9	C	Following completion of, and informed by pre-construction badger surveys, the Ecologist will determine the potential requirements for licensed works to badger setts. As a minimum, unless otherwise agreed with the NPWS, the two nearest setts to the Proposed Road Development (BS1 and BS3) will be temporarily excluded under licence from the NPWS, following NRA guidance (NRA, 2006a). The appointed contractor shall check spoil piles and evidence of excavations on a regular basis to monitor badger activity.
Biodiversity (Mammals)	Ch.7, Sec.7.5	C & O	Mammal fencing will be installed along the Proposed Road Development, and a dry mammal underpass has been designed into the proposed alignment (in a proposed road embankment in Blackwater Park with no risk of flooding (Chainage 450) (Volume 3, Drawing No. 60546769-SHT-20-NIS-EN-0102)). Mammal fencing and the proposed underpass will be designed (e.g. including ‘lead-in planting’), installed and maintained in accordance with the NRA specification (NRA, 2006). Appropriate setback distances from the River Blackwater corridor will be maintained to avoid any restrictions on the movement of Otter from utilising riparian zones along the river margins.
Biodiversity (Mammals)	Ch.7, Sec.7.5	C & O	Inclusion of a mammal ledge within the 1% AEP flood event (1:100 year) in the design of the proposed bridge crossing; to NRA standard (NRA, 2006b), to allow for continued passage of otter and other mammals in the event of a 1% AEP flood event (1:100 year).
Biodiversity (Mammals)	Ch.7, Sec.7.5.1.10	C	Four artificial hedgehog nesting boxes will be provided by the appointed contractor, for installation by the Ecologist in sheltered areas of retained scrub and woodland away from obvious sources of human disturbance, and with entrances pointing away from prevailing winds. The Ecologist will insert straw, while wearing gloves to prevent transference of pheromones, in each box during installation to encourage usage.
Biodiversity (Birds)	Ch.7, Sec.7.5.1.11	C	The Ecologist or other suitably experienced ecologist will advise the appointed contractor on timing of vegetation clearance to

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
			protect nesting birds while having regard for other protected features present, such as breeding frogs and their spawn, and invasive species.
Biodiversity (Birds)	Ch.7, Sec.7.5.1.11	C	Vegetation clearance for most areas will be restricted during summer months where possible. 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 works requires removal of vegetation during the breeding season, such works will be approved by the Ecologist, or other suitably experienced ecologist, 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 appointed contractor of any species-specific exclusion zones around potential or confirmed nests. The Ecologist will advise the appointed contractor on any licensing implications for removing vegetation during the nesting season, in consultation with the NPWS.
Biodiversity (Birds)	Ch.7, Sec.7.5.1.11	C	The need to remove vegetation containing nests 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, may be carried out to greatly reduce the risk of birds nesting within the Proposed Road Development for much of that breeding season (excluding for earth works where necessary).
Biodiversity (Other Species and Habitats)	Ch.7, Sec.7.5.1.12	C	Initial cut-off wall, initial ground works, and preparation and mitigation works within the floodplain of the Blackwater River, and the Windtown Stream (a dry drainage ditch) will be scheduled outside the peak breeding season for common frog (breeding season from February/early March to June (Reid et al., 2013)) unless otherwise agreed with the Ecologist and the Ecologist has determined there are no spawn, or tadpoles present. Where the programme does not accommodate this seasonal restriction, relevant wetlands will be surveyed to identify locations of any spawn and where necessary a licence will be obtained from the NPWS to permit the translocation the spawn outside of the working area in advance of construction. Where translocation is required, the NPWS will also be consulted to determine if translocation of adult frogs, froglets and/or tadpoles is also required (e.g. through capture by netting in conjunction with amphibian fencing as set out in NRA (2009b)), in addition to spawn. The Ecologist will agree suitable receptor sites with the appointed contractor for any translocations prior to any derogation licence application.
Biodiversity (Construction Phase Monitoring)	Ch.7, Sec.7.6.1.1	C	The appointed contractor will carry out a programme of water quality monitoring, whose parameters will be agreed with the IFI and the Ecologist
Biodiversity (Construction Phase Monitoring)	Ch.7, Sec.7.6.1.2.1	C	The Ecologist 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 function the Ecological Monitoring Strategy (EcMS) will be to: • Inform adaptive management measures to be agreed with MCC 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; • The specific aims of the EcMS will be to monitor and oversee the correct implementation of mitigation, and instruct the contractor on how to adapt mitigation as required, with particular regard to: ○ Results of pre-construction surveys which may identify new ecological constraints within the ZoI of the Proposed Road Development. ○ Implementation of the ISMP.

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
			○ Phasing of works including piling, earthworks, and vegetation clearance in response to potentially unforeseen weather conditions or programme changes. ○ Condition and performance of silt fencing silt de-watering sacs and other aspects of the CESCP, as informed by site observations by the Ecologist, and the results of the Contractor's WQMP. ○ Working methods within the flood plain of the River Blackwater; ○ Cowling of construction lighting to protect the QI of the River Boyne and River Blackwater SAC and SCI of the River Boyne and River Blackwater SPA. ○ Ensure directional lighting used to minimise light spillage on the QI of the River Boyne and River Blackwater SAC and SCI of the River Boyne and River Blackwater SPA ○ Construction and installation of the mammal ledge for otter and mammal fencing (including lead-in planting, and access ramps). ○ A habitat enhancement plan will be drafted to maintain and enhance the Annex 1 hydrophilous tall herb fringe habitat.
Land & Soils (Soil Excavation & Filling)	Ch.8, Sec.8.6.1.1	C	Temporary storage of soil will be carefully managed in such a way as to prevent potential negative effect 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; 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)	Ch.8, Sec.8.6.1.1	C	Soil requiring off-site 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 1999/31/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)	Ch.8, Sec.8.6.1.1	C	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 (Soil Excavation & Filling)	Ch.8, Sec.8.6.1.1	C	The construction compound will incorporate the protection and mitigation measures outlined in the EIAR and conform to the requirements outlined in the CESCP, NIS and planning conditions. Following completion of construction, the compound area will be re-instated.
Land & Soils (Fuel & Chemical Handling)	Ch.8, Sec.8.6.1.2 Ch.9, Sec.9.6.1.3	C	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.

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
			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.
Land & Soils (Fuel & Chemical Handling) Water	Ch8., Sec.8.6.1.2 Ch.9, Sec.9.6.1.3	C	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 (Fuel & Chemical Handling) Water	Ch.8, Sec.8.6.1.2 Ch.9, Sec.9.6.1.3	C	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 will 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 (Control of Concrete and Lime)	8.6.1.3	C	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.
Land & Soils (Control of Concrete and Lime)	8.6.1.3	C	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 on site, it will be carried out in carefully managed and monitored on site wash out areas.
Land & Soils (Control of Concrete and Lime)	8.6.1.3	C	During construction works suitable drainage, settlement and silt control measures will be implemented to mitigate disturbance to the SAC and SPA. The bridge span will be constructed using precast beams.
Land & Soils (Sources & Aggregates & Clean fill)	8.6.1.4	C	The source of fill material requirement will be sourced where possible from local quarries. A number of local quarries have been identified in Chapter 4 (Project Description) and soils/fill material to be brought to the Proposed Road Development site will be vetted with necessary chemical soil testing 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. will not introduce contamination to the environment).
Land & Soils (Sources & Aggregates & Clean fill)	8.56.2	O	Leaching to groundwater of minerals from imported fill used in unpaved areas such as embankment surfaces, will be controlled by soil sampling and assessment of fill quality prior to its import on to the site. Only suitable ‘clean’ fill material will be imported onto site for use in the Proposed Road Development. There will be no direct discharges to groundwater or soil environment during the operational phase.
Water	Ch.9, Sec.9.6.1.1	C	A CEMP will be prepared prior to construction by the contractor which incorporates relevant environmental avoidance or mitigation measures to reduce potential environmental impact. A CEMP will be prepared and will include a CESCP and a C&D 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 all proposed environmental monitoring for the duration of the construction works, be this good practice or as a planning condition requirement. Works will be undertaken in accordance with the following guidance for construction work on, over or near water: 1. CIRIA C532 Control of Water Pollution from Construction Sites. Guidance for Consultants and Contractors; and

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
			2. CIRIA C648 Control of Water Pollution from Linear Construction Projects.
Water Sedimentation (Suspended Solids)	Ch.9, Sec.9.6.1.2	C	During the construction phase, the mitigation measures will ensure that no sediment contamination, contaminated runoff or untreated wastewater will enter watercourses on or near the Proposed Road Development Site.
Water Sedimentation (Suspended Solids)	Ch.9, Sec.9.6.1.2	C	Drainage channels and streams will be clearly identified on site and shown on method statements and site plans. Construction compounds will be located at a minimum distance of 25 m from watercourses and out of the 1% AEP floodplain.
Water Sedimentation (Suspended Solids)	Ch.9, Sec.9.6.1.2	C	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)	Ch.9, Sec.9.6.1.2	C	During the construction activities there will be a requirement for diverting rain water 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 River Blackwater will be put in place by the contractor during construction activity on site.
Water Sedimentation (Suspended Solids)	Ch.9, Sec.9.6.1.2	C	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 dewatering water and groundwater arising from pumping (if any) or such water may be disposed of as construction site run off where appropriate.
Water Sedimentation (Suspended Solids)	Ch.9, Sec.9.6.1.2	C	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. Runoff from spoil heaps will be prevented from entering watercourses by diverting it through on-site settlement ponds and removing material as soon as possible to designated storage areas.
Water Sedimentation (Suspended Solids)	Ch.9, Sec.9.6.1.2	C	Silt traps will be placed across the works boundary in areas adjacent to watercourses to avoid siltation of watercourses. These will be maintained and cleaned regularly throughout the construction phase. Attention should 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 (Accidental Spillages and Leaks)	Ch.9, Sec.9.6.1.3	C	Prevent spillages to ground of fuels, and to prevent any consequent migration through the subsurface to surface waters or direct spillages to watercourses.
Water (Accidental Spillages and Leaks)	Ch.9, Sec.9.6.1.3	C	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 will be used for containing any spillages during transit.
Water (Surface Water/Storm Water Drainage)	Ch.9, Sec.9.6.2.1	O	The attenuation pond will be lined, and the surface water drainage network sealed in order to prevent infiltration of contaminated groundwater into surface water network. Solids removal is one of the main features of attenuation ponds, and high removal rates are

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
			possible. Nutrient and trace metals removal is more modest with potential uptake by some of the vegetation species within the pond.
Water (Surface Water/Storm Water Drainage)	Ch.9, Sec.9.6.2.1	O	A regular maintenance regime, including monitoring, will be put in place to remove any excess build-up of material. The Applicant will be responsible for the maintenance of the drainage network during the operational phase.
Air Quality Population and Health	Ch.10, Sec.10.6.1 Ch.6, Sec.6.6	Pre – C & C	A Construction Traffic Management Plan shall be produced prior to construction and implemented in full. A Construction Environmental Management Plan (CEMP) (including a Dust Minimisation Plan/Air Quality Management Plan) would be prepared by the appointed contractor prior to construction.
Air Quality Population and Health	Ch.10, Sec.10.6.1 Ch.6, Sec.6.6	C	Standard mitigation measures would be implemented on-site to control emissions of dust and PM_{10} during the earthworks. Such mitigation measures considered good practice include, but are not limited to: • Required works to be undertaken in a phased and controlled manner; • The dampening down of potential dust-generating activities; • Regular inspections of works for visible signs of emissions of dust and early application of measures to minimise emissions at source; • Considerate location of temporary storage of dusty materials and material transfer operations, so that it is as far from the nearest sensitive receptors as practicable; • Agree lines of communication between local authority pollution control officer and contractor(s) prior to commencement of works and procedure for reporting dust events or complaints from local residents; • Minimise drop heights and chutes where practicable; • During extended periods of dry weather (especially over holiday periods) plan for additional mitigation measures to avoid wind-blown dust issues, both within and outside normal working hours; • Avoid long-term stockpiles of material on-site without application of measures to stabilise the material surface, such as application of suppressants or seeding; • Re-vegetate earthworks and exposed areas/soil stockpiles to stabilise surfaces as soon as practicable; • The use of Hessian, mulches or tackifiers where it is not possible to re-vegetate or cover with topsoil, as soon as practicable; • Remove the cover in small areas during work and not all at once, where practicable. Measures specific to but not limited within the construction stage include: • Placing activities which are a potential source of PM_{10}, such as cutting and grinding of materials and cement mixing, away from boundaries would minimise the possibility of exposure to PM_{10} at receptors within 30 m of the site boundary; • Adoption of mobile booths for cutting and grinding operations if work cannot be undertaken away from sensitive receptors; • The provision of dust suppression on-site to be applied during adverse meteorological conditions or as and when potential dust-generating activities are being undertaken; • Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place;

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
			• Ensure bulk cement and other fine powder materials are delivered in enclosed tankers and stored in silos with suitable emission control systems to prevent escape of material and overfilling during delivery; and • for smaller supplies of fine powder materials, ensure bags are sealed after use and stored appropriately to prevent dust. Measures specific to but not limited within the track-out stage include: • Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary any material tracked out of the Site. This may require the sweeper being continually in use; • Avoid dry sweeping of large areas; • Ensure vehicles entering and leaving the site are covered to prevent escape of materials during transport; • Inspect on-site haul routes for integrity and instigate necessary repairs to the surface as soon as reasonably practicable; Record all inspections of haul routes and any subsequent actions in a site log book; access gates to be located at least 10 m from receptors where possible.
Air Quality Population and Health	Ch.10, Sec.10.6.1 Ch.6, Sec.6.6	C	• Materials required for the construction works shall be sourced locally where possible. There are operational quarries located in proximity to the proposed road development. Rock crushing shall be undertaken on site where possible, to reduce the requirement to import crushed stone to site; • Materials shall be handled efficiently on site to minimise the waiting time for loading and unloading, thereby reducing potential emissions; • Engines will be turned off when machinery is not in use; • The regular maintenance of plant and equipment will be carried out • Materials with a reduced environmental impact will be used where available, such as: – GGBS and PFA will be used as replacements for Portland cements; and – Recycled steel The contractor shall be required to implement an Energy Management System for the duration of the works. This will include the following at a minimum: • Use of thermostatic controls on all heating systems in site buildings; • The use of insulated temporary building structures; • The use of low energy equipment and power saving functions on all computer systems; and The use of low flow tap fittings and showers.
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	Limiting the hours during which noisy site activities are permitted by MCC to 07.00 – 19.00 Monday – Friday and 07.00 - 13.00 Saturday. Work outside of normal hours shall only take place where written permissions have been sought and received from MCC.
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	Appointment of a designated site representative responsible for matters relating to noise to establish channels of communication between the contractor/applicant and residents

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	Selection of construction plant with low inherent potential for generation of noise and/or vibration and use of quiet working methods to be implemented where practicable.
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	Mufflers or silencers should be used where practicable and in line with manufacturers guidelines, all machines and equipment should be shut down when not in use.
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	Erection of temporary barriers around items such as construction generators or high duty compressors. For maximum effectiveness, a barrier would be positioned as close as possible to either the noise source or receiver. The barrier would be constructed of material with a mass of > 7 kg/m2 and should have no gaps or joints in the barrier material. As a rough guide, the length of a barrier would be five times greater than its height. A shorter barrier would be bent around the noise source, to ensure no part of the noise source is visible from the receiving location.
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	Siting of noisy construction plant as far away from sensitive properties as permitted by site constraints
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	Plant and Machinery used on site should comply with the EC (Construction Plant and Equipment) Permissible, Noise Level Regulations, 1988 (S.I. No. 320 of 1988) or the most recent regulations available at the time of construction
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	All noise producing equipment should comply with S.I. No. 632 of 2001 European Communities (Noise Emission by Equipment for use Outdoors) Regulations 2001 or the most recent regulations available at the time of construction
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	Should construction noise levels raise above NRA guidance levels mitigation measures should be implemented to reduce noise levels.
Noise and Vibration Population and Health	Ch.11, Sec.11.5.1 Ch.6, Sec.6.6	C	The use of vibratory rollers will be monitored to ensure acceptable levels of vibration are maintained at sensitive receptors and measures will be undertaken to minimise levels when necessary.
Noise and Vibration Population and Health	Ch.11, Sec.11.5.2 Ch.6, Sec.6.6	O	A LNRS is to be implemented along all sections of the link road, as well as on the tie in points along the existing road network.
Noise and Vibration Population and Health	Ch.11, Sec.11.5.2 Ch.6, Sec.6.6	O	A 1.5 m high noise barrier is required along the new link road, extending 39.5 m along the northbound carriageway in the vicinity of 1 Blackwater Park. A 1.5 m high bund, extending 225 m along the southbound carriageway, is also proposed.
Landscape and Visual Impact Assessment Population and Health	Ch.12, Sec.12.5.2 Ch.6, Sec.6.6	C	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.

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
Biodiversity (General Mitigation)	Ch.7, Sec.7.5		
Landscape and Visual Impact Assessment	Ch.12, Sec.12.5.2	C	Road boundaries will be planted to reduce headlight glare intrusion into adjacent properties.
Population and Health	Ch.6, Sec.6.6		
Biodiversity (General Mitigation)	Ch.7, Sec.7.5		
Landscape and Visual Impact Assessment	Ch.12, Sec.12.5.2	C	Signage will be located sensitively so that it does not increase the visual effect upon dwellings.
Population and Health	Ch.6, Sec.6.6		
Landscape and Visual Impact Assessment	Ch.12, Sec.12.5.2	C	Rounding of the top and bottom of cut and fill slopes to tie in smoothly with existing adjacent landform.
Population and Health	Ch.6, Sec.6.6		
Biodiversity (General Mitigation)	Ch.7, Sec.7.5		
Landscape and Visual Impact Assessment	Ch.12, Sec.12.5.2	C	Provision of sufficient protection for trees to be retained in areas close to construction works (as described in BS 5837:2005).
Population and Health	Ch.6, Sec.6.6		
Biodiversity (General Mitigation)	Ch.7, Sec.7.5		
Landscape and Visual Impact Assessment	Ch.12, Sec.12.5.2	C	Noise mitigation will take the form of bunds rather than barriers where space allows.
Population and Health	Ch.6, Sec.6.6		
Landscape and Visual Impact Assessment	Ch.12, Sec.12.5.3	C	Appropriate native screen planting will be provided where the road will have an adverse visual effect on adjacent properties or views, and avenue or parkland planting will be provided where the design aim is to integrate the new road and path into the urban landscape.
Population and Health	Ch.6, Sec.6.6		
Biodiversity (General Mitigation)	Ch.7, Sec.7.5		
Landscape and Visual Impact Assessment	Ch.12, Sec.12.5.3	C	Wildflower mixes from native stock will be used on verges to maximise biodiversity.
Population and Health	Ch.6, Sec.6.6		
Biodiversity (General Mitigation)	Ch.7, Sec.7.5		

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
Landscape and Visual Impact Assessment Population and Health Biodiversity (General Mitigation)	Ch.12, Sec.12.5.3 Ch.6, Sec.6.6 Ch.7, Sec.7.5	C	Within the boundary of the SAC to the south, vegetative turves will be reused and reinstated where possible to retain native seed mix and to encourage rapid colonisation of vegetation.
Landscape and Visual Impact Assessment Population and Health	Ch.12, Sec.12.5.3 Ch.6, Sec.6.6	C	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.
Landscape and Visual Impact Assessment Population and Health	Ch.12, Sec.12.5.3 Ch.6, Sec.6.6	C	Noise bunds will be planted to integrate them into the overall landscape plan.
Landscape and Visual Impact Assessment Population and Health Biodiversity (General Mitigation)	Ch.12, Sec.12.5.4 Ch.6, Sec.6.6 Ch.7, Sec.7.5	O	**Ch. 0+100 – 0+000** - Grass verges and hedgerows will be established and reinstated as appropriate along L34094-1 Clonmagadden Road and L3409 Ratholdron Road.
Landscape and Visual Impact Assessment Population and Health Biodiversity (General Mitigation)	Ch.12, Sec.12.5.4 Ch.6, Sec.6.6 Ch.7, Sec.7.5	O	**Ch. 0+000 – 0+400** - Native woodland planting along roadside embankments and adjacent areas aligned with the new road corridor will provide screening of the LDR4 road corridor from surrounding areas, contributing to the reduction of road noise and light glare.
Landscape and Visual Impact Assessment Population and Health Biodiversity (General Mitigation)	Ch.12, Sec.12.5.4 Ch.6, Sec.6.6 Ch.7, Sec.7.5	O	**Ch. 0+400 – 0+500** - Existing bunds to the east of the road alignment will be retained. A proposed pedestrian entrance to Blackwater Park will be reinforced via an area of meadow grass with informal clusters of trees that will lead pedestrians into the existing parkland. Meadow grass is further planted along this access route along with a mixed native hedgerow that will tie in with the established park path network.
Landscape and Visual Impact Assessment Population and Health Biodiversity (General Mitigation)	Ch.12, Sec.12.5.4 Ch.6, Sec.6.6 Ch.7, Sec.7.5	O	**Ch. 0+500 – 0+750** - Roadside boundary treatments will comprise a woodland planted bund along the eastern section of the road, together with native meadow, clusters of feature trees and hedgerow planting to the west. Existing retained mature tree vegetation along the western section of the alignment will provide screening of the road corridor.
Landscape and Visual Impact Assessment	Ch.12, Sec.12.5.4 Ch.6, Sec.6.6	O	**Ch. 0+750 – 0+900** - Within the SAC boundary, vegetative turves will be reused and reinstated where possible to retain native seed mix and to encourage rapid colonisation of vegetation.

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
Population and Health Biodiversity (General Mitigation)	 Ch.7, Sec.7.5		
Landscape and Visual Impact Assessment Population and Health Biodiversity (General Mitigation)	Ch.12, Sec.12.5.4 Ch.6, Sec.6.6 Ch.7, Sec.7.5	O	**Ch. 0+900 – 1+100** - The road alignment crosses the River Blackwater, a designated Special Protection Area (SPA) where the landscape mitigation approach is to create minimal intervention through maximising the reinstatement of existing grassland that will be disturbed during construction. South of this, woodland planting provides screening from the nearby residential receptors on approach to the proposed junction with the R147/N51.
Landscape and Visual Impact Assessment Population and Health Biodiversity (General Mitigation)	Ch.12, Sec.12.5.4 Ch.6, Sec.6.6 Ch.7, Sec.7.5	O	**Ch. 1+100 – 0+200 -** Woodland screen planting terminates and grass verges with informal clusters of feature trees are located along the northern side of the proposed road junction with the R147/N51. To the south of the junction, existing trees, along the boundary of St. Patrick's School are retained, and the road edge is grass seeded with feature tree planting located along the western side of the road alignment. Grass seeded verges and additional feature tree planting is proposed along the upgraded sections of the existing R147/N51 alignment to tie the development into the surrounding road network and setting.
Cultural Heritage	Ch.13, Sec.13.5.6	Pre - C	Archaeological testing will be carried out at the pre-construction phase in areas identified in the construction impacts section of the EIAR (Section 13.5.2 of the EIAR) where the Proposed Road Development has the potential to impact upon archaeological remains All archaeological works (which will be agreed by the Archaeological Consultant and the NMS will be 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).
Cultural Heritage	Ch.13, Sec.13.5.6	Pre - C	A suitably qualified and licensed Archaeological contractor will be appointed to carry out the archaeological fieldwork. Relevant licenses will be acquired from the DoCHG/NMS and the NMI for all archaeological works, which will be carried out in accordance with an Overarching Method Statement for Archaeological Works prepared by the Archaeological Consultant and agreed with the NMS. It is anticipated that all archaeological works will be completed pre-construction. This is in accordance with the Code of Practice between the NRA (now TII) and the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (formerly Arts, Heritage, Gaeltacht and Islands), 2000. The archaeological fieldwork will be undertaken following the programme outlined which is standard mitigation procedure for all road projects: • Archaeological test trenching will be carried out following planning permission to a quantity of 12% of the green field areas. This will equate to every hectare (10,000 sqm) of green field construction area, there will be 1200 sqm of trenching opened. • Should test trenching reveal archaeological deposits then a phase of archaeological rescue excavation will be undertaken. This archaeological rescue excavation will be programmed to be completed in advance of construction where possible. • It is envisaged that there will be sufficient archaeological test trenching and rescue excavation to ensure that areas accessible for advance works will not require archaeological monitoring during construction. This will be subject to agreement with National Monuments Service. • Should there be areas that will be impacted by construction but are not accessible for archaeological works in advance of construction, then archaeological monitoring of these areas may be required.
Cultural Heritage	Ch.13,	Pre - C	Archaeological issues will be resolved where possible, at the pre-construction stage of the Proposed Road Development. This will

Environmental Aspect	EIAR Reference (Chapter / Section)	Phase	Mitigation and Monitoring Measure
	Sec.13.5.6		include topographical survey of the communications and agricultural assets located within the scheme footprint. If unexpected archaeological remains or artefacts are discovered during construction work, work in that area will cease and the area will be protected. An unexpected finds procedure will be included in the Overarching Method Statement for Archaeological Works prepared by the Archaeological Consultant and agreed with the NMS. The Archaeological Consultant and NMS will be notified, and the unexpected find protocol will be implemented.
Cultural Heritage	Ch.13, Sec.13.5.6	C	A high level of care whilst in the vicinity of nearby protected structures must be ensured during the construction phase to avoid any accidental damage.
Material Assets	Ch.14, Sec.14.4.	Pre - C & C	The timing of realignments of/diversions to local domestic connections will be addressed between the appointed contractor and the local community Effects on local domestic connections will be addressed at the detailed design stage.
Material Assets	Ch.14, Sec.14.5.1	C	Prior to excavation diversion works, the appointed contractor will be supplied with accurate service drawings additional site investigations will be carried out if necessary, to ensure services are not damaged during construction works. 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.
Material Assets	Ch.14, Sec.14.5.2	Pre - C	The majority of the land required for the Proposed Road Development will be acquired through a CPO process, unless other direct agreement (payment) are reached with individual landowners. However, compensation to be agreed as part of the land acquisition are outside the scope of the EIA process. It is also noted that some lands required for the Proposed Road Development is owned by a State Body, namely The Commissioners of Public Works in Ireland (OPW). These lands are exempt from CPO process and accordingly have not been included in the CPO schedule. The Commissioners of Public Works in Ireland (OPW) have however agreed in principle, subject to development consent being obtained, to the transfer of these lands required to Meath County Council. This agreement has been recorded in Letter of Consent dated 9 January 2020.
Material Assets	Ch.14, Sec.14.5.2	Pre-C & C	Access roads will be provided to access severed lands in cases where acquiring the severed lands is generally more expensive than the cost of providing the access. New vehicular accesses to residential properties shall be constructed to replicate the existing access layout as far as is practicable, whilst ensuring that visibility from the access is provided.
Major Accidents and Disasters (MADs)	Ch.15, Sec.15.7	C	A site-specific H&S Plan which will be produced by the appointed contractor and adopted during the construction phase of the Proposed Road Development.
Major Accidents and Disasters (MADs)	Ch.15, Sec.15.7	O	Embedded control measures are inherent in the Proposed Road Development design and as such no further operational mitigation measure have been proposed other than the embedded control measures considered in the design of the Proposed Road Development.
Climate	Ch.16, Sec.16.5.1	**C**	• A TMP shall be produced prior to construction and implemented in full, minimising congestion and encouraging car sharing and the use of public transport. • It is a requirement that a CEMP would 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 – Handling materials efficiently on site 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. GGBS and PFA) A requirement for the contractor to implement an Energy Management System for the duration of the works.
Climate	Ch.16, Sec.16.5.2	C	The construction stage CEMP will include a requirement to plan for additional mitigation measures to avoid wind-blown dust issues during extending periods of dry weather during the construction period.
Climate	Ch.16, Sec.16.5.2	C	Climate change impacts will be considered within maintenance plans and safety plans.

aecom.com